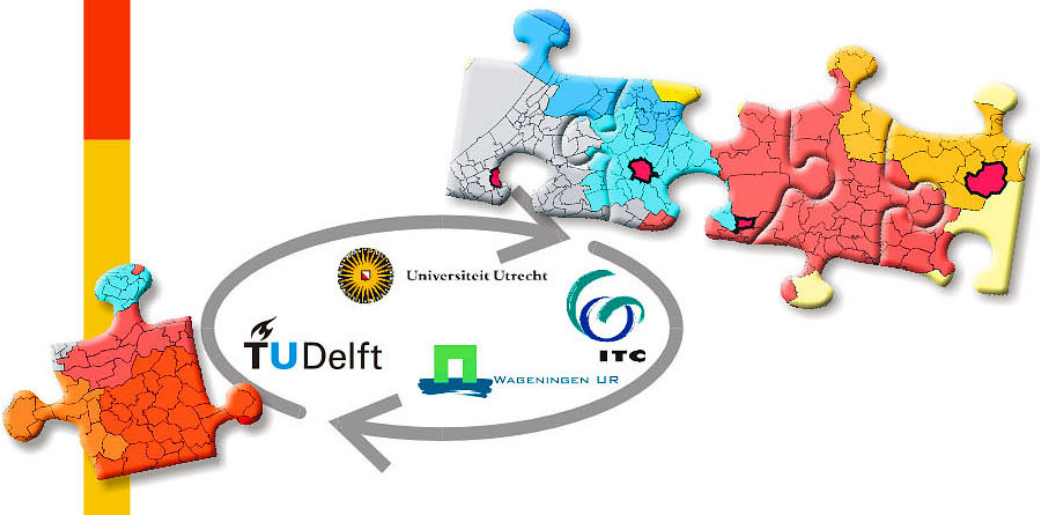
GIMA

Geographical Information Management and Applications

Multi-view SDI assessment of Kosovo

Developing a solid base to support SDI strategy development

Bujar Nushi



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Multi-view SDI assessment of Kosovo

Developing a solid base to support SDI strategy development

A master thesis

Geographical Information Management and Applications

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Thesis professor: prof. mr. Jaap Besemer (TU Delft)

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Mëmëdheu	***Motherland***
Memedhe quhet toka	*Motherland is the ground,*
Ku me ka renur koka ,	*Where I first raised my head,*
Ku kam dashur mem,e atë,	*Where I loved my mother and dad,*
Ku me njeh dhe guri i thatë,	*Where even dry stone knows me,*
Ku kam pasur shtepinë,	*Where once I had my home,*
Ku kam njohur perëndinë	*Where I first knew God,*
Strrgjyshët ku kanë qënë ,	*Where my ancestors lived,*
Dhe varret qi kanë vënë ,	*And left their graves behind,*
Ku jam rritur me thërrime ,	*Where I grew on bits of bread,*
Ku kam folur gjuhën time ,	*Where I spoke my language,*
Ku kam fis e ku kam farë ,	*Where my roots and family are,*
Ku kam qeshur, ku kam qarë	*Where I've laughed and where I've cried,*
Ku rroj me gazë e me shpresë ,	*Where I dwelled with delight and hope,*
Ku kam dëshirë të vdesë .	*Where I yearn to perish.*

Andon Zako ÇAJUPI (1866 – 1930)

(Albanian poet and writer that actively participated in the Albanian National Awakening)

(From the volume Baba-Tomorri, Cairo 1902. Adapted from the Albanian by Robert Elsie]

Abstract

The main objective of this Master of Science thesis was to assess the SDI of Kosovo and to define the driving forces needed to support SDI strategy development.

This research explores the basics of SDI assessments, and investigates the National SDI of different countries in transition. A literature study and the survey within the SDI stakeholders in Kosovo were the leading principles in this research.

The main focus is the assessment of SDI of Kosovo and defining the driving forces to improve it. The research assesses the status of SDI implementation of Kosovo using SDI readiness Index; INSPIRE State of Play and Maturity Matrix as assessment approaches. A questionnaire SDI readiness survey was conducted on the SDI stakeholders in Kosovo in 2007 and 2010. The INSPIRE State of Play is assessed for 5 countries Estonia, Lithuania, Latvia, Slovenia and Luxembourg and an attempt to define the State of Play for SDI of Kosovo was also part of the assessment. The last assessment was defining the Maturity matrix for SDIs of Slovenia and Kosovo.

From the analysis, the SDI of Kosovo has a small advantage of having a national policy backing its implementation. Another positive aspect is the policy for establishing of the coordinating body. However, the lack of clear SDI directive and funding are major hurdles in the implementation of the SDI making it lack behind most of the selected case study countries in this research.

This research has led to 6 driving forces selected to support development strategy of SDI at national level in Kosovo. Each of 6 defined driving forces is aiming on the particular aspect of Organisational aspects of Maturity matrix.

This report concludes with an evaluation of this research and suggestions for the further work.

Acknowledgements

These past 15 years have been a journey into the unknown for me, since I left Kosovo to move to this marvellous country where I did not know anybody. One friend believed in me from the first day and helped me with great moral support. So, I would first like to thank Muharrem Ombashi for encouraging me to fight for my future and for helping me stay on the path in moments of doubt.

I am grateful to my supervisors Bastiaan van Loenen and Jaap Besemer for accepting to guide me in the first place, especially since they knew very little about me until it was too late for you to get rid of me. Bastiaan, I would like to thank you for always steering me in the right direction without being too controlling and for knowing when to listen to me. I am also grateful to you for all the efforts you made in my final steps to help me write this thesis whilst knowing how difficult this step was for me.

I want to thank also Sisi Zlatanova, for putting me on the scientific rails, and for always having her door open for discussions. I am also grateful to my first supervisor Joep Crompvoets for infecting me with the 'SDI-virus' and for encouraging me to go to Kosovo t to find inspiration for my thesis back in 2007. The experience I gained there turned out to have great influence on my subsequent career decisions.

Combining part-time GIMA Master Studies with a demanding fulltime job was extremely challenging. For having understanding for my struggles, I am also grateful to my present employer, consulting firm DHV in Amersfoort.

I would like also to thank those who did not participate directly in my thesis formation, but certainly prepared me for it. I would like to thank Marco te Brömmelstroet, my GIMA buddy from the day one, for awaking the researcher in me after 3 years of time-out and for giving me moral support by calling the GIMA coordinator and asking him to persist with this thesis. Thanks Marco for all the nice conversations, scientific, interesting but above all philosophical. I am also grateful to my friend Kirsten Zagt, who helped me settle into this country and treated me like one of his own. Kirsten, I thank you for your friendship.

I posthumously thank my father, Isa Nushi, who always morally supported me and my brothers in our academic pursuit. I am incredibly grateful to my mother, Nerxhivane Nushi, for still encouraging me in my studies.

For me, one of the most difficult things to live with is the pressure to distinguish oneself from the rest, to exceed mediocrity. That's why it is nice for me to know that there is a place where I can feel special. I thank my brothers and their families in Finland for that. Driton, Edmond, Drita, Raset, Denis, Erza and Gemb, you mean a lot to me. I love you guys!

My two sons, Rron and Yll, listened to the ideas of this thesis with great calmness. Their language skills and out of the box thinking improved every chapter. The dedication to them is propelled both by fatherly pride and by the seeing how they become true cosmopolitans. Guys, as Hinckley quotes: "*Without hard work, nothing grows but weeds".*

Last but not least, I would like to thank my wife Evgjenije for her support and understanding of my physical and mental nonattendance in the last few months of writing this thesis. Most of this thesis was written while you were trying to sleep. Thanks for being patient with my night-owl habits. But, most of all, thank you for your support and your warmth. I could not have done this without you. For this and so much more, I adore you!

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List of abbreviations

CEN - European Committee for Standardisation

CORN - Continuously Operating Reference in Kosovo

EC - European Commission

GI - Geo-Information

GIS - Geographic Information System

ISO - International Organization for Standardisation

INSPIRE - Infrastructure for Spatial Information in the European Community

GSDI - Global Spatial Data Infrastructure

LAN - Local Area Network

MSc - Master of Science

NGO - Non-governmental organization

NSDI - National Spatial Data Infrastructure

OGC - Open Geospatial Consortium

PhD - Doctor of Philosophy

SDI - Spatial Data Infrastructure

SMART - Specific, Measurable, Attainable, Relevant and Traceable

SoP - State of Play

SWOT - Strengths-Opportunities-Weaknesses-Threats

TUD - University Delft

UN - United Nations

UNDP - United Nations Development Programme

UNECA - United Nations Economic Commission for Africa

UNMIK - United Nation Mission in Kosovo

UU - Utrecht University

WCS - Web Coverage Service

WFS - Web Feature Service

WMS - Web Map Service

WPS - Web Processing Service

WUR - Wageningen University & Research

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1 INTRODUCTION

Without hard work, nothing grows but weeds.
Gordon B. Hinckley

Information has grown to be of vital importance to the economic and social development of a country. Location-based information, in particular, is of increasing importance for the successful effecting of our daily private and public tasks. Crompvoets (2004) argues that Spatial Data Infrastructures (SDIs) are about the facilitation and coordination of the exchange and sharing of spatial data among stakeholders in the spatial data community. Explicitly, SDIs facilitate the collection, maintenance, dissemination, and use of spatial information. According to Chan (2001), SDIs could produce significant human and resource savings and returns by reducing duplication and facilitating integration.

Usually SDIs are developed at several different levels. As Rajabifard (2003) states, many countries are developing SDIs at different levels ranging from local to state/provincial, national and regional levels, to a global level, in order to improve management and utilisation of spatial datasets. Nevertheless, although many countries declare that they are involved in SDI development, Masser (2005) expresses that these claims need to be treated with caution. Commitment in SDI development does not necessarily mean that the initiative will transform into a fully operational SDI over time. Nevertheless, during the last few years, many countries have spent considerable resources creating optimal SDIs (Crompvoets, 2003).

National SDIs (NSDIs) have been developing rapidly sins 1994. An NSDI has a full impact on the other levels of the SDI hierarchy (global, regional, state/provincial and local). For example, in terms of policy, NSDIs have an important effect on the management of both the upper and lower levels. In terms of core datasets, an NSDI has an important role in establishing a data framework for a country. In 2002, 120 countries had already initiated projects for NSDI development (Crompvoets, 2003). This means that ,from a worldwide perspective, billions of Euros are spent yearly on NSDI

development (Crompvoets, 2004). Therefore the NSDIs development in different levels has to be monitored an assessed.

The assessment and evaluation of SDI initiatives is difficult due to a number of reasons. Many researchers have tried to assess SDIs (Crompvoets, 2006; Delgado-Fernandez and Crompvoets, 2007; Delgado-Fernandez et al., 2005; Kok and van Loenen, 2005; Masser, 1999; Onsrud, 1998; Rodriguez-Pabon, 2005; Steudler et al., 2004). All these attempts, though useful and valuable, either concentrate on one aspect of SDI, are bounded by one region, describe SDI development in only a few particular countries, or are still conceptual in nature.

Since each country is unique in historical, legal, economic, technological, cultural and institutional terms, the benefits gained and bottlenecks expected for the establishment and implementation of NSDIs are bound to be different as well. Thus, not only effective strategies for establishing and implementing may be country-specific but also NSDIs themselves may be different for each country.

In order to improve the SDI development of Kosovo, this thesis research assumes that defining 'the lessons learnt' and 'identification of good practices' during the implementation of SDIs in other similar countries is needed. This research also explores how to define the driving forces that could support further sustainable developing of SDI of Kosovo. Defining and drawing the comparison between the SDI readiness Index of Kosovo in 2007 and 2010 and investigating the INSPIRE Stat op Play programmes of five different European countries (Estonia, Latvia, Lithuania, Slovenia and Luxembourg) supports this research. The preference to look intensively into the SDIs of these countries is explained in the following section.

1.1 Motivation and problem description

Sustainable development of SDI National in Kosovo is a very essential topic of high urgency. Due to the long lasting conflict in Balkans ending with the war in 1999 in Kosovo the society infrastructure, including the Land Administration, was severely damaged. More than 300 000 buildings were destroyed and all cadastral plans and records were removed from Kosovo. Today the infrastructural reconstruction is mainly completed and Kosovo is transforming into a new phase of its development. Now the

focus is on the sustainable development and on the integration to the European standards and community.

In a post-war situation most of the data is reconstructed from backups, copies and re-surveys. The building of the spatial data started from scratch. Author strongly believes that good cooperation and coordination between the stakeholders in Kosovo may avoid mistakes made in similar activities elsewhere. A modern SDI can be an important step due to production of reliable information to promote and support scientific research, a modern government and economical activities in Kosovo.

Developing a modern SDI is a costly task that will take several years. Institutions in Kosovo are being reshaped and functioning, creating emerging needs for spatial data that cannot be programmed on a clear time frame all together. The lack of funds from local sources in Kosovo and the uncertainty regarding the long term availability of donor resources or international funding are all factors that call for a gradual but pragmatic approach to the SDI implementation.

There are several reasons for this research, namely:

- Kosovo is currently in a fast transition faze, both in economical and social terms. Those developments should be supported by use of well organized geospatial information.
- Building a SDI in Kosovo is demanded by the sustainable development and the implementation of important regional and European strategies on the economic development.
- A well structured SDI in Kosovo can support extremely needed processes of information management and decision-making.
- Building Kosovo's SDI is a premise condition of the involvement in the regional developments and fair economic, trade and scientific competition.
- There is lack of highly qualified experts in Kosovo who can steer this process of the development of a SDI.

Based on the information given above, it is obvious that getting the SDI of Kosovo as a research topic is very necessary and meaningful. The author believes that it is the duty

of every individual to help his country in his or her own way. As a born Kosovar, this is my way.

1.2 Overall objective

The main objective of this research is: *Assessing the SDI of Kosovo and defining the driving forces to support sustainable developing of a new SDI strategy of Kosovo.*

In order to achieve the main objective, understanding of SDI theoretical framework, defining the SDI Readiness of Kosovo, defining the problems and mistakes during the implementation of SDI's at other similar countries, defining the driving forces for development of a modern SDI in Kosovo and understanding the present state of SDI in Kosovo are required.

1.3 Research questions

Based on the research objective the following general research questions are formulated:

1. *What is an SDI?*
2. *How may an SDI be assessed?*
3. *What are the driving forces of SDI development?*

To get the answers of these questions the existing literature on theoretical aspects of SDI, different SDI assessment frameworks and theoretical base of identifying the driving forces are critically reviewed.

Also the following specific research questions regarding the SDI of Kosovo are formulated:

1. *What is the difference in SDI readiness in Kosovo in two separate time frames?*
2. *How to learn from other similar countries and their problems and mistakes made during the implementation of SDI's?*
3. *Which driving forces are most important for sustainably developing the SDI of Kosovo?*

The first specific research question: '*What is the difference in SDI readiness in Kosovo in two separate time frames?*' is divided into the following sub questions:

1. *What is SDI readiness?*
2. *What are, based on the literature, the indicators that influence most the SDI readiness?*
3. *What was the SDI readiness index of Kosovo in 2007?*
4. *What is the present state of SDI readiness in Kosovo?*

For answering the first specific research question the applied method is survey and document study.

The second specific research question: '*How to learn from other similar countries and their problems en mistakes made during the implementation of SDI's?*' is divided into the following sub questions:

1. *What is State of Play?*
2. *Which countries should be analyzed?*
3. *What kind of problems can arise later on during the implementation of SDI?*
4. *What could be the best practice model for Kosovo's SDI?*

For answering the second specific research question the applied method is document and case study.

The third specific research question: '*Which driving forces are most important for sustainable developing of SDI in Kosovo?*' is divided into the following sub questions:

1. *Which indicators where most influential in changes of the SDI readiness Index?*
2. *Which best practice model should be followed towards the sustainable developing of the SDI in Kosovo?*

For answering the third specific research question the applied method is desk research.

1.4 Thesis structure

Trying to find out which driving forces are most important for sustainable development of SDI in Kosovo a number of research steps has to be taken.

By critically reviewing existing literature on SDI and different SDI assessment frameworks, three SDI assessment approaches are identified which will be used in this research: SDI-readiness approach, INSPIRE state of play approach and the organizational approach (see chapter 2). The simultaneous application of multiple assessment approaches is important because of the vibrant and constantly developing nature of SDI. Moreover, a simultaneous measurement with several assessment approaches guarantees that the results of the assessment can easily be related and compared.

In two different time frames, a selected group of SDI experts from Kosovo is consulted to give their opinion on the most important variables needed for SDI Readiness assessment Index of SDI in Kosovo in 2010 (see chapter 3). These results of expert variables are compared and matched with the earlier defined SDI readiness Index of Kosovo in 2007 in the early stage of this research. Resulting from the comparison is that SDI readiness index is applied not as comparisons with other countries but as a temporally comparison of same SDI in different time frames.

To be able to compare present development of SDI of Kosovo with other countries the INSPIRE State of Play (SoP) case study desk research is done for four similar countries in transition and one country with geographical similarities with Kosovo (see chapter 4). This is done after thoroughly describing the analysing all 32 SoP indicators of the five case study countries. From the SoP review of the SDI initiatives in the five countries, a set of common case study indicators is being derived with special focus on the Organizational issues. Subsequently, the above results of SDI developments of Kosovo and Slovenia are projected in an SDI maturity matrix. This matrix describes the way a vision, leadership, communication channels and the ability of the geographic information community for self-organization are present or perform in an SDI depends on the stage of development (Kok and Van Loenen, 2005).

These research steps can be visualised with the following flow chart in figure 1. The details shall be explained in the following sections.

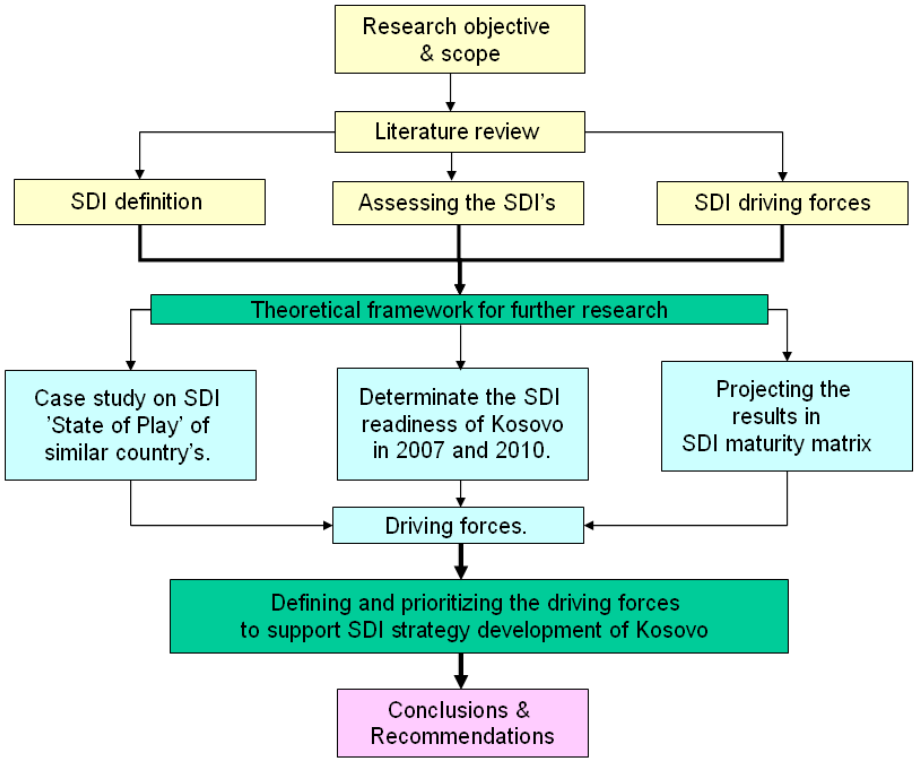


Figure 1: Flow chart of research methodology

To be able to have an overview of this thesis research report, author has used an online tool for generating "word clouds" from the provided text. The clouds give greater prominence to words that appear more frequently in the source text. Common English words are filtered to have an optimal set of terms related to the subject of this research. In the figure 2 is the word cloud of this research presented.

Figure 2: word cloud of this research

It is interesting to notice that beside expected words like SDI (708 times) and Kosovo (306 times) which are clearly in vast majority, other terms as development, assessment, countries, national, data, level, information, research and approach are relatively often used in this research (between 50 and 150 times). The next group of terms like INSPIRE, readiness, forces, support, framework, funding, leadership, Slovenia, organisational, policy, political is used less (between 25 and 50 times).

2 SDI ASSESSMENT

By believing passionately in something that still does not exist, we create it. The nonexistent is whatever we have not sufficiently desired.
Franz Kafka

The concept of Spatial Data Infrastructure will be clarified in the following chapter. First, an historic overview of SDI will be given following the SDI definitions. Further the theoretical background of multi-view SDI assessment methodologies will be described. Additionally the Organizational aspects of an SDI and the 'Garbage can' method of identifying the driving forces will be analyzed in greater detail. At the end present state of SDI in developing countries and countries in so called 'transition' will be elaborated.

2.1 History and definition of SDI

Since the publication of the Executive Order on 'Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure' (President Clinton, USA, 1994), many countries throughout the world have initiated NSDIs. The goal of these infrastructures is to reduce duplication of effort among agencies, improve quality and reduce costs related to geographic information, to make geographic data more accessible to the public, to increase the benefits of using available data, and to establish key partnerships with states, counties, cities, tribal nations, academia and the private sector to increase data availability (FGDC, 2006).

It can be noticed from literature that an SDI is defined in many different ways for example:

- ***"Let geographic information promote economic development, improve our stewardship of natural resources, and protect the environment"*** (Clinton, 1994);
- ***"The actual goal of the SDI is not to serve the data handling functions per se, but to serve the 'needs of the user community', such as issues of globalization,***

sustainable development, economic reform, political unrest and war, urbanization, environmental awareness and human rights" (Rajabifard et al., 2002).

"To create an environment in which all stakeholders can cooperate with each other and interact with technology to better achieve their objectives at different political/administrative levels" (Rajabifard et al., 2003)

"To help avoid fragmentation, gaps in availability of GI, duplication of data collection and problems of identifying, accessing or using the available data" (SADL, 2003);

"To support information discovery, access, and use of geographical information for example in crime management, business development, flood mitigation, environmental restoration, community land use assessment and disaster recovery" (Nebert, 2004);

"At the national level, strategic initiatives are formulated and implemented by governments in most countries to manage their national geographic information assets. In some countries, it may refer to comprehensive and inclusive GI strategies from the standpoint of the stakeholders involved, whereas in others it may describe initiatives that are partial in their coverage and limited in stakeholder participation" Masser (2005).

"Spatial Data Infrastructures are complex phenomena combining many more elements and aspects than a mere technological perspective can unravel. Yet the vast majority of studies on SDI focuses on technical aspects" (Koerten, 2008).

"An SDI is typically defined as a set of interacting organizational, technological, human and economic resources that are available for facilitating and coordinating geographic information access, use and sharing" (Nedovic-Budic et al., 2008).

"The intention is for SDIs to support of political, economic, social and personal development and include the technology, policies, standards, human resources, and related activities necessary to support its goals" (Onsrud, 2008).

Obvious is that authors do not define the objectives of SDI in the same way. Some of them only accept the SDI role as facilitating data exchange where others may see an

SDI only as a facility for spatial data production and storage. But Masser (2005) shows that four key concepts underpin all SDIs: (1) they attempt to maximize the use of geographic information, (2) they cannot be realized without coordination on the governmental part, (3) they must be user driven, and (4) a wide range of activities is involved in SDI implementation – ranging from technical to institutional matters as well as required human and financial resources.

SDI hierarchy is of tremendous importance. As Rajabifard (2000) discusses, the SDI at the national level accommodates a central connection between the lower and higher levels to guarantee a continuous agreement on standards, policies and sharing of data.

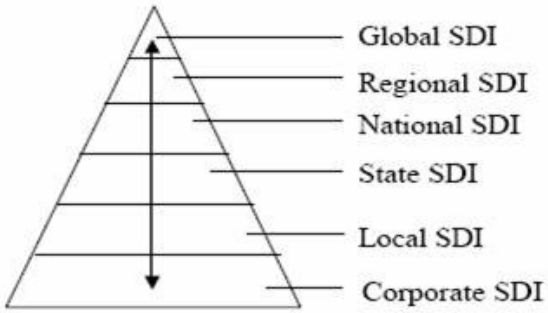


Figure 3: SDI hierarchy (Adapted from Rajabifard et al., 2003)

Figure 3 visualizes the SDI hierarchy: the national level occupies a central position in the SDI hierarchy as the critical link or hinge between the higher and the lower levels (Rajabifard et al., 2000).

Although all SDI initiatives strive to contribute significantly to local and national, but also regional and global economic growth and the establishment of preferred social and environmental objectives, the objectives of SDI initiatives differ. As one can clearly see that some initiatives have almost identical objectives emphasizing the same issues others diverge significantly.

SDIs, as defined in the context of this research, are network-based national solutions to provide easy, consistent and effective access to geographic information and services by public agencies and others.

2.2 SDI differences

The differences may be explained by the stage of development of a SDI. Several researchers have recognized two generations of SDI: the first and second generation SDIs (see Masser, 2000; Rajabifard et al., 2003, p. 95).

The first-generation SDIs developed starting in the mid-1980s and were designed to promote economic development, to stimulate a more efficient government and to foster environmental sustainability (Masser 1998). Countries like the United States relied on developing data access relationships, which became the precursor to the development of national SDI initiatives. These countries designed and developed SDIs based on their specific national characteristics, requirements, and priorities, paving the way for the documentation of experiences through status reports on SDI initiatives (such as Onsrud 1998). From this documentation, most countries developed a product-based approach to SDI development driven largely by national governments (Rajabifard et al. 2003).

In 2000, the second generation of SDI development began to appear with some of the leading countries changing and updating the SDI conceptual model. This was brought about by the creation of a much more user-oriented SDI perspective which was more effective in maximizing the added value of a nation's spatial-information assets and more cost-effective as a data dissemination mechanism (Masser 2005). The second generation focused much more on facilitating the management of information assets instead of accessing databases and using a process-based approach. The first and second generation models are shown in figure 4 (Rajabifard et al. 2006a).

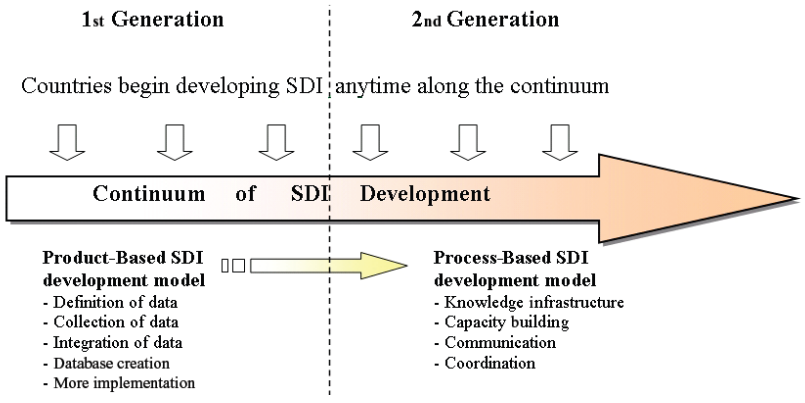


Figure 4: Relationship between the first and second generations of SDIs (from Rajabifard et al. 2006)

The first generation SDIs were mainly focused on data and the initial development was driven by top-down national governments, whereas the second generation is driven by the needs of users, with the focus on the use of data and data applications as opposed to the data itself, with one result being that sub-national governments and the private sector have greater influence.

SDI development over the past 15 years has seen 3 main players emerge - national governments, sub-national governments, and the private sector - with the role of each being quite different. As shown in figure 5, initial SDI development was the domain of national governments, which played both strategic and operational roles in mapping and collecting small scale data about nations. As policy development came from the national level, sub-national governments and the private sector had no clear role.

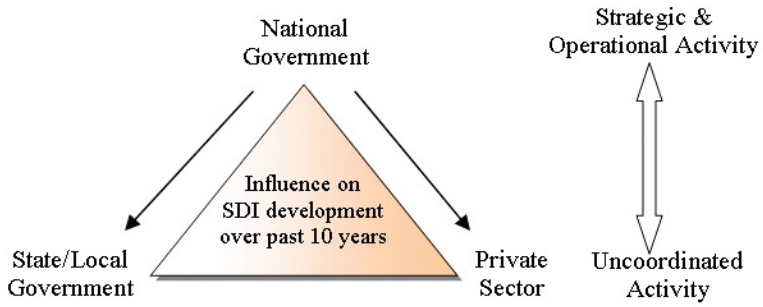


Figure 5: Roles of national governments, sub national governments, and the private sector in SDI development over the past decade (Rajabifard et al. 2006a).

The roles are now changing, with the national focus moving from being both strategic and operational to primarily strategic. National datasets are generally small scale, which fewer need for updating, maintenance, and infrastructure development. The operational responsibility for SDIs is moving to sub-national governments, where large scale data is being used for everyday decision making in emergency management, natural resource management and policy development. This data is very detailed and dynamic, requiring systems for updating and maintenance.

The operational role of the private sector is increasing, as it leads the drive for greater access to large-scale location based data (property and socioeconomic data). Sub-national governments are also moving forward in creating policies and initiatives that aid in the development of SDIs and utilize the expertise and cooperation of the private

sector. These two sectors are now responsible for building infrastructures in a collaborative manner with national government providing the overall framework in which such infrastructures can operate. In further developed SDIs as presented in figure 6, communication flows from these three players rather than only from a top-down national government (Rajabifard et al. 2006a). This overcomes problems inherent in purely top-down or bottom-up approaches.

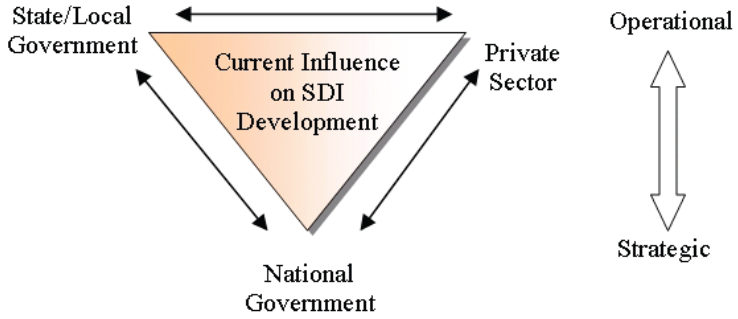


Figure 6: Current roles of national governments, sub-national governments, and the private sector in SDI development (from Rajabifard et al. 2005 and 2006)

As described by van Loenen (2006), in a top-down approach decision makers believe in the potential of an SDI, without actual commitment. A bottom-up approach has the opposite problem: the bottom acknowledges some successful experiences but lacks support from the top for broad-scale implementation.

This changing approach to SDI development has also been the driving force behind governments moving forward in creating policies and initiatives that open up more information to the public, and this change needs to continue. This goes beyond current first- and second-generation SDIs, which were designed primarily for data discovery and retrieval. In case of SDI of Kosovo this could be seen as an interesting point of view because citizens and organizations need infrastructures on which they can rely for provision of services.

2.3 Multi-view SDI assessment

Driven by different goals and interests, researchers of the last decade have tried several SDI assessment methods. Some authors focused on the description of the SDI themselves (Onsrud, 1998; Masser, 1999; Van Orshoven, 2003-2004; Vandenbroucke

and Janssen, 2005-2006; Delgado-Fernandez and Crompvoets, 2007), others paid more attention to the methodology (Steudler et.al., 2004, Delgado-Fernandez et.al., 2005; Kok and Van Loenen, 2005; Van Loenen, 2006; Rodriguez-Pabon, 2005; Grus, 2006-2007). All these attempts either concentrate on one aspect of a SDI, are restricted by one region, describe SDI development in only a few countries, or are still conceptual in nature.

A SDI is also difficult to assess because of its complex, dynamic, multi-faceted and constantly evolving nature and its vaguely defined objectives. SDIs also differ between countries as the same implementing rules may cause different results. For example, at the European level, the INSPIRE directive lays down general rules for establishing an SDI for the European Community (European Commission, 2007). Despite the fact that SDIs in the Member States will behave and operate in a generally similar way, as indicated by the directive, they will never be the same and will sometimes differ considerably depending on political, economic and cultural national circumstances.

An SDI is defined in multiple ways. For example, Chan (2001) collected the 11 most popular SDI definitions by different organizations and authors in different parts of the world at different times. Each of these definitions describes a SDI from slightly different points of view and none of them describe an SDI completely. The variety of ways in which an SDI is defined reflects its multifaceted character (De Man, 2006). Rajabifard et al. (2002) claims that some SDIs may be treated as products while others should be treated as processes which raise fundamental questions about SDI evaluation. Van Loenen (2006) argues that each SDI will need a hybrid approach to address both the products and processes. To be able to assess and compare the objects of the evaluation, an agreement must be reached on a single definition of the objects and about the criteria and values of merit. Referring back to Rajabifard's classification, as to whether we assess SDIs as products in terms of their structure or the processes they should facilitate or whether we assess both products and processes, the criteria and values of merit may therefore depend on how we understand the SDI concept.

The main idea behind the framework is that it covers all three purposes of assessing SDIs - accountability, knowledge and development (figure 7). It also acknowledges the multifaceted character of SDIs.

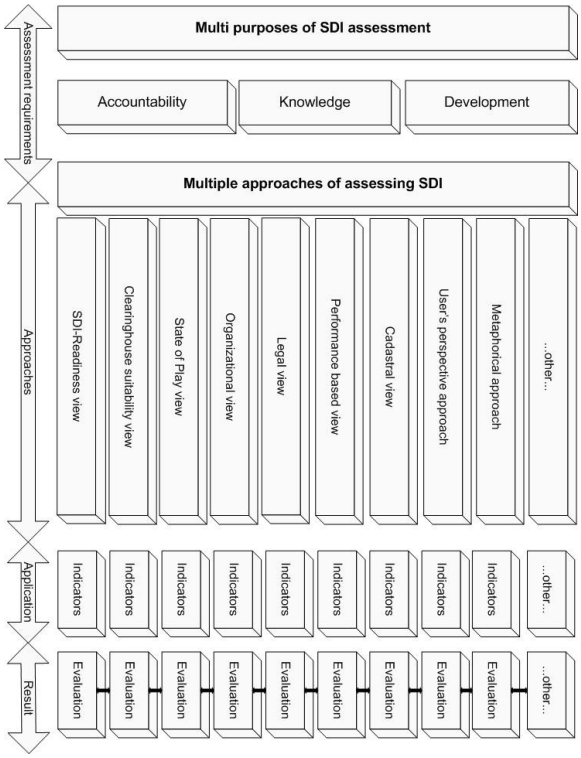


Figure 7: Multi-view SDI assessment framework (Adapted from Grus et al., 2008)

The core of the assessment framework is represented by the multiple assessment approaches that focus on different aspects of the SDI. Each approach treats SDIs from a different perspective. The essence of the multi view framework is that it accepts the multiple facets of an SDI and therefore accepts its complexity in terms of multiple definitions. Moreover, each assessment approach covers at least one of the three purposes of the assessment: accountability, knowledge and development.

The *SDI-Readiness assessment approach* is an existing model that assesses whether a country is ready to embrace SDI development (Delgado Fernández et al., 2005; Delgado Fernández and Crompvoets, 2007). When building an SDI readiness index, various factors like organization, information, access network, people and financial resources are taken into account. Each of these factors consists of numerous indicators that can be quantitatively measured. This model falls within the knowledge and developmental evaluation purpose. The results can be used to answer questions about comparing the progress made with implementing SDIs by different countries. It also helps to identify

obstacles in SDI implementations. SDI-readiness is measured by collecting and analyzing predefined indicators that are based on surveys.

The *Clearinghouse Suitability assessment* is based on research by Crompvoets et al. (2004) into measuring and assessing the development of National Spatial Data Clearinghouses worldwide. A method for measuring a specific set of quantitative indicators of clearinghouse portals can be applied as a continuation of longitudinal studies started in 2000. This knowledge and developmental assessment aims at exploring and showing the advances and trends in the development of clearinghouses (and web portals). This assessment approach uses survey (website visits) and contacting key informants to measure indicators for developing clearinghouse and web portals.

The *State of Play assessment approach* is a study covering the period from mid 2002 to 2007 in order to describe, monitor and analyze activities related to National Spatial Data Infrastructures in 32 European countries ─ 25 EU member states, 3 Candidate Countries and 4 EFTA countries. The major activity of this study is to collect and structure all the relevant information on the status of the six building blocks that together, according to this approach, constitute an SDI ─ the legal framework and funding, reference data and core thematic data, metadata, access and other services, standards along with the thematic environment (SADL, 2005). The same approach and methods can be used as a component of the multi-view framework, also in regions of the world outside Europe. Document studies (country reports), surveys (website visits) and contacting key informants (ie. national SDI experts) are the methods used in this approach.

The *Organizational assessment approach* is based on Kok and van Loenen's (2005) research into the assessment of the different stages of development of geographic information infrastructures, when viewed from the institutional (organizational) perspective. This approach focuses on measuring the development of the following SDI aspects: vision, leadership, communication, self-organizing ability, awareness, financial sustainability and the status of delivery mechanism. This approach falls into the developmental perspective of evaluation as it measures SDI development from an organizational perspective. So far, the authors of this approach have measured and analyzed the development of five SDIs using the case study method (van Loenen,

2006). This approach has also been successfully applied to assess SDIs in developing countries (Eelderink, 2006) and in Dutch municipalities (De Graaf, 2006).

The *legal assessment approach* concentrates on assessing the legal framework that underpins the functioning of an SDI. This approach consists of three levels of assessment: 1) compliance – assessing how an SDI complies with an existing legislation; 2) coherence – assessing the interaction between all the laws that make an SDI legal framework; 3) quality – assessing whether the legal framework of an SDI stimulates its development.

The *Performance-Based assessment approach* uses the Performance-Based Management (PBM) technique to evaluate, demonstrate and improve the performance of an SDI (Giff, 2006). This approach is based on the assumption that an SDI is an infrastructure and that methods like PBM normally used for assessing the performance of infrastructure can be used for assessing an SDI. This method aims to develop performance indicators based on the specific objectives of an SDI that are used to measure its effectiveness, efficiency and reliability. This approach is still in the conceptual stage and specific indicators and methods for their measurement are yet to be developed. The approach falls under the purpose of evaluation for accountability as it mainly seeks to answers questions about SDI efficiency and results.

The *Cadastral assessment approach* was originally developed as a land administration evaluation framework by Steudler et al. (2004). It presents a number of indicators for five areas in evaluating Land Administration Systems (LAS): the policy level, the management level, the operational level, influencing factors and assessing performance.

The aim of the *user's perspective assessment approach* is to measure the effectiveness of an SDI from the user's perspective. It derives measures mainly from information systems that are based on concepts such as: usefulness, effective use, information and organizational effectiveness. This assessment approach focuses on identifying its existing and potential users and on investigating how useful SDI-'products' are for meeting their particular needs.

The *Metaphorical assessment approach* analyses the relationship between an SDI and its organizational aspects. A framework based on organizational metaphors and paradigms has been developed to provide an overview of possible approaches for organizational analysis and to analyze existing literature on the organizational aspects of an SDI. This kind of assessment provides a basis to deepen the existing knowledge about SDI theories and might be the starting point to intervene in practice. This approach falls into Chelimsky's 'knowledge' assessment purpose.

Assessment approach	Goal Description	Method	Applicability	Assessment purpose class
SDI-Readiness	To assess if the country is ready to embrace the SDI development	Survey	Applicable	Developmental Knowledge
Cadastral	To measure five evaluation areas of LAS	Survey	Needs improvement	Knowledge Accountability
Organisational	To measure the SDI development from the institutional perspective	Case study	Applicable	Developmental
Performance-Based	To measure the SDI's effectiveness, efficiency and reliability	Not available	Needs improvement	Accountability
Clearinghouse Suitability	To measure the development and impact of SDI clearinghouses worldwide	Survey, key informants	Applicable	Developmental Knowledge
State of Play	To measure the status and development of SDIs	Document study, survey, key informants	Applicable	Developmental Accountability
User's perspective	To measure the SDI's effectiveness from the user's perspective	Case study	Needs development	Accountability, Knowledge
Metaphorical	To analyse organisational and management aspects of the SDI	Literature review	Needs development	Knowledge
Legal	To measure compliance, coherence and quality of the SDI legal framework	Case studies	Needs improvement	Knowledge

Table 1: SDI assessment approaches proposed for the multi-view assessment framework (Adapted from Grus et al., 2008)

Table 1 summarizes the attributes of all the evaluation approaches proposed for the multi-view framework. Some of the approaches exist only as theoretical constructs and need to be elaborated on further in order to develop application methods. These approaches include the Cadastral, Performance-Based, Legal, Metaphorical and Users' perspective.

The SDI-Readiness, Organizational and State of play approaches can be applied to the framework in a straightforward manner as the methodologies and application practices already exist. This combination of assessment methods is chosen as suitable platform to assess the SDI of Kosovo because of possibilities of gathering a wide range of data.

2.4 The SDI readiness model

The literature research on SDI Readiness Index has provided a basic overview of the problems that should be discussed with the key experts involved in SDI of Kosovo. The goal of this research step is to implement a SDI readiness Index to assess the bottlenecks of SDI development in Kosovo and to prioritize strategies to overcome these obstacles.

In this thesis SDI readiness index is not applied as comparisons with other countries but as a comparison in different time frames. The first attempt to assess the SDI Readiness approach by Delgado et al (2005) was also limited to one case study to compare the progress of SDI readiness in Cuba.

According to Delgado (2005) the SDI readiness index model integrates factors from several points of view: organizational (politicians vision-commitment-motivation, institutional leadership, national legal (umbrella) agreements); information (providers' motivation, digital cartography availability, knowledge of standards); access network (web connectivity; technological infrastructure, geospatial software availability /in-house development); people (educational level, SDI culture, individual leadership) and financial resources (government sources, private sources, national geospatial initiatives). The model is based on fuzzy logic, given the qualitative nature of the majority of factors.

Delgado (2005) assumes the following propositions:

- A country is ready to undertake an SDI if and only if it has an appropriated level of the global factors: Organizational (O), Informational (I), People (P) and Financial Resources (F), and any level of Access Network (A).

$$SDI\ Readiness = O \wedge I \wedge P \wedge F \wedge A^{0.5}$$

- A country has an appropriated level of organization (O) to undertake SDI if and only if it has an appropriate level of: vision on SDI (Ov), institutional leadership (Ol) and legal framework (Oa).

$$O = Ov \wedge Ol \wedge Oa$$

- A country has an appropriated level of information (I) to undertake SDI if and only if there is an appropriated availability of digital cartography (Ic) and metadata (Im) or if there is not an appropriated availability of digital cartography then it has a strong level of metadata.

$$I = Ic \wedge (\neg Ic \rightarrow Im^2)$$

- A country has an appropriated level of people (P) to undertake SDI if and only if there is an appropriated level of: national human capital (Pc), SDI culture (Ps) and individual leadership (Pi).

$$P = Pc \wedge Ps \wedge Pl$$

- A country has an appropriated level of financial resources (F) to undertake SDI if and only if there is an appropriated level of funding from the Government (Fg) or from private sector (Fp) or an appropriated level of return on investment (Fr) from geospatial industry.

$$F = Fg \vee Fp \vee Fr$$

- A country has an appropriated level of access network (A) to undertake SDI if and only if there is an appropriated level of technological infrastructure (At), web connectivity (Aw) and an appropriated availability of Geospatial software (As) or own geo-informatics development (Ad) or open source culture (Ao).

$$A = At \wedge Aw \wedge (As \vee Ad \vee Ao)$$

Then the SDI readiness index based on Fuzzy Logic could be formalized by means of the following model:

$$SDI\ readiness = (Ov \wedge Ol \wedge Oa) \wedge (Ic \wedge (\neg (\neg Ic) \wedge (\neg Ic \ \square\ Im^2)) \wedge (Pc \wedge Ps \wedge Pl) \wedge (Fg \vee Fp \vee F) \wedge (At \wedge Aw \wedge (As \vee Ad \vee Ao))^{1/2}$$

The only caution to take into account is in the case of the 0 value (absolutely false), because it implies a veto has been used. Applying the compensatory logic, we obtain the following expression:

$$SDI\ readiness = (Ov*Ol*Oa)^{1/3} * (Ic*(Ic*((1-Ic)*Im^2))^{1/2})^{1/2})^{½} * (Pc*Ps*Pl)^{1/3}*(1-((1-Fg)*(1-Fp)*(1- Fr))^{1/3}) * ((At*Aw*(1-((1-As)*(1-Ad)*(1-Ao))^{1/3}))^{1/3})^{1/2}$$

To evaluate each decision criterion of the fuzzy expression of the SDI readiness index due to its sensitivity with the variety, a multivalent logic system called Compensatory Logic is used (Espin, 2004). Espin also recommends assigning values by means of group techniques in order to minimize the subjectivity of isolated points of view.

Category	Truth Value
Absolutely False	0
Almost False	0.1
Too False	0.2
Rather False	0.3
More False than True	0.4
Equally False and True	0.5
More True than False	0.6
Rather True	0.7
Too True	0.8
Almost True	0.9
Absolutely True	1

Table 2: Categories and values in the fuzzy model selected (Espin, 2004).

2.5 Organizational aspects of SDIs

Koerten (2008) argues that the SDI literature is predominantly focused on technological, legal an economic aspects of SDI, there is undeniably and increasing stream of studies that address the organizational sides to SDI. He also focuses primarily at the role of individuals when arguing that people's perceptions, motives and expectations are more important to understand SDI practice than "*just looking at what design of organizational structure is most effective"*. The characteristic 'people-focus' is quite often discussed in literature. For instance, Reeve and Petch (1999) their main message is to put the people first, and trade the "technology push" approach in for a "demand pull" one. GIS is seen as a device by which value chains can be made more efficient. Based on this shift from a

techno-centric viewpoint to a, so called, socio-technical viewpoint, Rajabifard et al. (2003b) described the two SDI-generations.

More unenthusiastic suggestion of SDI's organizational side can be found in those studies that look for organizational aspects that obstruct successful deployment of SDIs. As Koerten (2008) states, organizational aspects are considered important, but seem hard to conceptualize. Explaining setbacks and failures, practitioners point at organizational obstructions but do not know how to deal with them.

Almost every publication on organizational aspects of SDI stresses the importance of (organizational) culture and (individual and organizational) behavior, most likely as a reaction to the perceived top-down and techno-centric way of thinking in the early days of SDI development. Omran (2007) uses a cross-cultural model for understanding individual and organizational spatial data sharing behavior. Omran and Van Etten (2007) also put a strong emphasis on willingness related to cultural aspects, although their use of social network analysis reveals some interesting aspects of organizational structure, showing that a hierarchical organization structure could put serious constraints to spatial data sharing.

Several authors also address process models describing stages either in the innovation diffusion implied in SDI development or in organizational change recipes involved in managing an SDI initiative. Masser (2005) also describes the diffusion of innovation model, developed by Rogers (2003), identifying 5 major user categories: innovators, early adopters, early majority, late majority, laggards. Masser applies this model to describe the state of development of national SDIs in different countries around the world. The results can provide a basis for specific guidance as to how policy makers may influence the actual behavior of spatial data sharing more effectively.

Van Loenen and Van Rij (2008) propose a grow model aimed to explain how the SDI may evolve from several 'stand-alone' organizations into an institutionalized network of collaborating organizations. Four stages of development lead to SDI maturity. Each stage is in fact an ideal-typical description of organizational behavior, but the possible explanations for this behavior remain underexposed. Another view on the proliferation of

SDI is described by De Man (2003), based on actor network theory, to explain the roles and importance of the main actors.

A clearer move towards management advice is made by Rajabifard (2003) who also refers to Rogers (2003) to describe an organizational innovation process model, made up of two main stages; initiation and implementation. Three classes of factors are mentioned which are influencing the SDI-participation rate: environmental factors, capacity factors and SDI organization factors. SDI participation is here about the engagement of member states in a regional SDI initiative. The possible utility of this approach to analyze the participation of organizations in actual spatial data sharing is dealt with. Craig (2005) elaborates on the importance of key individuals by describing them as white knights, driven by their idealism, enlightened self interest and involvement in a professional culture that honors serving society. Coleman et al. (2000) stress that geo-informatics professionals need specialized organizational and process management skills to facilitate the development and implementation of SDI, due to all non-technical issues related to data sharing within and between organizations, countries and regions.

Several studies address the inter-organizational domain. Nedovic-Budic and Pinto (2001) use the term “organizational interoperability” to assess inter-organizational interaction, coordination and implementation processes.

International assessments of national SDIs, like the Inspire State of Play (Vandenbroucke and Janssen, 2008) and SDI readiness studies (Fernández et al., 2006) contain a number of organizational elements, like the existence of a coordinating body or the level of participation of data users and producers in the initiative. Such general indicators are useful to do a general assessment of a national SDI, but are not very helpful to describe and interpret (inter)organizational issues.

As we concluded earlier, organizational conditions are relevant to developing a mature and sustainable SDI. These circumstances need to change with the changing requirements for the SDI. Sooner or later also needs of communities change. Chan (2001) argues that because of internal and external dynamics, it will never be possible to specify the ideal SDI because as the SDI develops, the environment in which this development occurs also changes.

The four stages of SDI development as presented in figure 8 (Standalone, Exchange, Intermediary and the Network stage) builds on the work of many researchers and lay down together in work of Kok and Van Loenen (2005), and Van Loenen (2006).

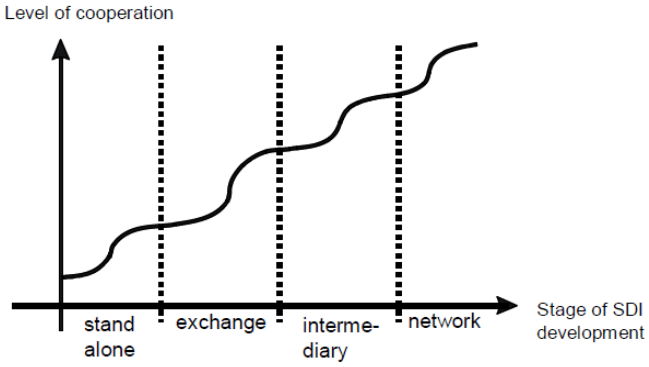


Figure 8: Stages of SDI Development (Van Loenen, 2006)

The SDI would be categorized as an inter-enterprise organization. An inter-enterprise organization is a more stable, though not static, group of organizational entities that have developed preparedness to cooperate in the case of a specific task (Kürümlüoglu et al., 2005; see also Oosterwijk, 1995), developing the SDI. The SDI concerns a network of organizations, in which individual organizations become a component of an interdependent network of organizations. In accomplishing successful organizational change, the organizational theoretical framework of Boonstra (2000) can be used to identify the characteristics of the stakeholders in an organization, or community, in a certain stage of developing the change process. Therefore, the model has been assessed as useful to include in the stages of SDI development model. The stage model aims to explain how the SDI may evolve from several 'stand-alone' organizations to an institutionalized network of collaborating organizations.

An interesting assessing approach of organizational perspective of SDI is to define an SDI maturity matrix (see also Van Loenen, 2006; Kok and Van Loenen, 2005). This matrix describes the way a vision, leadership, communication channels and the ability of the geographic information community for self-organization are present or perform in an SDI depends on the stage of development.

The SDI maturity matrix consists of four stages of SDI development. In the network stage, ultimate, most advanced stage, it is commonly understood what an SDI consists of and what its objectives and ideal are. In this idealistic view, leadership, open communication channels and a pro-active geographic information sector have resulted in a capacity that is such that the SDI enjoys broad support at all levels, resulting in sustainable funding for SDI development.

Stage / Aspect	Stand alone/ initiation	Exchange/ standardization	Intermediary	Network
Vision	Focus on individual organisation	Developed with all stakeholders	Implementation	Commonly shared, and frequently reviewed
Leadership	Focus on individual organisation	Questioned	Accepted	Respected by all stakeholders; 'champion'
Communication	Focus on individual organisation	Open between public parties	Open between all stakeholders	Open and interactive between all
Self-organising ability	Passive problem recognition	Neutral problem recognition	Actively helping to solve identified problems	Actively working on innovation
Awareness for GII	Professionals in one organisation: organisational 'SDI'	Professionals of organisations together: SDI	Awareness at many levels incl. decision making	Commitment at all levels/continuous support in politics and management
Financial sustainability	Limited to projects	Neutral	Guaranteed for certain period	Sustainable but frequently reviewed

Table 3: Maturity of SDI from an Organizational Perspective (Van Loenen, 2006)

The organizational maturity matrix has been used to assess the coherence of the geo-information community. From that perspective, the more coherent the community, the more successful the SDI development. Successful implies in this view a network, a 'multi-purpose system' with a clear distribution of responsibilities and shared leadership (Kok and Van Loenen, 2005). In other words, a more 'mature' SDI in terms of the model was regarded as a more successful SDI.

2.6 INSPIRE State of Play - Assessing the status of SDI's

The INSPIRE state of play assessment approach is an adapted version of an approach to measure the status of NSDIs in the European Community (SADL, 2006). This approach measures a number of organizational issues and seven generic SDI-components: organizational aspects; the legal and funding framework; spatial data; metadata; access and other services; standards and thematic environmental data.

In order to have a better view on the status and development of these SDIs, the Commission launched a study known as INSPIRE State of Play in 2002. The study collected information on 32 National SDIs in Europe according to the components as described in the GSDI cookbook. A list of 30 indicators was established to assess the SDIs at organizational, legal, funding and technical level. From this perspective, the State of Play follows a generic approach.

The conclusion could be drawn that organizational structures, in which SDIs are embedded, are the key vehicles when it comes to aspects of SDI performance and effectiveness.

2.7 The Garbage can model

We all agree that awareness at executive management level is of incredible importance for development of SDI. The 'garbage can model' of Cohen, March and Olsen (1972), improved by Kingdon (1995) may teach how awareness for the SDI may be developed among high level politicians. Relating the SDI to the 'driving forces' of these high-levels may promote the awareness for SDI and its development.

Kingdon's 'garbage can model', focuses more on the flow and timing of policy action than on its component steps. In this model, attention is focused on three streams: the problem stream, the policy stream, and the political stream, which move independently through the policy system. This model contradicts the rational approach to decision-making, claiming that policies are not the product of rational actions, because policy actors rarely evaluate many alternatives for action and because they do not compare them systematically.

As emphasised by Van Loenen (2006), this model aims to explain why some issues and problems become prominent in the policy agenda and are eventually translated into concrete policies while others never do so. The 'Garbage can model' identifies three major factors that may lead to political recognition:

1. Fluctuation of problems pressing in on the system;
2. Gradual accumulation of knowledge, and

3. The political process.

Fluctuation of problems pressing in on the system: Since geographic information may be linked to almost any problem in society, SDI executives in Kosovo need to ask themselves continuously: "What strategic goals are important this year which can help improve SDI?". Recent examples of capital infrastructural projects in Kosovo like the highway connecting Prishtina with Tirana, the new Hydropower plant in Zhur, the new thermo-electric power plant 'Kosova e re' and the need for high quality geographic information to master this kind of projects effectively. As a result of these capital investments in Kosovo, different ministries have put a major role for geographic information. The message for the SDI of Kosovo here is: have your solutions ready and wait, because there is always an issue where one can relate its geographic information solution to.

The rationale behind this stream is that a given situation has to be identified and explicitly formulated as a problem for it to bear the slightest chance of being transformed into a policy. Indeed, a situation that is not defined as a problem, and for which alternatives are never envisaged or proposed, will never be converted into a policy issue.

Gradual accumulation of knowledge: New knowledge may also change the political agenda. New knowledge may result in the accumulation or diffusion of academic arguments among policy makers so they are more receptive to some proposals than others. According to Van Loenen (2006), in the geographic information sector, new technology has brought the advanced Mobile GIS and GPS systems, Location Based Services, and even has brought satellite imagery on the PDAs. These were previously only available to professional users, but are now part of the every day life of many individuals (for example, Open street map, Google Earth, Virtual Earth, Street view, Layar, Dynamic Car Navigation systems, Mobile GIS etc). New technology has allowed for the inexpensive dissemination of geographic information through electronic means, for ways to search for information (clearinghouses), and as a result for the widespread knowledge of the existence of a dataset.

Political process: Although they take place independently from the other two streams, political events, such as an impending election or a change in government, can lead a

given topic and policy to be included or excluded from the agenda. Indeed, the dynamic and special needs created by a political event may move the agenda around. Kingdon categorises four potential events that may impact the political agenda: swing of national mood, vagaries of public opinion, election results and change of administration.

Van Loenen (2006) describes that the political process can have a major impact on the political agenda. Also the political beliefs, culture, or the fads and fancies of decision-makers are not easy to influence, but may certainly be relevant for choices made.

According to Kingdon, the three factors are largely independent of one another, and each develops according to its own dynamics and rules. But at some critical junctures the three streams are joined, and the greatest policy changes grow out of that coupling of problems, policy proposals, and politics. Solutions become joined to problems, and both of them are joined to favourable political forces (Kingdon 1995, 20). This coupling is most likely when policy windows – opportunities for pushing pet proposals or conceptions of problems – are open.

The first two factors that Kingdon has identified, new problems and new knowledge, may also be described as awareness building factors. New insights about the importance of geographic information, new technology allowing for new solutions to old problems, and new research results may make people aware of the value of geographic information and the geographic information infrastructure. Figure 9 provides the SDI drivers based on Kingdon's "Garbage can model".

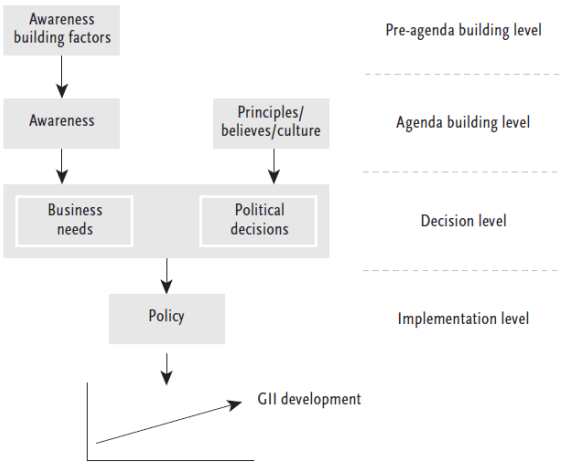


Figure 9: driving forces based on Kingdon's "Garbage can model" (Van Loenen, 2006)

It is not always necessary, however, for all three streams to meet simultaneously for a SDI policy to develop. Indeed, in some cases, partial couplings, the meeting of two of the streams, are sufficient, though the whole SDI policy-making process is made more uncertain. Kingdon argues that policy entrepreneurs play a key role in connecting the streams, and that there are different types of couplings. Indeed, couplings can be more or less "tight" or "loose," depending on the degree to which streams depend on each other for an issue to develop into a concrete policy.

What specific force is driving the SDI at a certain time may depend on the stage of development of the SDI. The strategy will help to complete the SDI vision. Ultimately this may result in the ideal SDI of that day.

The major strength of this model is that it recognises that the policy process is fluid and non-linear and that it involves a vast number of actors and forces. In this model, there is no chronological sequence or priority among the streams. On the contrary, streams act and react according to their own logic, until a window of opportunity is opened and two or more streams coincide and coalesce into a policy.

2.8 SDI in developing countries

A developing country can be defined as a country with a relatively low standard of living, undeveloped industrial base, and moderate to low human development index (a comparative measure of poverty, literacy, education, life expectancy, childbirth, and other factors) (World Bank, 2006). Akinyede and Boroffice (2004) note that policy-makers in developing countries do not have the adequate access to accurate (geo) information needed to make rational and prospective allocation and management decisions. Besides the dependency on (external) funding sources, developing countries are facing some other challenges to establish and implement SDIs. According to Rajabifard and Williamson (2003), the main limitations of SDIs in developing countries are thought to be in the lack of appreciation of what an SDI can and cannot do the lack of resources and trained personnel, inefficient bureaucratic processes, and the lack of data.

Between 1998 – 2000, a survey to assess the nature, extent and status of SDI activities of nations around the world was accomplished by the University of Maine (USA). The survey results suggested that NSDIs were planned in about 54 countries. In South/Central-America, initiatives were noticed in 15 countries. In Asia, 8 initiatives were observed. In Africa, only South Africa responded to the questionnaire. Because of the expanded interest in geographic information, nowadays many countries and organizations have embraced SDIs. In 2002, 120 countries had already initiated projects for SDI development (Crompvoets, 2003).

It is difficult to implement SDIs, partly due to the shifts in bureaucratic power that are associated with it. For an SDI to be successful, governments must participate and continuously contribute and support the SDI developments (FGDC, 2006). To actually sustain the SDI is a major challenge in developing countries. In many cases foreign donors drive the initiatives instead of the respective governments (Lance, 2003).

As described by De Man (2004), SDIs seem to be another 'promise' within the continuous development of geographic information technologies. Does the promise of SDIs also hold for developing countries? Are enabling conditions and possible bottlenecks of developing countries different from those of developed countries?

Masser (2005) describes SDI initiatives based on a model called: 'The diffusion of innovations' as developed by Rogers (2003). The model can be used to describe types of innovations – like SDI. Rogers defined five adopter categories based on the degree to which an individual or a unit of adoption is relatively earlier in adopting new ideas than other members of the system: innovators, early adopters, early majority, late majority, and laggards. According to the model of Rogers, 11 SDI initiatives are described as innovators/early adopters. At that time (1998), no initiatives were listed in Latin America and/or Africa.

Masser also describes the early adopters of NSDIs and a considerable number of developing countries in South/Central-America and Asia fall into this category. In Africa, only one initiative is noted in the early adopter category, which is South Africa. Some other, mainly sub-Saharan African countries follow as 'early majority'. South Africa

played an important role in promoting SDI in the region (mainly sub-Saharan Africa), likewise Colombia with respect to Latin America.

For the first generation of NSDIs (Rajabifard et al., 2003), data was the key driver of development and the focus of initiative development. For the second generation (as of the year 2000), the use of data and applications and the need of users are the driving forces for development. Rajabifard concludes that a switch to a more 'socio-technical viewpoint', including facilitation and coordination ('people'), could be observed while the first NSDIs were more techno-centered.

Masser (2005) summarizes the driving forces behind NSDI initiatives as 'the promotion of economic development, the stimulation of better government, and fostering of environmental sustainability'. Predominantly in Africa, the driving forces are related to the modernization and environmental management. Nowadays, e-government is also mentioned in literature as an important driving force: a robust NSDI can expand the power of geo-information and enable the spatial delivery of government services (FGDC, 2006). E-government refers to the use by government agencies of information technologies that have the ability to transform relations with citizens, businesses, and other arms of government (World Bank, 2006). In the developing world, international donors are playing an important role in the enforcement of (N)SDIs. However, projects funded by the donors almost always have a restricted life span, whereas SDI developments require continuous achievements over a long period of time. Therefore, the input of the donor raises issues of sustainability. It might very well be that, as soon as the funding is exhausted, collaboration and continuity fades away.

From this part of the chapter, one can conclude that the driving forces of SDIs in developing countries are: e-government which can enable the spatial delivery of government services and actively participation, continuously contribution and support of government in SDI developments

The following sections further investigate the development op SDIs in European countries in politic transition.

2.9 SDI developments in European transition countries

The political and economic changes in Eastern and South-Eastern Europe which ensued after the socialist regime dismantled, turned out to be more comprehensive than anyone could estimate at the beginning of last decade of the last century when the process called transition started. The transitional changes have been present in the past twenty years and actually they are still present which is visible from the numerous processes of restructuring particular segments of these states, i.e. societies and their economies (Boes and Pavlova, 2002).

If we use the term geo-sector for all constituent parts which contribute to the SDI establishment and if we analyze the relation between the transition and geo-sector, it can easily be seen that the structural changes within it are not conducted at the same speed as they are conducted in some other sectors, such as financial sector, environmental protection or the real estate market. This particularly refers to the land administration itself, i.e. the real property and title registration, and it affects less some other geo-sector segments, such as the activities of collecting spatial data and developing spatial data sets, then the development of geo-information system, i.e. the development of services intended for users. All the abovementioned is also logical because the real property and title registration is a complex process which includes large quantities of data, and high standards of processing and user protection. In transitional countries, it is impossible to use simple procedures for inappropriate conditions found in the field and turn them into legal and geodetic forms required by the modern society (Bačić, 2009).

Bačić (2009) states further that many new European countries before the fall of the Berlin Wall were not independent, but were part of larger federative states. There are 14 such new states currently in Europe and it is important to point out the fact that before they reached independency, the majority of these states did not have an independent or comprehensive legislation that would cover the geo-sector, nor did they have the necessary institutions established. From the example of the states established after the former Yugoslavia fell apart, this means that the legislation covering the land administration was under the authority of the republics within the former Yugoslavia. However, as the concept of social ownership reached the highest degree of development in the former Yugoslavia in terms of negating ownership, this meant that

the society and land registration institutions ceased to monitor adequately the changes in the form and contents of real property and its ownership titles.

The situation, which is alone very demanding, has been additionally worsened by the war that broke out in the part of newly established states in the south-east of Europe, namely in Slovenia, Bosnia and Herzegovina, Croatia, FYR of Macedonia, Montenegro, Kosovo and Serbia states Bačić (2009). Not only due to the several year long delay in starting the reforms or implementing them at a slow pace, but also due to the changed circumstances in which the reforms were to be implemented. This was not the case in other former socialist countries, but the possible delays were caused primarily by the overall speed of reform implementation, i.e. by the political and economic instability of each State.

Before the downfall of the socialist regime, responsibility for geographical maps and data lay within military organizations, called military topographic institute or service that still exist. Today, most activities are carried out by civil ministries. The most important ministries are in all countries the ministry of regional development, the ministry of agriculture and the ministry of environment. For the purposes of tax collection, ministries of finance work with cadastre data, and ministries of justice are in charge of national registries. However, these have to be considered as specific application oriented data usages (Boes and Pavlova, 2002).

According to Vasile, C. and Oana, C. (2008), Romania is maybe the most advanced country, having established its Agency for Cadastre and Real Estate (ANCPI) with the broadest mandate for spatial data. This agency was also one of the main initiators to support SDI activities in Romania as part of the first INSPIRE work group in 2005.

Since 2004, efforts have been made to structure the Bulgarian SDI activities. The work is coordinated by two agencies: the State Agency for Information technology and Communications (SAITC) and the Agency for Sustainable Development and Euro-integration (ASDE). The objective is to coordinate activities from ministries, regional and local authorities, specific agencies, and organize collaboration with the private sector. Major efforts are made to develop new datasets which are basic components for the building the INSPIRE oriented Bulgarian SDI (SoP, 2007).

The first segment affected by the transitional changes has been the real property register (cadastre) and the real property title register (land registers) which is logical by itself because the cancellation or rather the negation of the private ownership was one of the key ideological differences. The laws reinstituting the private ownership and returning the alienated real properties have been adopted by the countries in transition, whereby the solutions on the restitution technique and thereby the speed of its implementation have depended on political and historic factors. To serve an illustrative purpose; the solutions implemented in the Baltic countries of Estonia, Lithuania and Latvia are considerably different to those implemented in the countries of South-Eastern Europe. From the aspect of the geo-sector, the legal aspect of the aforementioned processes is thereby less important than the role of the cadastre and spatial datasets as well as the manner in which to bring the existing datasets, that entered the transition as decayed and not updated, to the level that will meet the needs of the new social structure. Since the re-privatization of the land and the adjoining real properties has developed in parallel with the development of the real property markets and the outstanding growth of the transactions, the registers have been faced with new challenges (Bačić, 2009).

The development of the SDI, the development of the mechanisms and the building of the SDI system are a logical consequence of the general situation in the field of using the spatial information. In this context, the geo-sector must bear in mind that the initiatives and the solutions such as the INSPIRE Directive (European Union, 2007) are primarily the result of the user dissatisfaction and not of a clear vision of the spatial information suppliers. However, the countries in transition have been differently affected by the SDI concept and its realization.

In this context, the societies in transition are facing the additional challenge of how to build the instruments for implementing the NSDI that will enable not only the realization of the NSDI establishment in line with the INSPIRE Directive but also influence the GI systems in a manner that will from the outset provide for the implementation of the adopted standards, models and specifications, thus reducing the subsequent costs and increasing the efficiency of the NSDI system.

3 SDI ASSESSMENT OF KOSOVO

A dream you dream alone is only a dream. A dream you dream together is reality.
John Lennon

3.1 Republic of Kosovo

Kosovo has about 2.2 million inhabitants in an area of about 11.000 km^2. There are 30 municipalities with five of them Serbian dominated and eight as ethnically mixed municipalities. Kosovo borders with Serbia to the north and east, the Republic of Macedonia to the south, Albania to the west and Montenegro to the northwest. The largest city and the capital of Kosovo is Prishtina.

It was until 1989 that Kosovo remained an autonomous province of the Federal Republic of Yugoslavia, with its own administration. The autonomy was revoked in 1989 and most of the administration moved from Prishtina to Belgrade. Kosovo Albanians were expelled from their work in public administration at the provincial and municipal. Discrimination laws were passed. During this period, the Kosovo Albanians built a parallel structure of administrative services such as education. The whole situation erupted in an ethnic conflict between Albanians and Serbs in the spring of 1999, where after a 77 day NATO military air bombing campaign on Serb military targets; Serbia withdrew its forces from Kosovo, leaving significant damage.

United Nations Interim Administration Mission in Kosovo (UNMIK) was established on June 10, 1999 when the Security Council in resolution 1244 authorizes the Secretary-General to establish in the war-ravaged province of Kosovo an interim civilian administration led by the United Nations under which its people could progressively enjoy substantial autonomy.

The peace-enforcement force KFOR entered Kosovo on June 12, 1999 under an UN mandate. KFOR is a NATO-lead international force responsible for establishing a security presence in Kosovo.

Kosovo declared independence on 17 February 2008. Currently, about 70 United Nations states recognise the independence of Kosovo and it has become a member country of the IMF and World Bank as the Republic of Kosovo[1].

Figure 10: The "NEWBORN" monument unveiled at the celebration of the 2008 Kosovo declaration of independence

The "newborn" Republic of Kosovo is in an intensive stage of development after the independency declaration in February 2008. The Government has declared its priorities in the comprehensive "Program of the Government of Republic of Kosovo, 2008-2011" and is gradually implementing the Ahtisaari[2] plan including decentralization issues also impacting the land administration. One of the Governments aims is to take steps towards European integration.

3.2 Background of Kosovo's SDI

The awareness for SDI was extremely low in the first years after the violent conflict in Kosovo. Remarkably, there where even at least three different projections used in Kosovo in early years of this century. Yet for several early adopters in Kosovo, efficient and transparent spatial information and management was of a special importance for the future of Kosovo. With hasty and technocratic development in Kosovo regarding Geographic Information System (GIS) and its applications, more and more unsynchronized and scattered information has been generated. There was a vast

[1] *http://en.wikipedia.org/wiki/Kosovo, 2010*

[2] *On 2 February 2007, UN Special Envoy Martti Ahtisaari delivered a draft status settlement proposal, covering a wide range of issues related to Kosovo's future.*

amount of datasets stored in different places and in different formats, but awareness of reusing and sharing the information for new applications was very limited. Unfortunately this diversity in information can be still seen in different governmental departments. Standardizing geographical information and sharing is still a big challenge for the sustainable development of SDI in Kosovo.

Different experts in Kosovo experienced an increasing demand in spatial data for planning, decision making and monitoring of effects within different areas, such as environment, agriculture, forestry, transportation, telecommunication, energy, security, real estate management, etc. Also the development of e-Government services, the increased cooperation in Europe and globally, the restructuring of the public sector as well as issues related to the future handling of security, vulnerability and integrity where more and more accepted. Sustainable implementation of the SDI concept was therefore of importance for the Kosovo society. Aspirations to enter the EU provides important fundamentals to implement the INSPIRE Directive and other EC Directives impacting NSDI development.

The Land Administration Policy (LAP) adopted in 2003 was aimed at defining and then implementing a modern land administration framework. The LAP has also suggested outlining the policy for NSDI implementation in Kosovo. The Kosovo Cadastral Agency (KCA) is only one of the stakeholders among others in land administration. Other stakeholders have responsibilities for planning, land use, zoning, building management, utility infrastructure and mining – activities that contribute to effective administration and management of land and immovable property. The High Level Policy Objectives adopted are as follows:

- Create an efficient land administration based on best practice;
- Resolve land tenure problems and create tradable assets;
- Provide clear definitions of land and property with secure and safe administration of property rights;
- Support local Land Management consistent with public good and sustainable social and economic, rural and urban development;
- Support stable and secure land markets;
- Promote capacity building and professionalism in the public and private sector;

- Improve information flow, access and dissemination of land information and basic spatial data; and
- Provide basic Geo-information Infrastructure.

The High Level Policy Objectives are still valid and are the basis for the government's goal for land administration. When reviewing the policy it should be harmonized with other government initiatives. Entering into the European Union (EU) means that Kosovo would have to apply to Directives issued by the European Commission (EC). In relation to land administration the Infrastructure for Spatial Information in the European Community (INSPIRE) will have to be considered.

Of course also other directives and initiatives of republic of Kosovo related to spatial information issues must be considered. These include the Public Sector Information Directive, the directives on Global Monitoring of Environment and Security and the Water Framework Directive and the Flooding Directive. These directives should be considered when reviewing the SDI part of the land administration policy and further on passing legislation regarding SDI.

A SDI Council is established to lead the all-embracing sector implementation of SDI. In Kosovo, however, it might be more suitable to charge the Inter-Ministerial Land Administration Committee to lead the all-embracing sector implementation of NSDI. The committee could have an advisory role towards the Government and the KCA.

Aerial photo production in accordance with a long-term plan is foreseen during the planning period. Aerial photographs are available, and new aerial photographs will be available for the whole territory of Kosovo by spring 2009. Production of rather simple topographic vector maps would, in addition to the existing cadastre maps, aerial photos and digital terrain model (DTM), could be the start of developing a sustainable National Spatial Data Infrastructure (NSDI) for Kosovo in compliance with the EC INSPIRE Directive. The vector maps will be of importance to support planning, development and construction/ improvements of infrastructure in Kosovo. Preparation of such maps, based on an agreed data model, could easily be done by the private sector. Subsequent distribution could be done by KCA and enhance their role as the mapping authority of Kosovo.

Permanent GPS Network available for users in Kosovo will also be implemented based on proposal presented in General Feasibility Study: 'Continuously Operating Reference in Kosovo', (CORN, August 2006).

It is important to mention in this context that the Republic of Kosovo and the Republic of Slovenia has gone into an agreement on cooperation in the field of geodetic activity. Outline of terms of reference on technical assistance for establishing of Kosovo Spatial Data Infrastructure with support from the Surveying and Mapping Authority of the Republic of Slovenia is already drafted.

3.3 Assessing the SDI readiness of Kosovo

SDI-readiness approach (Delgado-Fernández, 2005) aims to measure the degree to which a country is prepared to deliver its geographical information to the community. This approach focuses on measuring the following aspects of SDI readiness: organizational, information, access network, human resources and financial resources.

The application of the SDI readiness model can contribute to identifying critical factors to undertake an SDI (Delgado et al., 2005). The knowledge about the level of these factors in Kosovo could support policy makers in developing successful strategies for establishing and maintaining of sustainable national SDI of Kosovo. Therefore author believes that the SDI readiness model could contribute to the improvement of national SDI of Kosovo.

According to Delgado (2005), the SDI readiness index can be defined as a composite measurement of the capacity and willingness of countries to use SDIs. The index incorporates organizational, informational, human resources, technological and financial resources factors and the determination of the index value is based on a survey that only authorised experts of a country are able to complete. Most of the factors that are included in the SDI readiness model are qualitative rather than quantitative. A basic seven tier classification system is used — from Extremely High to Extremely Low.

- The 'organization index' is a composite score consisting of three primary factors: politicians' SDI vision, institutional leadership and legal framework. The SDI vision deals with the awareness of politicians on the importance and development of a National SDI. Institutional leadership can be expressed as the coordination by one or more institutions of the national agenda regarding SDI.
- The 'information index' focuses of the availability of core spatial data sets (for example geodesy, elevation, cadastral, administrative boundaries, hydrography, transport, ortho-images and place names) as well as metadata.
- The 'human resources index' is a composite score that incorporates the: human capital index, culture/education on SDI and individual leadership.
- The 'financial resources index' is a crucial index that focuses on the sources of funding in order to develop an SDI.
- The 'technology index' focuses on how access networks and technologies facilitate the use of data and services from SDIs. The 'technology index' is composed by the communication infrastructure, the Web connectivity, the availability of commercial or in-house spatially-related software and the use of open source resources related to SDI.

The scope of this research step assumes that stronger conditions at the beginning of SDI development increase the likelihood of sustainability in the future. Based on the questionnaires of 10 SDI experts from Kosovo, the SDI readiness index, based on fuzzy logic, was calculated in 2007 and 2010.

The SDI readiness Index approach is applied in Kosovo in two time periods: in summer 2007, when this research started; and in summer 2010, when author decided to finish this thesis. In two different time frames, a selected group of ten (10) SDI experts from Kosovo were consulted to give their opinion on the most important variables needed for SDI Readiness assessment Index of SDI in Kosovo. The experts have been chosen based on the following criteria:

- Experience with organisational and managerial aspects of GIS and SDI implementation.
- Representation of different departments.
- Wiliness to participate and recommendations of already interviewed experts.

The list of participating experts can be found in Appendix A. Very few of the experts were part of the private organisation that was using GIS but most of them were involved in GIS activities within different ministries of Kosovo. Most of the participants belong to the middle management with few from the executive management level.

The returned 10 questionnaires is considered to be representative, considering the fact this was a targeted research, and the research results are to be considered valid. What follows is an overview of the results of the SDI Readiness Index research in 2007.

The results of SDI readiness index assessment in 2007

First SDI readiness Index assessment was held in summer 2007 during my 2 weeks stay in Prishtina (Kosovo). In this period author has conducted several individual discussions with key experts involved in different activities regarding the SDI developments in Kosovo. The concepts of SDI where not always understood in the same way and there was no priority for SDI at that moment. SDI awareness at level of institutional leadership was at very low level. At this time (2007), Kosovo Cadastral Agency has carefully identified the need to start developing a NSDI of Kosovo.

In order to be able to create reliable and above all comparable input, the exact same questionnaire (Appendix B) defined by Delgado (2005) is used to determine the national SDI readiness Index of Kosovo. Based on these initial statements and discussion points conceived from the interviews, it is decided that before sending the questionnaires a short introduction workshop session should be held. Trying to increase reliability of research input, author has organized an informal workshop at offices of Ministry for Environment and Spatial Planning (MESP) of Kosovo. During the workshop the main definitions and principles of SDI were presented and importunacy of awareness creation for SDI in Kosovo was elaborated. Even after the basic explanation of SDI most of the experts did not feel comfortable understanding and starting using the terms and concepts of SDI. This problem was mitigated in the second part by giving more detailed information and clarifying questions. In the second part the SDI readiness questionnaire was explained and in smaller groups a SDI Readiness Index as case study filled in. Later we agreed that input collected during this workshop should be seen as practical experience to be more familiar with questionnaire.

In next days author has carried out several interviews with experts willing to participate but not having experience with filling out questionnaires and surveys. The interviews and workshop were carried out in Albanian language as almost all of the experts were Albanians. Every interview lasted for approximately 2 hours. During the interview session the questionnaire was filled. Every interview was coded in a form of a list of relevant statements in order to be used together with the input from the survey.

Later after author returned to the Netherlands he received digital questionnaires filled in by 10 key experts. All the statements have been organised in a relational database in order to be able to track and revert changes and perform data manipulations needed to calculate the SDI Readiness Index. Key experts might be subjective in their judgments of SDI in Kosovo because they can have an interest in showing the healthier picture of the SDI. It is therefore important to test the objectivity of the key experts. For this purpose we used information gathered from the individual interviews (asking somewhat the same questions as in the survey) and by generating the own objective view by reading the available literature.

All 10 statements were organised in 7 boxes related the 7 possible levels of answers according to the questionnaire as presented in Appendix B. For example, for the first organizational factor '*Political vision regarding SDI'* a score in box 7 means that the respondent view is that *'No vision exist as well as no intention exist to formulate a vision regarding the importance and development of the national SDI'*, while a score in box 1 indicates that there is an *'Extremely high vision regarding the importance and development of the national SDI'* according to the respondent. Results are shown in table 4.

Factor	Decision Criteria		Box1	Box2	Box3	Box4	Box5	Box6	Box7	totaal
Organizational	Politician vision regarding SDI	Ov					1	3	6	10
Organizational	Institutional leadership	Ol					1	1	8	10
Organizational	Umbrella legal agreement(s)	Oa					1	5	4	10
Informational	Digital cartography availability	Ic			1	1	2	4	2	10
Informational	Metadata availability	Im					2	4	4	10
People	Human Capital	Pc					1	5	4	10
People	SDI culture	Ps				1	1	3	5	10
People	Individual leadership	Pl					1	1	8	10
Access network	Web connectivity	Aw				1	1	2	6	10
Access network	Telecommunication infrastructure	At					1	2	7	10
Access network	Geospatial software availability	As				1	2	4	3	10
Access network	Own geoinformatics development	Ad					1	1	8	10
Access network	Open source culture	Ao					1	2	7	10
Financial Resources	Government central funding	Fg				1	1	4	4	10
Financial Resources	Return on investment	Fr					2	3	5	10
Financial Resources	Private sector activity	Fp					1	2	7	10

Table 4 - response of SDI Readiness Index questionnaire based on the interview and survey of 2007

Next, the calculation model for the SDI Readiness Index was tested with the known results from the research of Delgado (2005). After elimination of some minor errors the model has been fine-tuned. This fine-tuning process was carried out in several iterations as well (see Appendix A). At the end the SDI Readiness Index of Kosovo for 2007 is calculated as explained in chapter 2.4 and presented in table 5 and figure 11.

Factor	**Decision Criteria**		**SDI Index**
Organizational	Politician vision regarding SDI	Ov	**0,18**
Organizational	Institutional leadership	Ol	**0,15**
Organizational	Umbrella legal agreement(s)	Oa	**0,21**
Informational	Digital cartography availability	Ic	**0,33**
Informational	Metadata availability	Im	**0,22**
People	Human Capital	Pc	**0,21**
People	SDI culture	Ps	**0,22**
People	Individual leadership	Pl	**0,15**
Access network	Web connectivity	Aw	**0,21**
Access network	Telecommunication infrastructure	At	**0,16**
Access network	Geospatial software availability	As	**0,27**
Access network	Own geoinformatics development	Ad	**0,15**
Access network	Open source culture	Ao	**0,16**
Financial Resources	Government central funding	Fg	**0,24**
Financial Resources	Return on investment	Fr	**0,21**
Financial Resources	Private sector activity	Fp	**0,16**

Factor		**SDI Index**
Organizational	O	**0,17**
Informational	I	**0,28**
People	P	**0,19**
Access network	A	**0,43**
Financial Resources	F	**0,20**
SDI Readiness Index (2007)		**0,26**

Table 5: 2007 SDI Readiness Index of Kosovo

The score of 0.26 in range up to maximum of 1.0 is obviously very low. The determinants in this are the low values obtained by them for the organisation, human and financial resources factors.

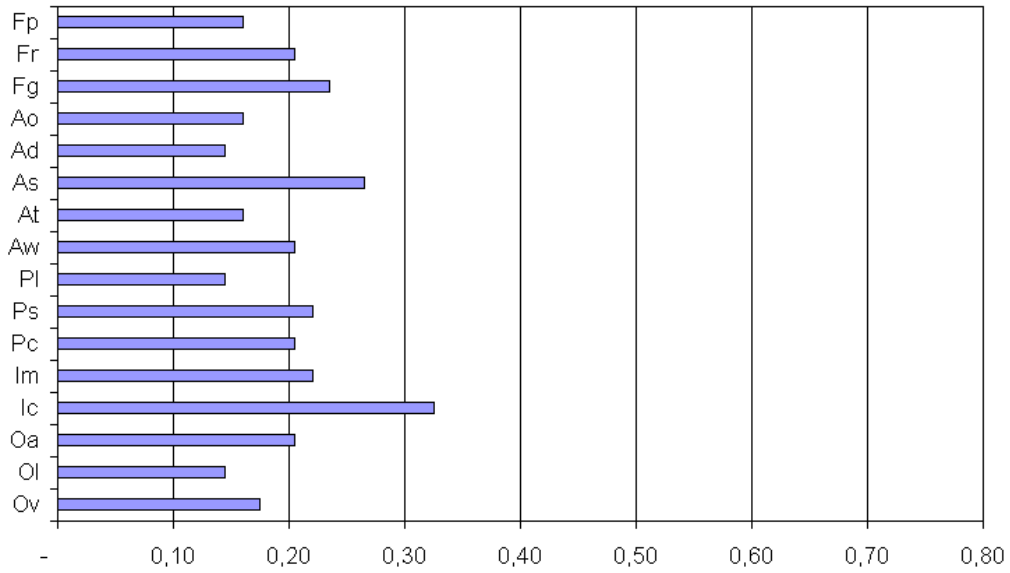


Figure 11: 2007 SDI Readiness Index of Kosovo

This result is in the same time very important for Kosovo seeing that this is first attempt ever for assessing the SDI of Kosovo. By actively participating in the survey, key experts demonstrate their interest for SDI initiatives. On the other hand, they can now take advantage of the best practices of other SDIs, once they have identified their main weaknesses, and their awareness of the situation has been raised.

The results of SDI readiness index assessment in 2010

In the summer of 2010 author invested again two weeks in defining the SDI readiness index of Kosovo for 2010. Not all key experts from 2007 were available for this new assessment. But author managed to organize a group of ten key experts (seven of them participated in 2007 assessment) which have filled in the questionnaires. The questionnaire was sent by email to all participating experts. The experts were also informed about the deadline for their answers which was within 2 week time from the sending the questionnaire. In table 6 the list of ten response statements is presented which is gathered by means of interviews and surveys.

Factor	Decision Criteria		Box1	Box2	Box3	Box4	Box5	Box6	Box7	totaal
Organizational	Politician vision regarding SDI	Ov					3	3	4	10
Organizational	Institutional leadership	Ol			1	2	2	3	2	10
Organizational	Umbrella legal agreement(s)	Oa				2	3	3	2	10
Informational	Digital cartography availability	Ic			1	3	3	2	1	10
Informational	Metadata availability	Im				1	2	3	4	10
People	Human Capital	Pc			2	1	2	2	3	10
People	SDI culture	Ps				2	3	3	2	10
People	Individual leadership	Pl				2	2	3	3	10
Access network	Web connectivity	Aw				1	3	2	4	10
Access network	Telecommunication infrastructure	At				1	3	3	3	10
Access network	Geospatial software availability	As				1	4	3	2	10
Access network	Own geoinformatics development	Ad					1	3	6	10
Access network	Open source culture	Ao					1	2	7	10
Financial Resources	Government central funding	Fg			1	2	2	3	2	10
Financial Resources	Return on investment	Fr				2	2	3	3	10
Financial Resources	Private sector activity	Fp				2	3	3	2	10

Table 6: response of SDI Readiness Index questionnaire based on the interview and survey of 2010

The same calculation model built earlier is used to calculate the SDI Readiness Index of Kosovo for 2010 as presented in table 7 and figure 12.

Factor	**Decision Criteria**		**SDI Index**
Organizational	Politician vision regarding SDI	Ov	**0,24**
Organizational	Institutional leadership	Ol	**0,36**
Organizational	Umbrella legal agreement(s)	Oa	**0,33**
Informational	Digital cartography availability	Ic	**0,42**
Informational	Metadata availability	Im	**0,25**
People	Human Capital	Pc	**0,36**
People	SDI culture	Ps	**0,33**
People	Individual leadership	Pl	**0,30**
Access network	Web connectivity	Aw	**0,27**
Access network	Telecommunication infrastructure	At	**0,28**
Access network	Geospatial software availability	As	**0,31**
Access network	Own geoinformatics development	Ad	**0,18**
Access network	Open source culture	Ao	**0,16**
Financial Resources	Government central funding	Fg	**0,36**
Financial Resources	Return on investment	Fr	**0,30**
Financial Resources	Private sector activity	Fp	**0,33**

Factor		**SDI Index**
Organizational	O	0,30
Informational	I	0,34
People	P	0,32
Access network	A	0,50
Financial Resources	F	0,33
SDI Readiness Index (2010)		**0,36**

Table 7: 2010 SDI Readiness Index of Kosovo

SDI Readiness Index score of 0.36 is improvement compared with score of 0.26 in 2007 but still very low. Despite the improvements of the organisation, human and financial resources factors they remain still low.

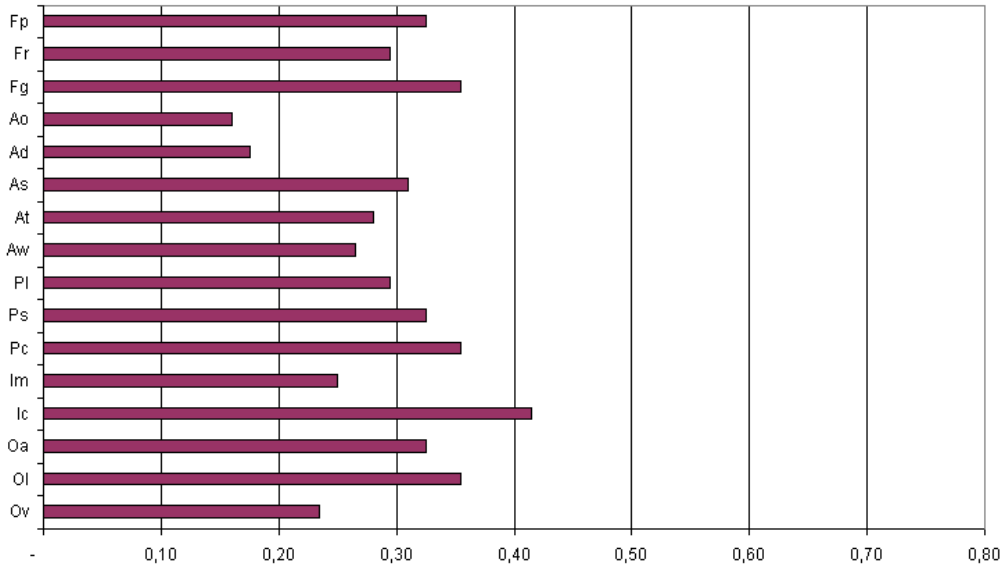


Figure 12: 2010 SDI Readiness Index of Kosovo

Further, the comparison of the results of the SDI Readiness Index research in 2007 and 2010 is presented.

The comparison of SDI readiness index 2007 and 2010

Based on the data gathered in this part of the thesis research, the following results, shown in table 8, were obtained (seven people did both the 2007 and 2010 survey):

			SDI R2007	SDI R2010	SDI R-delta
Organizational	Politician vision regarding SDI	Ov	0,18	0,24	0,06
Organizational	Institutional leadership	Ol	0,15	0,36	0,21
Organizational	Umbrella legal agreement(s)	Oa	0,21	0,33	0,12
Informational	Digital cartography availability	Ic	0,33	0,42	0,09
Informational	Metadata availability	Im	0,22	0,25	0,03
People	Human Capital	Pc	0,21	0,36	0,15
People	SDI culture	Ps	0,22	0,33	0,11
People	Individual leadership	Pl	0,15	0,30	0,15
Access network	Web connectivity	Aw	0,21	0,27	0,06
Access network	Telecommunication infrastructure	At	0,16	0,28	0,12
Access network	Geospatial software availability	As	0,27	0,31	0,05
Access network	Own geoinformatics development	Ad	0,15	0,18	0,03
Access network	Open source culture	Ao	0,16	0,16	-
Financial Resources	Government central funding	Fg	0,24	0,36	0,12
Financial Resources	Return on investment	Fr	0,21	0,30	0,09
Financial Resources	Private sector activity	Fp	0,16	0,33	0,17

Table 8: SDI Readiness Index in Kosovo for 2007 and 2010.

From Organisational index perspective the Institutional leadership as decision criteria has largest increase (from 0.15 to 0.36) while the political vision regarding SDI (from 0.18 to 0.24) has the smallest increase. Increasing in the People index is relatively consistent in all decision criteria. The largest increase is at Human capital (from 0.21 to 0.36) and Individual leadership (from 0.15 to 0.30) while for SDI culture (from 0.22 to 0.33) is slightly lower.

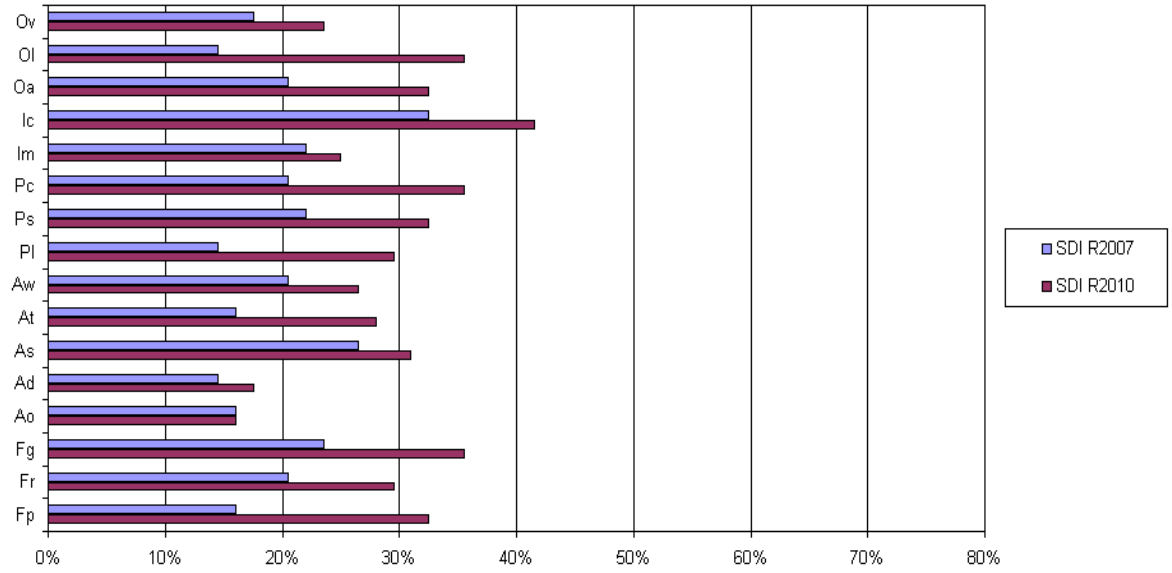


Figure 13: Comparison between decision criteria SDI readiness index in Kosovo for 2007 and 2010.

As these results indicate, there is a high spreading of the performance between the different factors. For instance, the technology performance seems to be related to income, in opposition with the organisational factor which has very different actions regarding incomes. In case of the SDI of Kosovo it is important to highlight the organisational aspects as key to the success of a SDI. A stronger organisational and legal framework aims to strengthen the coordination role so a more powerful and sustainable SDI is developed.

Factor		SDI R2007	SDI R2010	SDI R-delta
Organizational	O	0,17	0,30	0,13
Informational	I	0,28	0,34	0,06
People	P	0,19	0,32	0,14
Access network	A	0,43	0,50	0,07
Financial Resources	F	0,20	0,33	0,12
SDI Readiness Index (2010)		**0,26**	**0,36**	**0,11**

Table 9: SDI Readiness Index in Kosovo 2007 and 2010.

This comparison of the SDI Readiness Index of Kosovo over time demonstrates a self-effecting increase. It is clear that the main merit for this increase is the very low SDI Readiness Index score of 0.26 in 2007. As explained earlier, the scope of this research was not to compare the SDI readiness index of Kosovo with other countries, but it becomes obvious that the present score of the SDI Readiness Index of 0.36 for 2010 is still very low. We can assume that although the SDI of Kosovo has made considerable progress, there are still many challenges towards an effective implementation of a National SDI in Kosovo.

The increase along the SDI readiness scale signifies considerable progress, but there is room for plenty of improvement. However, some conclusions can be made at this stage. The largest increase is in People (from 0.19 to 0.32) and Organisational (from 0.17 to 0.30) index. The lowest Readiness Index increase is at Informational (from 0.28 to 0.34) and Assess network (from 0.43 to 0.50) index. This is also due the relatively high score in these two indexes in 2007. This represented in figure 14.

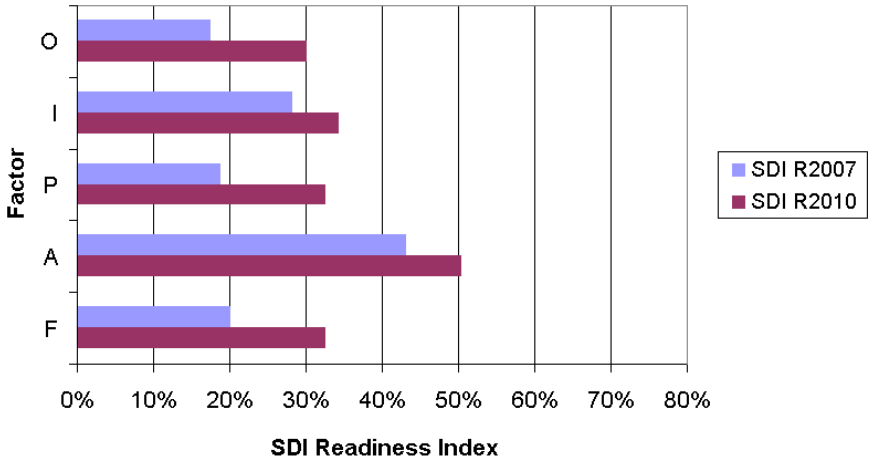


Figure 14: Comparison between factors and SDI readiness index in Kosovo for 2007 and 2010.

There is a humble improvement realised on almost each level of decision criteria. In table 10 this overview of those improvements are represented.

	2007	2010
Vision	No vision exist as well as no intention exists to formulate a vision regarding the importance and development of the national SDI	Low vision regarding the importance and development of the national SDI (a vision is being formulated)
Institutional leadership	No leadership of one or more institutions	Medium leadership of one or more institutions that coordinate partly the activities relating the national SDI
Umbrella legal agreement(s)	Very Low legal support to the national SDI-initiative (not existing legal instruments at a national level)	Medium level of the legal framework (existence of a framework, but it is incapable to support the national SDI)
Digital cartography availability	Very Low level of core spatial datasets in digital format (availability of very few core spatial datasets)	Medium level of core spatial datasets in digital format (partial availability of core spatial datasets)
Metadata availability	No availability of any metadata describing spatial datasets	Very Low level of metadata availability describing spatial datasets
Human Capital	0.58	0.89
SDI culture	No existence of any SDI-culture and education (capacity building among the stakeholders	Low level of SDI-culture and education (capacity building) among the stakeholders
Individual leadership	No existence of any individual leadership	Low individual leadership
Web connectivity[3]	0.34	0.35
Telecom. infrastructure	0.14	0.21
Geospatial software availability	Low level of availability of commercial or in-house spatially-related software	Medium level of availability of commercial or in-house spatially-related software
Own geoinformatics development	No availability of own software development	Very Low level of own software development availability
Open source culture	No use of Open source services	Low level of the use of Open source services
Government central funding	Very low level of funding by the government to finance the national SDI-initiative	Low level of funding by the government to finance the national SDI-initiative
Return on investment	No funding by means of the application of policies regarding cost recovery	Low level funding by means of the application of policies regarding cost recovery
Private sector activity	No funding by the private sector and/or enterprises to finance the national SDI	Low level of funding by the private sector and/or enterprises to finance the national SDI

Table 10: SDI improvements in Kosovo from 2007 until 2010.

[3] *Results from UN e-government survey 2005 and 2008 adapted from Serbia (as Kosovo was statistically part of Serbia in that period).*

Using the SDI readiness index we can specify the driving forces towards further implementation of a National SDI of Kosovo. The evolution of SDI readiness of Kosovo from 2007 to 2010 is evident. This period marks the time between the situation when the government of Kosovo was led by United Nations Mission in Kosovo (UNMIK) and the situation created after independency and introduction of democratically chosen Kosovo's government. There is a very low number of genuinely professional SDI professionals. In addition, there is a lack of respective legislation, applicable working methodology, relevant standards and proper coordination of their activities as well enforcements processes.

Although all the formal and fundamental institutional elements of a SDI are present, the SDI organisation is still undersized and under skilled for the challenges it will have to face. The existing legal provisions reflect concern for the basic functions identified in today's EU. However, for default-proof, client-friendly and internationally recognised cost-efficient delivery, the SDI needs to be organised more purposefully, fully covering both the core and supportive functions of the central administration. It is widely known that a multidisciplinary sector like SDI requires an enormous effort of strategic vision and coordination. Without coordinating mechanisms, the SDI administrative system cannot function effectively. Unfortunately, the effective horizontal communication and top-bottom planning approach are still missing. Noticeable huge effort was undertaken in the policy area. Several strategy documents have been produced (most of them by the foreign experts or under their supervision), e.g. Business Plan 2009-2014 for the Cadastral Agency (KCA) and the Cadastral Sector in Kosovo bringing a comprehensive list of recommendations and provides concrete actions for development of the KCA and the cadastre sector in Kosovo.

Performance results are less satisfactory in the legislative field. Primary legislation is gradually being adopted by amending the former UNMIK regulations supported from the international donors. Whilst this has advanced in the sense that it is progressing towards European harmonisation, the secondary legislation is lagging badly behind. This lag blocks implementation of modern administrative tools for country-wide SDI in Kosovo.

During the implementation of the reviews of ministries in Kosovo arose the request to transfer the KCA under the responsibility of the MESP. This recommendation is mainly due the close interrelation between spatial / land use planning and land registration. Transfer of the KCA into the MESP organizational portfolio will significantly increase the quality of land use planning and enable the closer essential cooperation with the sector of agriculture and forestry.

3.4 Summary

In section 3.1 a short overview of the historical context of Republic of Kosovo is presented, at the same time in section 3.2 an overview is given of the present state of SDI in Kosovo. By critically reviewing existing literature on multi-view SDI assessment frameworks, the SDI Readiness Index approach is used to asses the SDI of Kosovo.

In section 3.3 the SDI Readiness Index assessment of Kosovo in 2007 and 2010 are discussed in detail and the progress is made visible. SDI Readiness Index was used to identify the changes in SDI in Kosovo in that time frame. Most important conclusion is that even if the SDI of Kosovo has made substantial progress, there are of course still countless challenges on the way to an effective SDI in Kosovo. The main merit for this increase of SDI Readiness Index in 2010 is in fact the very low score in 2007. The present score of 0.36 is still very low.

4 CASE STUDY

Experience is not what happens to a man. It is what a man does with what happens to him.

Aldous Leonard Huxley,

Steudler (2003) argues that the most important benefits of comparing SDIs with each other are 'the lessons learnt' and 'the identification of good practices'. Based on this, this Master of Science (MSc) research compares SDI developments of Kosovo with four different European countries in transition (Estonia, Lithuania, Latvia, and Slovenia) and one country with a relatively high level of socio-economic development (Luxembourg). The Luxembourg SDI was included in the sample set, because of the geographical similarities with Kosovo. By reviewing SDI initiatives of these countries, differences and similarities between the SDI developments can be observed.

4.1 Selection of case study countries

In the past twenty years, many European countries have experienced a process of transition from the Socialist setting into the market economy and political environment. Under specific transitional circumstances, these countries develop in parallel their spatial data infrastructures (SDI). The processes that arise from the situation are somewhat different from the processes happening in the developed countries because their premises differ as well as their motors of changes and immediate goals. Further differences also exist between countries in transition due to different historic legacy, culture, motors of economic development and political environment.

In the countries in transition, the challenge of SDI development is even greater because with its development, other processes are simultaneously conducted; the initial collection or digitalization of data as well as development of numerous national databases and GI systems. However, the above-mentioned risk can be used up to a certain level as an advantage, because with the implementation of SDI rules in the phase of new system developments, it is possible to achieve remarkable effects and significantly accelerate the SDI development. All this of course includes a remarkable effort made by the SDI

entity and the right guidance of subjects, together with ensuring the support necessary during the development of their SDI segments.

The reason to focus on complementary case study countries (figure 15) during this research is to take into account the business requirements and driving forces that have shaped the purpose, scope, design, implementation and technical aspects of SDIs. A positive reception of these business requirements and driving forces could assist in the improvement of establishing and implementing SDIs.

Figure 15 – INSPIRE SoP case study countries

Estonia has not developed a specific NSDI strategy. Environmental and spatial data are considered as part of the national IT policy, these are listed as one of the six main action lines for the years 2004-2006. There is a special action line for environment and spatial data: starting of environmental register; open access to environmental monitoring, fisheries and forest registers; development of land information system and especially e-services for public sector (INSPIRE SoP, 2007).

A *Lithuanian* governmental programme on Information Society is developed in 2004 in which Coordination of GI by the Department for Information and Informatics is stated. The InGIS specifications set the standards for the collection, coding, attribute structure,

metadata and data exchange of geographic data among agencies at both national and local level. There is no national GI-association. The Lithuanian Surveyors Association and the Lithuanian Cartographers Association organises education of specialists and provide advice to the Government. They have however no major impact on decision making (INSPIRE SoP, 2007).

Latvia has no explicit SDI policy although existing legislation on Geodesy and Cartography may provide a framework. The Council of Geodesy and Cartography is a body established by the Cabinet of Ministers with the mandate to co-ordinate GI activities within the public sector. The main executive player is the State Land Surveyof Latvia (SLS). It occupies a central position on the GI-scene in Latvia. The SLS was reorganized in 3 separate branches: the Latvia Geo-Informatics Agency (LGIA), the State Land Survey (VZD) and the State Surveyor Agency (INSPIRE SoP, 2007).

In *Slovenia*, a far reaching SDI is being built in a centralized top-down approach. There is no clear legislation in place concerning the SDI but the NMA (Survey and Mapping Authority of the Republic of Slovenia – SMA), operating under the Ministry of Environment and Spatial Planning (MESP), has a de facto mandate to coordinate the elaboration of the SDI. This mandate results from legal acts on geodesy and cadastre mainly. A Centre for Geo-Information has been set up within SMA to deal with the executive work for the SDI (INSPIRE SoP, 2007).

Slovenia has always played an important role in promoting SDI in the region and in particular Kosovo. It will be interesting to review the process over the last years and compare the current state of the Slovenian SDI with Kosovo.

In *Luxembourg* is sins 1992, the need for coordination, sharing and re-use of spatial data in the administration has been recognized and has resulted in the informal creation of the Inter ministerial working group on GIS (GTIM-SIG). This working group is still active today and operates as a consultative body for the Administration du Cadastre et de la Topographie (ACT) which acts as the de facto executive body for the GTIM-SIG (INSPIRE SoP, 2007).

Characteristic of all five selected countries is that National Data Producer (National Mapping Agency or a similar type of agency like a National Land Service, Cadastral Agency) is the officially mandated or de facto leading organization for the establishment of the SDI. At a second level, the further involvement of associations or communities of data users in the coordination activities is taken into account. In four selected countries: Estonia, Lithuania, Latvia and Slovenia users are not directly involved. Only in Luxembourg users are involved[4] in coordination activities around SDI. Finally Slovenia and Lithuania have they SDI operational[5] while Luxembourg, Estonia and Latvia have they SDI partially operational. The following table is showing the five case study countries classified according to SDI type (INSPIRE SoP 2007).

Level I	Level II	Level III	EU-27	CC(-1)	EFTA-4	Class
NDP-led	users involved	operational	DK, FI, SE, PT, HU		IS, NO	1,1,1
		partially operational	AT, GR, LU, PL			1,1,2
		not operational	BE, **RO**			1,1,3
	users not involved	operational	SI, SK, LT			1,2,1
		partially operational	EE, LV, CY		LI	1,2,2
		not operational	MT, BG	TR		1,2,3
not NDP-led	formal mandate	operational	BE-VL, DE, **ES, NL**, CZ		CH	2,1,1
		partially operational	IT, IE			2,1,2
		not operational				2,1,3
	no formal mandate	operational	UK, BE-WA			2,2,1
		partially operational	FR			2,2,2
		not operational				2,2,3

Table 11: Classification of countries according to NSDI type (INSPIRE SoP - 2007)

Based on existing frameworks, procedures and literature review, the SDI of Kosovo is carefully investigated and compared with the five case study countries. By investigating and comparing the different aspects of the five countries in transition the common variables might be revealed and possibly the driving forces can be found for future development of SDI in Kosovo.

[4] *Involvement in this respect means that user organizations are present in bodies defining the mandate of the lead agency for the SDI and/or advising upon the SDI-projects.*

[5] *The degree of operationality of the SDI-initiative, i.e. whether one or more of its components are operational or whether the SDI is rather in the planning stage, is considered.*

4.2 Cross-country comparison INSPIRE State of Play

This research examines in detail the SDI status of the five case study countries, as well as their development between 2003 and 2007. The main results of this research step are finding similar examples of good practices regarding the organizational approaches as they are being applied in these five countries in transition. This should not be seen as attempt to clone SDI "recipes" from other countries to Kosovo because that is no guarantee of sustainable SDI development. Furthermore, this step describes some of the key issues for successful SDI development of Kosovo during the coming years.

As stated before in chapter 1, the second research question is '*How to learn from other similar countries and their problems en mistakes made during the implementation of SDI's?*' Trying to answer this research question author has compared the present development of SDI of Kosovo with five other countries. The INSPIRE State of Play (SoP) case study desk research is done for four similar countries in transition (Estonia, Latvia, Lithuania, Slovenia) and one country (Luxembourg) with geographical similarities as Kosovo, but with a higher level of socio-economic development. In this section we describe the results of the assessment of the 5 countries for 2007, as compared with the previous year 2006, and the evolution over time since the start of the study (2003). We review the typology for 2007 as well.

The State of Play assessment approach is an important step in this thesis research covering the period from mid 2003 to 2007 in order to describe and analyse SDI related activities in 5 European countries: Estonia, Lithuania, Latvia, Slovenia and Luxembourg. The major activity of this research is to analyse all the relevant aspects of SDI in those 5 case countries. This is done after thoroughly describing the analysing all 32 SoP indicators of the five case study countries. From the SoP review of the SDI initiatives in the five countries, a set of common case study indicators is being derived with special focus on the Organizational issues. The main focus of this research is on the Organizational Indicators.

Vandenbroucke et al. (2008) argued that 'while most of the indicators are not quantitative, they allow to 'measure' the 'distance-to-target', that is the degree of development as compared to the 'ideal' situation described in the SDI cookbook. On the

other hand, some indicators are not meant to measure, but rather classify the SDIs according to the organisational approach.

From the first group of 16 indicators, seven describe the organisational aspects; nine describe the legal framework and funding. In table 12 these 16 indicators are presented.

I. Organisational issues		
Level of SDI	1	The approach and territorial coverage of the SDI is truly national
Degree of operationality	2	One or more components of the SDI have reached a significant level of operationality.
Coordination	3	The officially recognised or de facto coordinating body of the SDI is a NDP, i.e. a NMA or a comparable organisation (Cadastral or Land Survey Agency, i.e. a major producer of GI)
	4	The officially recognised or de facto coordinating body for the SDI is an organisation controlled by data users Coordination
	5	An organisation of the type 'national GI- association' is involved in the coordination of the SDI
Participants	6	Producers and users of spatial data are participating in the SDI
	7	Only public sector actors are participating in the SDI
II. Legal issues and funding		
Legal framework	8	There is a legal instrument or framework determining the SDI-strategy or –development
Public-private partnerships (PPP)	9	There are true PPP's or other co-financing mechanisms between public and private sector bodies with respect to the development and operation of the SDI-related projects
Policy and legislation on access to public sector information (PSI)	10	There is a freedom of information (FOI) act which contains specific FOI legislation for the GI-sector
Legal protection of GI by intellectual property rights	11	GI can specifically be protected by copyright
Restricted access to GI further to the legal protection of privacy	12	Privacy laws are actively being taken into account by the holders of GI
Data licensing	13	There is a framework or policy for sharing GI between public institutions
	14	There are simplified and standardised licences for personal use
Funding model for the SDI and pricing policy	15	The long-term financial security of the SDI initiative is secured
	16	There is a pricing framework for trading, using and/or commercialising GI

Table 12: Indicators for organisational, legal and financial building blocks

Next 16 indicators (from 17 to 32) are technical building blocks of SoP. They are divided in Data and Metadata for the themes of the INSPIRE annexes, Access and other services, Standards and Thematic environmental data categories. In table 13 these 16 indicators are presented.

III. Data for the themes of the INSPIRE annexes		
Scale and resolution	17	Geodatasets exist which provide a basis for contributing to the coverage of pan-Europe for the INSPIRE-selected data themes and components
Geodetic reference systems and projections	18	The geodetic reference system and projection systems are standardised, documented and interconvertable
Quality of reference data & core thematic data	19	There is a documented data quality control procedure applied at the level of the SDI
Interoperability	20	Concern for interoperability goes beyond conversion between different data formats
Language and culture	21	The national language is the operational language of the SDI
	22	English is used as secondary language
IV. Metadata for the data of the themes of the INSPIRE annexes		
Availability of metadata	23	Metadata are produced for a significant fraction of geodatasets of the themes of the INSPIRE annexes
Metadata catalogue availability + standard	24	One or more standardised metadata catalogues are available covering more than one data producing agency
Metadata implementation	25	There is a coordinating authority for metadata implementation at the level of the SDI
V. Access and other services for data and their metadata		
Discovery Services	26	There are one or more discovery services making it possible to search for data and services through metadata
View Services	27	There are one or more view services available for to visualise data from the themes of the INSPIRE annexes
Download Services	28	There are one ore more on-line download services enabling (parts of) copies of Datasets
Transformation Services	29	There are one or more transformation services enabling spatial datasets to be transformed to achieve interoperability
Middleware Service	30	There are one or more middleware services allowing data services to be invoked
VI. Standards		
Standards	31	The SDI-initiative is devoting significant attention to standardisation issues
VII. Thematic environmental data		
Thematic Environmental data	32	Thematic environmental data are covered by the described SDI-initiative or there is an independent thematic environmental SDI

Table 13: Indicators for the technical building blocks

The assessment of the SoP of SDI studied has been made in terms of whether or not: (1) it is in full agreement with the statement, (2) it is in partial agreement, (3) it is not in agreement or (4) there is no information available. Table 14 contains a summary of the information compiled for the SDI in 5 case studies. An attempt by the author to project the State of Play of Kosovo in 2007 is also presented in this table. It has to be taken in account that the input for SoP is received from national representatives of SDIs who may be subjective.

Colours indicate whether the studied SDIs are *in large* (■), *partial* (■) or *no agreement* (■) with the statements about the SDI-building blocks presented in table 5 and table 6. The summary table for 2003, 2004, 2005 and 2006 is presented in Appendix B.

		Organisational issues							II. Legal issues and funding								III. Data				IV. Metadata				V. Access and other services						
	2007	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Estonia	EE																																
Lithuania	LT																																
Luxembourg	LU																																
Slovenia	SL																																
Latvia	LV																																
Kosovo	KO																																

Table 14 - Assessment matrix of 5 case countries and Kosovo SDIs for 2007

Based on the research of Grus et al. (2008) the scores of each case country in SoP assessment approach are presented as a percentage of the maximum possible score. The motivation for presenting the scores as percentage values is to make the SoP assessment results easily comparable with each other. Furthermore, normalising the results to percentage values makes the results more understandable. In this case if statement of an SDI is in large agreement the maximum score possible is given (100%). For statements in partial agreement 50% is given. No agreement is treated as 0%. Results are presented in sorted table 15 with different scores.

	2007	Organisational issues							II. Legal issues and funding								III. Data						IV. Metadata			V. Access and other services							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	average
Slovenia	SL	100%	100%	100%	0%	0%	0%	100%	50%	50%	0%	100%	0%	100%	100%	50%	100%	100%	100%	0%	0%	100%	100%	100%	100%	100%	100%	0%	100%	0%	0%	100%	100%	67%
Estonia	EE	100%	50%	100%	0%	0%	0%	50%	0%	100%	50%	100%	50%	100%	0%	50%	50%	100%	100%	50%	0%	100%	100%	100%	100%	0%	100%	50%	0%	0%	0%	100%	50%	58%
Lithuania	LT	100%	100%	100%	0%	0%	0%	100%	100%	0%	50%	100%	0%	50%	0%	50%	50%	50%	100%	50%	50%	100%	50%	100%	50%	0%	0%	100%	0%	0%	0%	0%	50%	47%
Luxembourg	LU	100%	50%	100%	50%	0%	50%	100%	0%	0%	0%	0%	0%	50%	0%	0%	0%	100%	100%	0%	0%	100%	0%	50%	50%	0%	50%	50%	0%	0%	0%	100%	50%	36%
Latvia	LV	100%	50%	100%	0%	0%	0%	100%	0%	50%	50%	100%	0%	0%	0%	0%	0%	50%	100%	50%	0%	100%	50%	50%	0%	0%	0%	0%	0%	0%	0%	50%	100%	34%
Kosovo	KO	100%	50%	100%	0%	0%	0%	100%	0%	0%	0%	0%	0%	50%	0%	0%	50%	50%	100%	50%	0%	100%	100%	50%	50%	0%	0%	0%	0%	0%	0%	50%	50%	33%

Table 15: Normalised results of 5 case countries and Kosovo SDIs for 2007

As can be derived from table 15, all case countries have a similar level of SDI development and are developing a truly national SDI. It is also clear intention for Kosovo to develop a truly national SDI. Only Slovenia and Lithuania have reached a significant level of functionality regarding one or more components of the SDI. In all case countries the officially recognised coordinating body of the SDI is a NDP or a comparable organisation. In almost all case countries (besides Luxembourg) the producers and users of spatial data are not involved in the SDI processes because only public sector actors are participating in the SDI. Furthermore, it is clear that regarding legal issues and funding the ambiguous situation persist. As example in case of Estonia it is confusing

that in one hand only public sector is participating in the SDI while according to indicator 9 exist a true PPP's or other co-financing mechanisms between public and private sector bodies. There is still no clear information available or the legal status of the SDI in the respective countries. Some of the legal issues results of SoP are debatable from the modern SDI perspective. On the other hand, data, metadata and services are quite developed, especially in Slovenia and Estonia. Other countries are working hard in this field. One can see that standardization is becoming an important aspect for all case countries.

From the INSPIRE State of Play assessment approach perspective Slovenia has highest score of 67% followed by Estonia with 58%. Lithuania scores lower with 47%. Two other countries score lower than the sample average (48%). Luxembourg scores 36% followed by Latvia 34%. Attempted projection of SoP of SDI in Kosovo ended last with 33%. Figure 16 presents the assessment results of the 5 SDIs using the INSPIRE state of play approach.

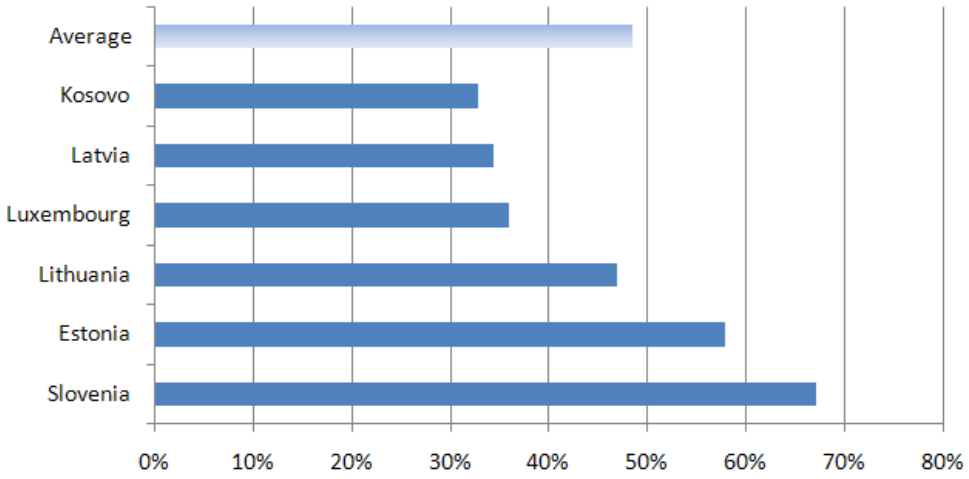


Figure 16: INSPIRE SoP scores per case study (in %)

The next table presents the differences on SDI building blocks for which the assessment in 2007 is changed from the one in 2003 (the starting period of the original SoP study). Colours indicate whether the changes occurred in studied SDI are:

- *in better agreement* (),
- *In much better agreement* (),

- *in less better agreement* ( ) and
- *Unchanged* ( ).

The summary change matrix table for 2007-2006, 2006-2005, 2005-2004, 2004-2003 is presented in Appendix B.

	2007 - 2003																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Estonia	EE																																
Lithuania	LT																																
Luxembourg	LU																																
Slovenia	SL																																
Latvia	LV																																

Table 16: Change matrix of 5 case countries SDIs for 2007-2003

The change matrices give information about the changes over time. The fact that for some countries 'no changes' have been recorded can be explained by fact that some countries which already were 'in agreement' for a lot of indicators can't shift to another class anymore. Furthermore, the changes could have been not significant enough to allow the shift to a higher class. If we look at the change matrix for 2007-2003, then one will note the following things:

- A score could be given to the indicator in more cases because more information or clearer information became available. For 28 indicators, scoring 'improved' (more in agreement than before). The SDIs are becoming more and more mature.
- In 2003 a fully developed NSDI with all components did not exist in any of these case countries. In 2007 the situation has changed, influenced by the INSPIRE initiative.
- In all case countries It is the public sector that drives SDI development in 2003 and that is not changed in 2007.
- In case of Slovenia and Estonia in we see in 2007 that data and metadata are becoming more and more available, and that standards are introduced progressively.
- In 2007 we see an important progress regarding web mapping services and more and more web feature services.

Focus on Organisational issues of SoP

As discussed earlier the focus of this thesis research are Organisational aspects of SDIs. That is the reason to focus on the Organisational Issues of SoP assessment for 5 case countries.

		Organisational issues						
	2007	1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							
Kosovo	KO							

Table 17: Organisational issues of 5 case countries and Kosovo SDIs for 2007

Also in this case the scores of each case country in SoP assessment are presented as a percentage of the maximum possible score. For statement of an SDI in large agreement the maximum score possible is given (100%). For statements in partial agreement is 50% given. For no agreement is treated as 0%. Results are presented in sorted table 18 with different scores.

	2007	Organisational issues							
		1	2	3	4	5	6	7	%
Luxembourg	LU	100%	50%	100%	50%	0%	50%	100%	64%
Lithuania	LT	100%	100%	100%	0%	0%	0%	100%	57%
Slovenia	SL	100%	100%	100%	0%	0%	0%	100%	57%
Latvia	LV	100%	50%	100%	0%	0%	0%	100%	50%
Kosovo	KO	100%	50%	100%	0%	0%	0%	100%	50%
Estonia	EE	100%	50%	100%	0%	0%	0%	50%	43%

Table 18: Organisational issues for 5 case countries and Kosovo SDIs for 2007

Conclusion from the table 18 is that Luxembourg scores highest with 64% following with Slovenia and Lithuania with 57%. Latvia and Kosovo with 50% and Estonia with 43% scored below the average of 54%. The results are presented in the figure 17.

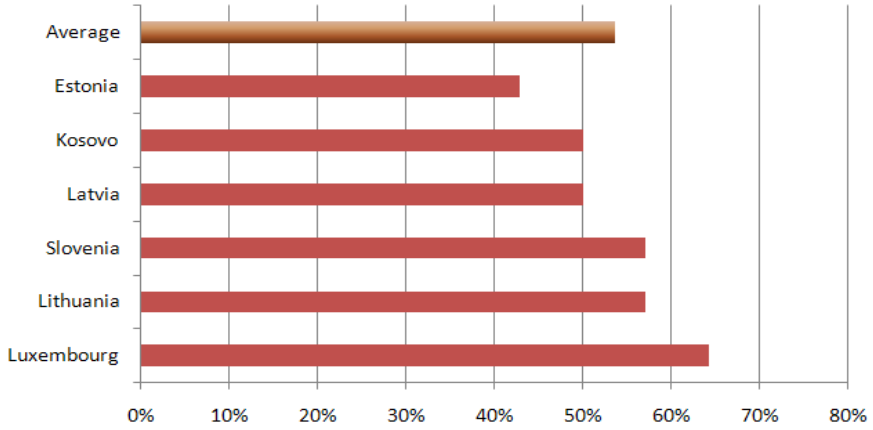


Figure 17: Organisational issues for 5 case countries and Kosovo SDIs for 2007

It is interesting to compare the results of SoP Organisational issues (SoP O) and total score of 32 indicators of SoP (SoP tot) for 5 case countries. This is done in the table 19 and figure 18.

		SoP O	SoP tot
Luxembourg	LU	64%	36%
Lithuania	LT	57%	47%
Slovenia	SL	57%	67%
Latvia	LV	50%	34%
Kosovo	KO	50%	33%
Estonia	EE	43%	58%

Table 19: SoP and Organisational issues for 5 case countries and Kosovo SDIs for 2007

The average score of Organisational issues of SoP is lower (43%) than the total average (58%). One can conclude that Slovenia has the most stabile SDI development with the highest total SoP score of 67% and 57% for the organisational issues of SoP (both scores are exceeding the average scores). Interesting developments occur at the SDI of Luxembourg with the highest score regarding the Organisational Issues (64%) and almost the lowest total SoP score (36%). Latvia and Kosovo have similar scores 50% for Organisational Issues of SoP and a lower total score (respectively 34% and 33%).

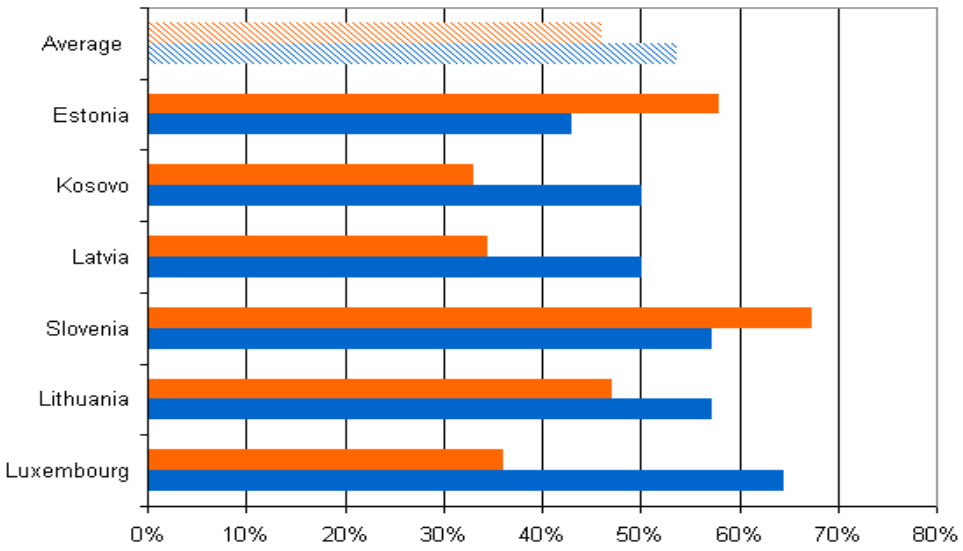


Figure 18: SoP and Organisational issues for 5 case countries and Kosovo SDIs for 2007 (blue = organisational score; red= total score)

From the figure 18 one can conclude that 5 case countries could be separated in two groups:

1. Slovenia and Estonia total scores are higher than their score regarding the organisational issues.
2. Lithuania, Latvia, Luxembourg and Kosovo total scores are lower than their score regarding the Organisational issues.

It is clear that the implementation of the INSPIRE Directive, which started in 2007 and which will go on until at least 2013, will influence to a large extent the further development of the SDI, as well as of the sub-national SDIs. This could be seen as an important driving force for developing of a SDI in Kosovo.

As concluded earlier, Organisational issues are incredibly important for successful SDI development. Explanation of the differences in the organisational scores may be found in applying the SDI maturity matrix to the SDIs of Kosovo and Slovenia.

4.3 Organizational perspective – Maturity matrix

The focus of organizational assessment approach is based on research of Kok and van Loenen (2005) on the evaluation of the different stages of development of geographic information infrastructures, when viewed from the organizational perspective. This approach focuses on measuring the development of SDI the following aspects: vision, leadership, communication, self-organizing capacity, awareness, financial viability and status of the delivery mechanism. The focal point of this approach is the developmental perspective of evaluation as it measures SDI development from an organizational perspective. This approach has also been successfully applied to assess SDI in developing countries (Eelderink, 2006) and Dutch municipalities (De Graaf, 2006).

The SDI maturity matrix consists of four stages of SDI development: stand alone, exchange, intermediary and network stage. In the first network stage different organizations try to build their own infrastructure in sort analogy with island infrastructure. In the network stage, ultimate, most advanced stage, it is commonly understood what an SDI consists of and what its objectives and ideal are. In this idealistic view, leadership, open communication channels and a pro-active geographic information sector have resulted in a capacity that is such that the SDI enjoys broad support at all levels, resulting in sustainable funding for SDI development. (Van Loenen, 2006).

The aim of this research step is to measure and analyze the development of Kosovo and Slovenia SDIs using the maturity matrix method. Subsequently, the above results of SDI developments of Kosovo and Slovenia are projected in an SDI maturity matrix (see chapter 2.5). Motivation of author to choose the SDI of Slovenia is based on the fact that the Republic of Kosovo and the Republic of Slovenia have gone into an agreement on cooperation and technical assistance for establishing of Kosovo's SDI. Another aspect is that the Slovenian level of SDI development is a realistic and an achievable aspiration for Kosovo. This matrix describes the way a vision, leadership, communication channels and the ability of the geographic information community for self-organization are present or perform in an SDI depends on the stage of development (Kok and Van Loenen, 2005; Van Loenen, 2006). In other words, a more 'mature' SDI in terms of the model was regarded as a more successful SDI.

SDI Slovenia

As Ažman and Petek (2009) explain, the first steps in the organization of development of the Slovenian SDI were taken within the Ministry of Environment and Spatial Planning of the Republic of Slovenia (MESP) and its bodies, but a lot of parallel activities were running in other institutions and organizations. This Ministry has a particularly important role as most of the key providers of SDI depend from it. This includes the Surveying and Mapping Authority of the Republic of Slovenia (SMA). The SMA was nominated in 2009 as a responsible body for a INSPIRE directive implementation process with the mission to regulate and co-ordinate GI policy at a national level, and co-operate with other national and international organizations regarding the SDI. The Ministry also includes the "Office for Physical Planning" which is responsible for the development and control of spatial plans, and the "Slovenian Environmental Agency". Among the other government ministries and agencies the most important with respect to SDI is the "Statistical Office of the Republic of Slovenia" and Ministry for public Administration. The SMA is responsible for reference data, the Environmental Agency is responsible for providing high-quality environmental data, analyses and expert foundations for decision making, and MESP is responsible for data about spatial planning, such as land use data.

Vision has been developed in the past with all stakeholders and is now in implementation level. Leadership is appointed to the SMA and is clearly accepted. Communication is not limited but open between all stakeholders involved in SDI. The self-organizing ability is at the level of neutral problem recognition and that could be will be one of the most interesting aspects for improvements in the nearby future. Professionals and organisation are cooperating together and there is a high awareness of SDI at this level. But increasing the SDI awareness at decision making level could be a big challenge in time to come. Regarding the financial stability the SMA has made an estimation of financial costs for implementing and improving existing SDI until the year 2019. The budgets are guaranteed for a certain period.

The SDI of Slovenia can be classified in between the phases 'Exchange and Standardisation' and 'Intermediary' of the matrix. Especially the components Self-Organising ability and awareness for GII need to be developed further. Maturity matrix findings are based on a desk research of the literature but mainly on the recent work of Ažman and Petek (2009), Lipej and Modrijan (2010) and SoP reports for Slovenia. Table

20 summarises the conclusion for Slovenia presented by defining the stage (★) of Slovenian SDI for each aspect of maturity matrix.

Aspect \ Stage	Stand alone/ initiation	Exchange/ standardization	Intermediary	Network
Vision	Focus on individual organisation	Developed with all stakeholders	Implementation ★	Commonly shared, and frequently reviewed
Leadership	Focus on individual organisation	Questioned	Accepted ★	Respected by all stakeholders; 'champion'
Communication	Focus on individual organisation	Open between public parties	Open between all stakeholders ★	Open and interactive between all
Self-organising ability	Passive problem recognition	Neutral problem recognition ★	Actively helping to solve identified problems	Actively working on innovation
Awareness for GII	Professionals in one organisation: organisational 'SDI'	Professionals of organisations together: SDI ★	Awareness at many levels incl. decision making	Commitment at all levels/continuous support in politics and management
Financial sustainability	Limited to projects	Neutral	Guaranteed for certain period ★	Sustainable but frequently reviewed

Table 20: Maturity of Slovenian SDI

SDI Kosovo

In 2003 Kosovo started with defining and then implementing a modern land administration framework. That year could be seen as a starting point of outlining the policy for NSDI implementation in Kosovo. The Kosovo Cadastral Agency (KCA) is only one of the stakeholders among others in land administration. There is clear ambition of Kosovo to be part of the European Union (EU) and that means that Kosovo would have to apply to Directives issued by the European Commission (EC). In relation to SDI INSPIRE will have to be considered. A SDI Council is established to lead the all-embracing sector implementation of SDI in Kosovo; however, it is still far from the comprehensive sector implementation of SDI.

At this stage SDI Vision in Kosovo is still scattered and focused on individual organisations. Some organisations have an own organisational SDI vision but there is still no common vision for a national SDI of Kosovo. Leadership is also not well defined and as Bemelmans and Matthijsse (1995) explain '*everybody is concerned with surviving the slump and nobody recognises the need to invest in common interests because of lack of leadership'*. Communication is open between public partners to a greater extent than it is with stakeholders. Some people pro-actively address issues, sometimes by developing their own tools and making them compliant to the organisations system. Others are more reluctant. Self-organizing ability is at the level of passive problem

recognition. This is in correlations with lack of vision and leadership. There is at present moment a low level of GII Awareness and mainly present at professionals and fixed on organisational SDI. Financial sustainability is lacking and limited to the donors and project based. The research further identified a more male culture with short term successes for GI as the primary objective.

The SDI of Kosovo is in almost all aspects classified in stage 'Stand alone / Initiation'. Only component Communication is somewhat in stage 'Exchange / Standardisation'. Maturity matrix findings for present state of SDI in Kosovo are based on a desk research of the literature but mainly on "Business plan 2009-2014" and "Development Strategy 2009-2011" for The Kosovo Cadastral Agency and The Cadastral sector in Kosovo. Table 21 summarises the findings by defining the stage (★) of Kosovo SDI for each aspect of maturity matrix.

Stage / Aspect	Stand alone/ initiation	Exchange/ standardization	Intermediary	Network
Vision	Focus on individual organisation ★	Developed with all stakeholders	Implementation	Commonly shared, and frequently reviewed
Leadership	Focus on individual organisation ★	Questioned	Accepted	Respected by all stakeholders; 'champion'
Communication	Focus on individual organisation	Open between public parties ★	Open between all stakeholders	Open and interactive between all
Self-organising ability	Passive problem recognition ★	Neutral problem recognition	Actively helping to solve identified problems	Actively working on innovation
Awareness for GII	Professionals in one organisation: organisational 'SDI' ★	Professionals of organisations together: SDI	Awareness at many levels incl. decision making	Commitment at all levels/continuous support in politics and management
Financial sustainability	Limited to projects ★	Neutral	Guaranteed for certain period	Sustainable but frequently reviewed

Table 21: Maturity of Kosovo SDI

For the purpose of being able to combine the results with other assessment methods in this research we translated the four stages of the organisational approach into percentage values (%) (see also Grus et al., 2010, p.87). The scores indicate respectively the following stages: stand-alone (25%), exchange (50%), intermediary (75%) and network (100%). The gap between the SDI developments in Slovenia and Kosovo becomes understandable from the figure 19.

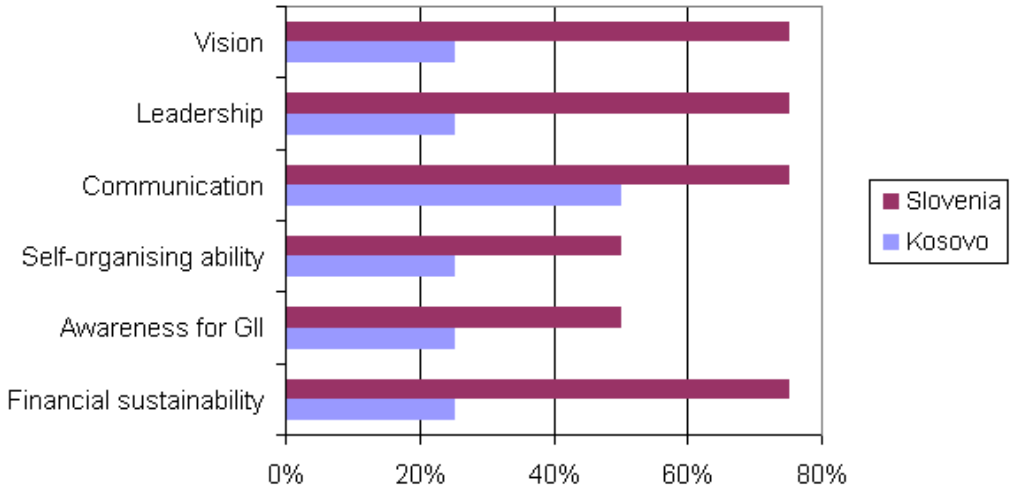


Figure 19: Maturity matrix approach scores for Slovenia en Kosovo (in %)

Figure 19 clearly identifies the gap between the developments of the SDI in Kosovo and Slovenia. Most significant gap occurs in Vision, Leadership and Financial sustainability in which SDI of Kosovo should put together a largest leap from stage 1 (stand alone) to stage 3 (Intermediary). The reason for this lies, most likely, in the lack of common vision, undefined leadership and inadequate budgeting processes. The traditional human resource management is also of big influence.

On the other hand the gap between the SDIs of Kosovo and Slovenia is slightly smaller in Communication (stage 2 to 3), Self-organizing ability and Awareness for GII aspect (stage 1 to 2). The results of the Maturity matrix prove that improving the Kosovo's SDI is totally necessary and justifiable. In other words, preservation of the current state of the SDI of Kosovo is not acceptable, not from organisational perspective nor from the financial sustainability. It is important to accentuate that there are no identical SDIs in the world, and it is impossible to replicate a model from one country to another. Kosovo, considering its uniqueness, social needs and the present SDI development stage, has to develop its own model of the SDI. But the SDI of Kosovo can follow the development trend of SDI of Slovenia to be geared up to meet all challenges and future needs in line with INSPIRE directives. Improvement of the existing SDI of Kosovo is to be treated as a public project of permanent character, in which before defining the particular activities and resources in all levels, an efficient improvement strategy should be created. Even of larger importance is that Kosovo should build such a strategy by itself.

4.4 Summary

In section 4.1 the selection of the case study countries is explained while section 4.2 describes the INSPIRE State of Play assessment of five selected countries. The implementation of the INSPIRE Directive, which started in 2007 and which will take at least until 2013, will influence to a large extent the further development of the SDIs in Europe. In case of the SDI of Kosovo this could be seen as an important driving force.

The SDIs of Kosovo and Slovenia are assessed from Organisational perspective using the maturity matrix method in section 4.3. The Maturity matrix result presented in this thesis research serves as good foundation for creating a vision and a national strategy of Kosovo's SDI enhancement. This research identifies the significant gap between the developments of the SDI in Kosovo and Slovenia. While the SDI of Kosovo is still in the maturity stage 1 (stand alone), the Slovenian SDI has achieved maturity of stage 3 (Intermediary). This could be seen as an understandable roadmap towards future sustainable development of SDI in Kosovo.

5 ANALYSIS

My Mama always said, 'Life is like a box of chocolates; you never know what you're gonna get.'
Forest Gump

5.1 Discussion of the results

By applying the multi-view assessment framework author intended to have an objective overview of present stage of SDI development in Kosovo and to test its applicability to assess SDIs. In this chapter we present the assessment results by using the three assessment approaches mentioned before: SDI Readiness Index, State of Play and Organisational Maturity matrix. The special focal point is given to the Organisational aspects of SDI Readiness and SoP.

By synchronized use of three assessment approaches author expected to create a much broader and more comprehensive picture of SDI of Kosovo. In that way the assessment is more objective because author is not limited to one view on an SDI. Furthermore focusing on the Organisational aspects of multiple assessment approaches allows easier identification of the important driving forces that require more attention than others. Table 22 and figure 20 presents the final results of the application of multi-view SDI assessment of Kosovo.

Assessment aproach	Kosovo
SDI Readiness Idex	36%
SDI Readiness Index - Organisational	30%
INSPIRE SoP	33%
INSPIRE SoP - Organisational Issues	50%
Maturity Matrix (average)	29%

Table 22: Multi-view approach scores for SDI of Kosovo (in %)

It is interesting to notice that the average scores of different assessment approaches are in relatively balanced level. The higher score is that of SDI readiness Index (36%) while

the lowest score is of Maturity Matrix (29%). The average score of multi-view assessment for SDI of Kosovo is 33%.

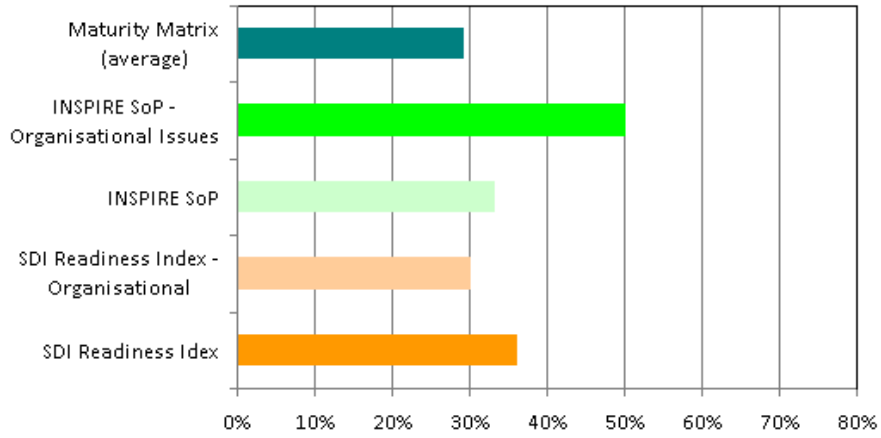


Figure 20: Multi-view approach scores for SDI of Kosovo (in %)

If we focus on the organisational aspects of each approach one can see that SDI of Kosovo scores higher in the organisational aspects of SoP (50%) than in the total score of SoP (33%). In case of SDI Readiness Index is the opposite situation where Organisational aspects scored lower (30%) than total Readiness Index (36%). This figure may help people working at the strategic level of SDI implementation in Kosovo to have objective overview for taking the necessary steps for further development of Kosovo's SDI and also compare their SDI with those from other countries.

Another important aspect of this research is to define the driving forces which have been of great influence until now but also in the future development. In many cases the original driving force was closely focussed around traditional governmental surveying and mapping activities. Another characteristic aspect for SDI of Kosovo is that the initial development of SDI was largely in the hands of small elite of spatially aware professionals. This influential group not only dominated the production of geographic information, but was also its main user group. In recent years we can see an slightly change of influencing forces to the extent that the majority of the public are users of spatial information, either knowingly or unknowingly. To be able to define those driving forces author has sliced the scores of three assessment approaches to the organisational factors shown in table 23.

	Assessment aproach	Kosovo
SRI	Politician vision regarding SDI	24%
SRI	Institutional leadership	36%
SRI	Umbrella legal agreement(s)	33%
SoP	SDI is truly national	100%
SoP	significant level of SDI operationality	50%
SoP	Coordinating body of the SDI is a NDP	100%
SoP	Coordinating body for the SDI data users	0%
SoP	'national GI- association' is involved in SDI	0%
SoP	Producers and users are participating in the SDI	0%
SoP	Only public sector actors are participating in the SDI	100%
MM	Financial sustainability	25%
MM	Awareness for GII	25%
MM	Self-organising ability	25%
MM	Communication	50%
MM	Leadership	25%
MM	Vision	25%

Table 23: Scores of the organisational factors for SDI of Kosovo (in %)

One can conclude that SDI assessments approaches like the State of Play and the SDI readiness Index contain a number of organisational elements, like the existence of a coordinating body, or the level of participation of data users and producers in the initiative. Such general indicators are useful to do a general assessment of a national SDI, but are not very helpful to describe and interpret (inter)organisational issues. Figure 21 presents the scores of three assessment approaches to the organisational factors.

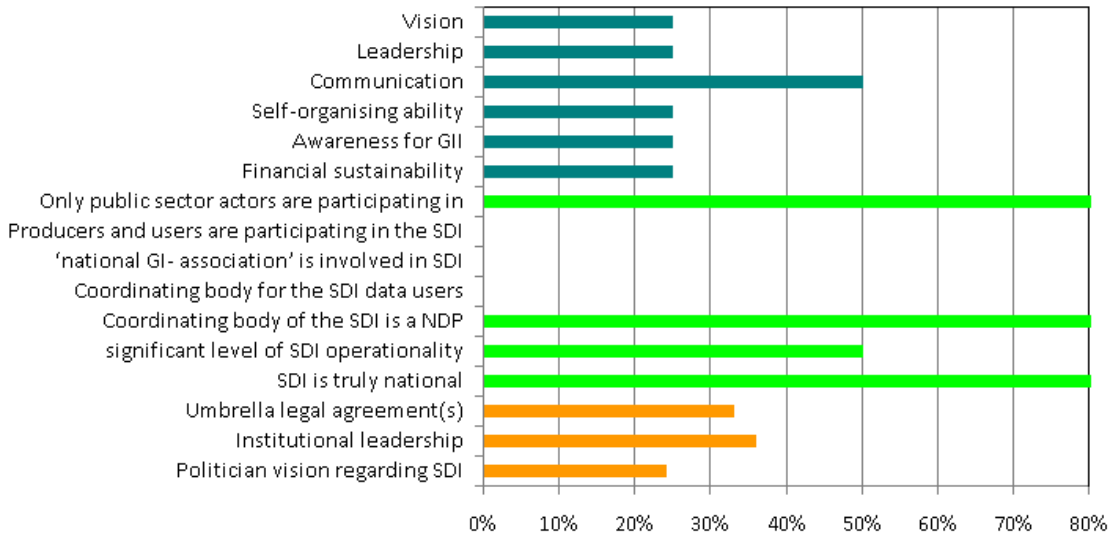


Figure 21: Scores of the organisational factors for SDI of Kosovo (in %)

A clear vision on the national SDI development is of essential importance. According to the results from the figure above we can see that in SDI readiness the 'political vision regarding SDI' scores 24% while 'vision' aspect of Maturity matrix scores 25% and both scores are lower than total average score of multi-view assessment (33%). The reason for this lies in low vision regarding the importance and development of the national SDI (a vision is being formulated). Besides that, the lack of common vision within the key stakeholders plays a huge impact. While the SDIs are evolving in the last years towards Spatially Enabled Society it must be recognised that many of the Kosovo's SDI unfastened elements developed over the last five years are still not fitting in their current forms for realising this vision of lifting the SDI of Kosovo towards a Spatially Enabled Government.

Leadership is also one of most important organisational aspects of an SDI development. Results of different approaches regarding the leadership are not fine balanced. One can notice that in SDI readiness Index the 'institutional leadership' scores 36% while 'leadership' aspect of Maturity matrix remains low at 25% and lower than total average score of multi-view assessment (33%). The reason for this lies clearly in still undefined leadership which is scattered between one or more institutions that coordinate partly the activities relating the national SDI. State of Play aspect 'coordinating body of SDI is NDP' is in large agreement in case of Kosovo. That is clear because the officially recognised or de facto coordinating body of the SDI is the KCA, thus a National data producer and not a public stakeholder.

To ensure the future development of SDI in Kosovo it is obvious that almost all Organisational aspects of SDI have to be improved. Therefore the driving forces should be to support this improvement.

5.2 The driving forces of SDI in Kosovo

By definition the driving forces are the reason why the particular SDI initiatives emerged. Examples of driving forces can be multiple: promoting national competitiveness and productivity, to support economic growth, environmental protection, better governmental planning and development, natural resources management, better coordination in

dealing with emergences, keeping data, military reasons, SDI initiatives imposed by others, executive order of the government body etc.

The analysis and comparison of the SDI of Kosovo and the case study countries increase insight in the driving forces behind the SDI development of Kosovo. In this research step the differences and similarities between the initiatives and the driving forces behind the initiatives have become apparent. The necessary steps for SDI of Kosovo to make progress and ensure continuity over time are revealed. The understanding of these issues can assist in the improvement and better implementation of SDI in Kosovo.

The main objective of this thesis was to assess the SDI of Kosovo from the different assessment approaches with the focal point on the Organisational aspects. Besides that a significant part of this research is to try to define the important driving forces which will ensure further development of SDI of Kosovo.

Van Loenen (2006) argues that knowledge about the driving forces of the SDI development is maybe the key of the sustainable SDI strategy. Recognising driving forces is the first step based on the strategy can be designed to influencing these forces following in effective and efficient use of resources. Literature review has shown that the driving force of the first generation SDIs has been *information development* where the second generation SDIs has focused on *information use*. It is almost unquestionable that SDI of Kosovo is still in first SDI generation.

Williamson and Rajabifard (2003) have provided six key factors to speed up SDI development. From an organisational perspective, the first three forces are critical for the success of a SDI. The key factors are:

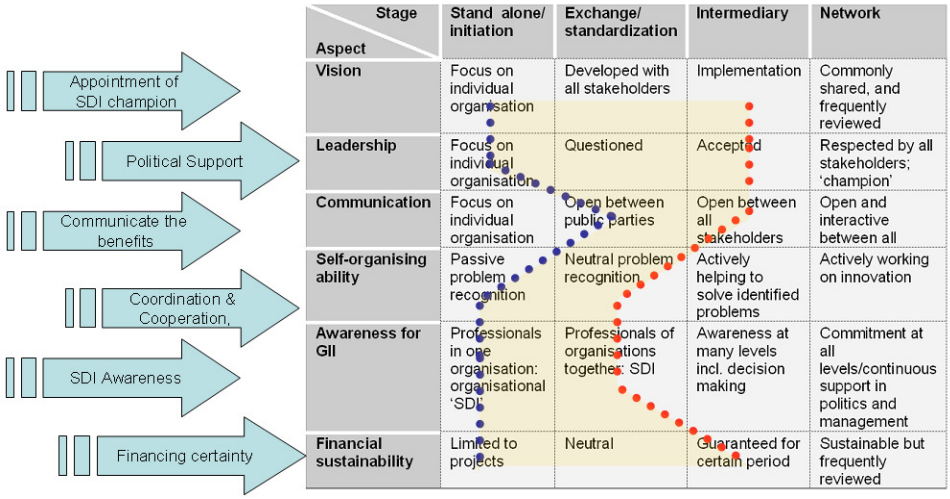
1. Awareness of use of geographic information and SDIs;
2. Involvement of the politicians concerned;
3. Cooperation between the various stakeholders;
4. Knowledge about the type, location, quality and ownership of datasets;
5. Accessibility of datasets;
6. The successful widespread use of the datasets.

A list of success factors which can lead to the defining of the driving forces have been drawn primarily from the case studies reviewed, but also from general SDI definitions, and components presented in the literature. Based on the research of Lipej and Modrijan (2010) one can observe that one important driving force of the Slovenian SDI is the well organized SDI national point of contact at The Surveying and Mapping Authority of the Republic of Slovenia (SMCA) with an important role for awareness creation and coordination of activities. Another important driving force is the early appointment of an Slovenian representative into the Permanent Committee for INSPIRE to coordinate communications with EU commission. A third important driving force is the cooperation between public organizations and between public and also private stakeholders.

A compilation and combination of the issues has led to 6 driving forces selected for the purpose of sustainable development of SDI at national level in Kosovo. These 6 driving forces have been chosen due its particular relevance to local conditions in Kosovo and the perceived contribution of each driving force in developing a solid base to support SDI strategy development of Kosovo. Driving forces for future improvement of SDI of Kosovo could be:

1. SDI Awareness,
2. Political Support,
3. Coordination & Cooperation,
4. Financing certainty,
5. Communicate the benefits.
6. Appointment of SDI champion

Results of the Maturity matrix assessment of SDIs of Slovenia and Kosovo clearly identify the gap in SDI development of Kosovo. Most significant gap occurs in Vision, Leadership and Financial sustainability in which SDI of Kosovo should put together a largest leap from stage 1 (stand alone) to stage 3 (Intermediary). As shown in figure 22 each of 6 defined driving forces are aiming on the particular aspect of Organisational development of SDI in Kosovo.



Aspect \ Stage	Stand alone/ initiation	Exchange/ standardization	Intermediary	Network
Vision	Focus on individual organisation	Developed with all stakeholders	Implementation	Commonly shared, and frequently reviewed
Leadership	Focus on individual organisation	Questioned	Accepted	Respected by all stakeholders; 'champion'
Communication	Focus on individual organisation	Open between public parties	Open between all stakeholders	Open and interactive between all
Self-organising ability	Passive problem recognition	Neutral problem recognition	Actively helping to solve identified problems	Actively working on innovation
Awareness for GII	Professionals in one organisation: organisational 'SDI'	Professionals of organisations together: SDI	Awareness at many levels incl. decision making	Commitment at all levels/continuous support in politics and management
Financial sustainability	Limited to projects	Neutral	Guaranteed for certain period	Sustainable but frequently reviewed

Figure 22: Driving forces projected in the Maturity matrix

Driving force 1 – SDI Awareness

Awareness for the value of SDI at the decision making levels is, like any other issue, critical for its successful SDI development. Rajabifard and Williamson (2001) argue that: "All stakeholders, including politicians and technical people, should be aware of the potential and advantages of geographic information and SDIs". The Kosovo Cadastre Agency, as organisation responsible for a SDI initiative, must help to raise this awareness. Awareness creation about importance of spatial data in society is of key importance, on which success of the improvement greatly depends. One of key factors is the degree of education of SDI subjects as well as whole geographical information market and community. In Kosovo, experts and those who use spatial data are aware of the benefits of improving the existing SDI, but it is not the case in the Kosovo's society as a whole. Without broad and sincere acknowledging of the importance and effect of spatial data on everyday decision making could portrait the SDI improvement as unnecessary and matter of lower priority.

Driving force 2 – Political support

The involvement of the politics and politicians concerned with the SDI development is essential. The politicians' support provides legitimacy and encourages the necessary financial investment for the SDI development." Especially high-level political support and

strong leadership are commonly considered important (see e.g., Longhorn, 2004; Craglia et al., 2003; Rajabifard et al., 2003, p. 108).

The experiences of SDIs reviewed in this research show that the more successful SDI as that of Slovenia enjoyed the highest and most consistent level of political support throughout their development. On the other hand, the less successful SDIs tend to have developed in a climate of more limited political support. This of course does not come as a surprise but it is important to have it confirmed by this assessment.

Three aspects are worth underlining regarding the political support in the case of Kosovo:

- Political support at the highest level is crucial. This is because most of geographic information is collected, maintained, and used by public sector organisations, which are dependent on the policies set by government in respect to organisational priorities, funding, and regulatory mechanisms.
- Setting up a SDI is costly and needs political support. Another aspect that emphasizes the importance of political support is the fact that geographic information is an expensive product, as well as underpinning a large number of government services to the citizen. It is therefore an area of tension between policies aimed at maximizing government revenue, and those, such as e-government, aimed at maximizing benefits to citizens. Political support is therefore needed to resolve these conflicts.
- Political support needs to be sustained over time. By their very nature, political priorities may change due to external circumstances, change of administration, or even only change of key individuals. The experience of the Slovenian SDI indicates (Bačić, 2009) that even after many years of successful development they remain thin-skinned to changes in political priorities and leadership and needs continuous and careful nurturing.

With these considerations in mind, it is clear that one of the most important driving forces for the development of a sustainable SDI in Kosovo is persistent action to gather and maintain support among political decision makers at all levels. After all, political support is needed to support and spread the vision, set up the legal framework, and assign resources to get results.

Driving force 3 – Coordination and cooperation

In developing a SDI, coordination and cooperation should be key, because no organization by itself can establish or improve the SDI. Therefore the sustainable development of a SDI is a matter of coordination and cooperation between all stakeholders.

Coordination is one of the most important aspects in the development of an SDI, as indicated by the experience of all the countries analysed. Strong multi-agency coordinating frameworks distinguish further developed Slovenian SDI. Countries with the least developed national SDI, such as Kosovo have the weakest coordination at the national level. But there are positive developments regarding the coordination within most important SDI stakeholders in Kosovo. According to the Development Strategy of the KCA 2009-2014, the framework for cooperation should be the establishment of an Inter-Ministerial Land Administration Committee. The committee should have an advisory role towards the Government and the KCA; and discuss matters of mutual interest for the members e.g. cadastre and land registration; legal framework and implementation of laws; quality and pricing of services and products; competence and training; and development, maintenance and cooperation related to technical systems such as the Kosovo Cadastral and Land Information System (KCLIS). The Secretariat for the Committee should be provided by the KCA. The Committee should act as the main Advisory Board to the Government and the KCA on matters concerning land administration and SDI; monitor and coordinate initiatives within the field of land administration and NSDI to ensure consistency and the promotion of the national, municipal interests as well as private sector interest; and promote specific cooperation issues and public-private partnership. Members of the committee should be drawn from the governmental sector. To the Committee's disposal should be established working groups for specific issues with members from governmental, municipal and private sector. The Committee should be empowered with decision-making powers in certain issues on behalf of the Government.

Another coordination body that is specific for present situation in SDI of Kosovo is introduction of The Donor Steering Committee which co-ordinates, monitors and supervises the activities and use of funds for implementation of the Development

Programme, based on donations by the foreign governments and World Bank loans. The members of the Donor Steering Committee are representatives from all contributing donors.

But along with the coordination body as this Committee, creation of an independent multidisciplinary body is to be considered, which would be independent of the government policy, and on the other hand represent the interests of a wider community of users and citizens of Kosovo. Only cooperation between the public sector, the private sector, the academia, non-government organizations, civic associations and individual users can give a clear vision of the SDI development.

Coordination and cooperation does not have to be expensive or imply large bureaucracies. Using the Slovenia as an example, the Surveying and Mapping Authority of the Republic of Slovenia (SMA), which coordinates the National SDI, performs all of the functions above with a relatively small budget of 15 million Euros until 2009, of which approximately 10% is spend for coordination purposes (Azman en Petek, 2009).

Driving force 4 – Financial certainty

A mechanism of financing certainty of the existing SDI has to include both a short-term and a long-term period. Spatial data and information are quasi-public good, and improvement of the existing SDI is to support an efficient government and e-government. Moreover, the government is generally the most frequent user of spatial data. This leads to the conclusion that the initial funds for improvement are to be granted from the state budget. Further financing requires additional sources, and considering the research results, public-private partnership seems to be the optimal mechanism. The fact is that the SDI of Kosovo can not be implemented only by government alone and by being dependent on the financial donations. Private enterprises have to play an imperative and matching role in software solutions and data gathering.

According to Lipej and Modrijan (2010) Slovenian SDI made an estimation of financial costs for implementing and improving existing SDI. The costs for Slovenia are approaching 15 million Euros until the year 2019. These costs include spatial data and services accommodation, creating new services, communication infrastructure, metadata preparation and some human resources costs. According to the developing strategy

2009 – 2014 of the KCA, the total cost for the development programme is estimated to 20 million Euros for the whole implementation period until 2014. In Kosovo, so far the main funding mechanisms are the international donations of the governments of Norway, Slovenia, Switzerland and Sweden.

Driving force 5 – Demonstrate the Benefits

A SDI can and should be developed at local, regional, national, European, and global levels. Therefore, there is a need to address politicians and decision makers at each of these levels and demonstrate the benefits of having an SDI. The benefits have to address areas of high political priority such as national security, crime reduction, health, education, spatial planning, environmental protection and disaster management. The SDI champions must constantly demonstrate how to support e-government and general economic development, reduce duplication and waste of resources, and increase competitiveness through the development of new industries in the location-based services.

To demonstrate such benefits it is possible at the beginning to use examples and best cases from other parts of the world, suitably adapted to address local concerns, and as the local SDI develops, it is important to focus on applications that can deliver quick wins, rather than spending a long time before showing any payback.

Driving force 6 – Appointment of SDI champion

The developing of a SDI strategy is very important but it is '*people'* who make it happen (see Craig, 2005). In other words the individuals are the key. Thus, SDI development in Kosovo needs a champion at the highest political level. This individual needs to be known to all stakeholders and also his position of Champion should be widely recognized within the SDI community of Kosovo. Such an individual would act in the absence of policies and would work to change or manipulate those policies if they did exist. Champions are leaders. They take charge, lead by example, see beyond effortless trends, and overcome distractions and obstacles to perform the task at hand. They uphold their convictions as they welcome opposing views. As natural visionaries, champions often see possibilities long before they are visible to others.

The question is how to find a SDI Champion? There are enough skilled individuals in the SDI society of Kosovo but there is a larger body of people who do not have the passion or skills to be champions. Maybe the answer lies in encouraging of Champions SDI idealism and celebrating their good work as champion because that is a primary motivator.

5.3 Summary - Prioritizing the Driving forces of Kosovo.

The empirical results of this thesis research are analysed in this chapter. First the results regarding the SDI of Kosovo are discussed in section 5.1 and a list of driving forces needed for the further sustainable development of the SDI in Kosovo is elaborated in section 5.2.

Based on this research the driving forces are prioritized in a logical order trying to compensate the largest gaps between the SDI development of Kosovo and Slovenia documented from Maturity matrix as shown in figure 22. Figure 23 could be seen as an understandable roadmap towards future sustainable development of the SDI in Kosovo.

Figure 23: prioritizing the driving forces of Kosovo.

The driving forces presented in this thesis research serves as good foundation for creating a vision and a national strategy of Kosovo's SDI enhancement. First a SDI champion has to be appointed and then political support has to be established. After the

financing certainty has been guaranteed the SDI awareness will be improved. After communicating the benefits the coordination & cooperation will be seen like next logical step.

6 CONCLUSIONS AND RECOMMENDATIONS

People do not like to think. If one thinks, one must reach conclusions. But conclusions are not always pleasant.
Helen Keller

This chapter gives the conclusion of the research by discussing the research questions, limitations of the study, and recommendations for future work.

6.1 Conclusions

The objective of this research was to develop a solid base to support SDI strategy development of Kosovo based on experiences elsewhere. The main specific research question of the thesis was formulated as follows: 'Which driving forces are most important for sustainable developing of the SDI in Kosovo? To answer this question, a number of sub-questions had to be answered like: 'What is the difference in SDI readiness in Kosovo in two separate time frames?' and 'How to learn from other similar countries and their problems en mistakes made during the implementation of SDI's?'

Based on a number of research steps as presented in the Chapter 1, a multi-view assessment of SDI in Kosovo based on the SDI Readiness Index, INSPIRE SoP and Organisational aspects (Maturity Matrix) is applied.

The first specific research question
'*What is the difference in SDI readiness in Kosovo in two separate time frames?*'

- This comparison of SDI Readiness Index of Kosovo over time demonstrates a self-effacing increase in SDI Readiness Index from 26% in 2007 to 0.36% in 2010. It is clear that the main merit for this increase is the very low SDI Readiness Index score of 0.26 in 2007.

- We can assume that although SDI of Kosovo has made considerable progress, there are of course still many challenges towards an effective implementation of a National SDI in Kosovo.
- The largest increase is in aspects 'People' (from 0.19 to 0.32) and 'Organisational' (from 0.17 to 0.30) index. The lowest Readiness Index increase is at aspects 'Informational' (from 0.28 to 0.34) and 'Assess network' (from 0.43 to 0.50) index. This is also due the relatively high score in these two indexes in 2007.
- An important driver is increasing of level of the Institutional leadership due to the arising of pressure for using the spatial information in decisions of national importunacy. Another driving force is improved availability of core spatial datasets due to the relatively structural international support programme from donor countries.

The second specific research question

'*How to learn from other similar countries and their problems and mistakes made during the implementation of SDI's?*'

Learning issues from INSPIRE State of Play:

- To be able to compare the present development of SDI of Kosovo with other countries the INSPIRE State of Play (SoP) case study desk research is done for four similar countries in transition like Estonia, Lithuania, Latvia, Slovenia and one country with geographical similarities with Kosovo like Luxembourg.
- All studied cases have similar levels of SDI development and are developing a truly national SDI. In a lot of cases, this is going hand in hand with the development of regional initiatives. It is also clear intention for Kosovo to develop a truly national SDI. Furthermore, it is clear that regarding legal issues and funding the unclear situation persist. Mostly because there is still no clear information available or the legal status of the SDI has not been clarified yet in this respective. On the other hand, data, metadata and services are quite developed, especially in Slovenia and Estonia. Standardization is also becoming a 'normal' issue for Slovenia and Estonia. Most countries are actively developing services. Mostly discovery and viewing services, but also download services are becoming a point of attention.

- The average score of Organisational issues of SoP is lower (43%) than the total average (58%). One can conclude that Slovenia has the most stabile SDI development with the highest total SoP score of 67% and 57% for the organisational issues of SoP (both scores are exceeding the average scores). Interesting developments occurs at SDI of Luxembourg with highest score regarding the Organisational Issues (64%) and almost lowest total SoP score (36%). Latvia and Kosovo have similar scores 50% for Organisational Issues of SoP and lower total score (Respectively 34% and 33%)
- It is clear that the implementation of the INSPIRE Directive, which started in 2007 and which will take at least until 2013, will influence to a large extent the further development of the NSDI, as well as of the sub-national SDIs. This could be seen as an important driving force for developing of a SDI in Kosovo.

Learning issues from Maturity matrix:

- Maturity matrix clearly identifies the gap between the developments of SDI in Kosovo and Slovenia. Most significant gap occurs in Vision, Leadership and Financial sustainability in which SDI of Kosovo should put together a largest leap from stage 1 (stand alone) to stage 3 (Intermediary). On the other hand the gap between SDIs of Kosovo and Slovenia is slightly smaller in Communication (stage 2 to 3), Self-organizing ability and Awareness for GII aspect (stage 1 to 2).
- The results of the Maturity matrix prove that improving the Kosovo's SDI is necessary and justifiable. In other words, preservation of the current state of SDI of Kosovo is not acceptable, neither from organisational perspective nor from the financial sustainability.
- SDI of Kosovo can follow the development trend of SDI of Slovenia to be geared up to meet all challenges and future needs in line with INSPIRE directives.
- The Maturity matrix result presented in this thesis research serves as good foundation for defining the driving forces for supporting the strategy of Kosovo's SDI enhancement. This could be seen as an understandable roadmap towards future sustainable development of SDI in Kosovo.

The third specific research question

'*Which driving forces are most important for sustainable developing of SDI in Kosovo?*

- This research has led to 6 driving forces selected to support development strategy of SDI at national level in Kosovo. Each of 6 defined driving forces is aiming on the particular aspect of Organisational aspects of Maturity matrix.
- Driving force 1 – SDI Awareness - The Kosovo Cadastre Agency as organisation responsible for a SDI initiative must help to raise this awareness. Awareness creation about importance of spatial data in society is of key importance, on which success of the improvement greatly depends.
- Driving force 2 – Political support - The involvement of the politics and politicians concerned with the SDI development is essential. With these considerations in mind, it is clear that one of the most important driving forces for the development of a sustainable SDI in Kosovo is persistent action to gather and maintain support among political decision makers at all levels
- Driving force 3 – Coordination and cooperation - In creation of an SDI, coordination and cooperation should have the key role, because no organization by itself can establish nor improve the SDI. According to the Development Strategy of the Kosovo Cadastral Agency (KCA) 2009-2014, the framework for cooperation should be the establishment of an Inter-Ministerial Land Administration Committee. The Committee should be empowered with decision-making powers in certain issues on behalf of the Government. Another coordination body that is specific for present situation in SDI of Kosovo is introduction of The Donor Steering Committee who co-ordinates, monitors and supervises the activities and use of funds for implementation of the Development Programme, based on donations by the foreign governments and World Bank loans.
- Driving force 4 – Financial certainty - A mechanism of financing certainty of the existing SDI has to include both short-term and long-term period. According to the developing strategy 2009 – 2014 of Kosovo cadastre Agency, the total cost for the development programme is estimated to 20 million Euros. In Kosovo, so far the main funding mechanisms are the international donations of the governments of Norway, Slovenia, Switzerland and Sweden. In future initial funds for improvement of SDI in Kosovo are to be granted from the state budget.
- Driving force 5 – Demonstrate the Benefits - An SDI can and should be developed at local, regional, national, European, and global levels. Therefore, there is a need to address politicians and decision-makers at each of these levels

and demonstrate the benefits of having an SDI. The benefits have to address areas of high political priority such as national security, crime reduction, health, education, spatial planning, environmental protection and disaster management. It is important to focus on applications that can deliver quick wins, rather than spending a long time before showing any payback.

- Driving force 6 – Appointment of SDI champion - Developing of a SDI strategy is very important but it is '*people'* who make it happen. In other words the individuals are the key. Thus, SDI development in Kosovo needs a champion at the highest political level. This individual needs to be known to all stakeholders and also his position of Champion should be widely recognized within the SDI community of Kosovo. Such an individual would act in the absence of policies and would work to change or manipulate those policies if they did exist.
- The driving forces are prioritized in a logical order trying to compensate the largest gaps between SDI development of Kosovo and Slovenia. First a SDI champion has to be appointed and then political support has to be established. After the financing certainty has been guaranteed the SDI awareness will be improved. After communicating the benefits the coordination & cooperation will be seen like next logical step.

6.2 Recommendations

To contribute the improvement of a solid base to support SDI strategy development of Kosovo author makes the following recommendations:

- The SDI must not be developed in a hurry, but a clear vision is needed, which is to be based on organizational, human and financial resources.
- Improvement of the existing SDI of Kosovo is to be treated as a public project of permanent character, in which before defining the particular activities and resources in all levels, an efficient improvement strategy should be created. Even of larger importance is that Kosovo should build such a strategy by itself.
- The introduction of NSDI in Kosovo will take many years. A step-by-step approach is, therefore, suggested for the implementation of the SDI.
- The users should be engaged as far as possible in the future development and implementation of SDI in Kosovo and to base the work on user requirements.

- The vision for the future development of SDI should be clearly expressed and widely communicated. Based on the vision a short strategy document should be set up describing strategic goals and what actions should be taken to achieve the goals.
- Another important issue should be to set up a framework related to the implementing rules for the INSPIRE Directive.
- It is recommended that politicians be encouraged to take an active role in all committees involved in establishing and steering the development of the Kosovo's SDI.
- It is recommended organizing the Strategic Coordination to support the development of National SDIs and to ensure that policies and actions at the European level are consistent with the development of the SDI in Kosovo.
- To coordinate with national organisations in raising awareness at the political level through the dissemination of use-cases and pilot projects that have a direct relation to political top priorities such as environment and e-government.
- Creation of an independent multidisciplinary body is to be considered, which would be independent of the government policy, and on the other hand represent the interests of a wider community of users and citizens of Kosovo.
- Also, it should be stressed that the developed strategy is to be updated frequently in line with technological and social developments and the user's needs.
- Conduct cost/benefit analysis to emphasizing the merits of SDI to convince decision makers about the importance to invest in geospatial matters.
- Encourage international capacity building projects, for instance, from SDI or other international institution with authority in the topic.
- Stimulate the natural individual leadership in person of GIS Champion wherever it could be appreciated.

6.3 Limitations of the Study

Some obstacles and difficulties are encountered during this thesis research.

- This research has started in 2006 and due to circumstances stopped in 2007 to be continued in 2010. Due to this large 'break' the research outline was changed from "defining the SDI readiness of Kosovo" in (2007) to 'multi-view assessment

of the SDI of Kosovo' (2010). Assessment period was in summer 2007 and 2010 when the data was collected in Prishtina. Assessment of SDI Readiness Index at different moments in time is necessary so as to capture the progress of development.

- In such a dynamic and constantly evolving environment like SDI the time of conducting the assessments is of great importance. Therefore the intervals between data collections should be as short as possible to allow the application of multiple assessment approaches to be synchronized.
- There is a room for improvement of the method. The weakness of using the indicators from the Multi-view SDI assessment framework was that some of the indicators from the three operational assessment approaches might have been very similar and therefore the list of indicators can be improved. By fussing the different indicators of three assessment approaches (by deriving the common nominator) into thematic groups of indicators would make the assessment and monitoring easier for the SDI stakeholders.
- Another shortcoming of the method is that the results are giving the impression that indicators are easy to be quantified while they have to be constantly interpreted and therefore leaving room for being not objective.
- The next reflection is the difference in data availability between various assessment approaches and methods. In case of SDI of Kosovo there is lack of reports or any other data that could be used directly in the assessment analysis. Therefore for some assessment approaches it was almost unfeasible to collect reliable and complete data, such as reports on SDI finances, revenues or internal self-assessment reports.
- Integrating three different assessment approaches in case of the SDI of Kosovo was quite difficult. The attempt to integrate the results of several assessments in chapter 5 has shown different pictures of SDI in Kosovo. Based on these differences future investigators can build their studies. Some of the general indicators from this three assessment approaches are not very useful to explain and value specific organizational issues but are useful for more general overview of national SDI.

6.4 Recommendations for Future Work

Based on the above highlights of limitations of the study, the following recommendations for further research can be given:

- In the near future, similar multi-view assessment research could be carried out on SDIs of the south east Balkans to better understand the progress but especially development gaps between countries;
- The added value of multi-view assessments of SDIs should be studied in more detail. Most approaches do not automatically result in clear steps needed for the further development of SDIs.
- A kind of multi-view assessment 'cookbook' is needed for similar countries in same region.
- It could be explored if other assessment techniques give another result regarding the key driving sources.
- It is a challenge for the near future to capitalize possibilities given by the popular social networks and use Crowd sourcing techniques to speed up the SDI assessments and to monitor SDI developments.

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8 APPENDICES

8.1 Appendix A – list of stakeholders for SDI Readiness Index 2007 and 2010

List of stakeholders (key experts) involved in SDI Readiness assessment in Kosovo (2007 and 2010).

	Name	*Organization*	*Department*	*Position*	*mail*	*2007*	*2010*
1	Hazer Dana	Ministry	IPH	Middle management	hdama04@hotmail.com	x	
2	Miradije Gerguri	Mapping Agency	DMM	Middle management	mr_gerguri@hotmail.com		
3	Mimoza Kallaba	Mapping Agency	IPH	Operational	mozakallaba@hotmail.com	x	x
4	Besim Abdyli	Ministry	IPH	Operational	babdyli@hotmail.com		
5	Fidaim Sahiti	Ministry	DU	Executive	fidaimi04@hotmail.com		
6	Hazir Cadraku	Ministry	DU	Middle management	haziri_07@hotmail.com		
7	Bekir Bozhdaraj	Ministry	IPH	Middle management	bakirb_iph@hotmail.com		
8	Shpend Agaj	Ministry	IPH	Executive	shpend_agaj@yahoo.com	x	
9	Besim Gollopeni	Ministry	IPH	Middle management	besi_st@hotmail.com		
10	Festa Nixha Nela	Ministry	IPH	Operational	festanixha@yahoo.com	x	x
11	Servet Spahiu	Ministry	DBN	Middle management	servetspahiu@yahoo.com		
12	Tomor Cela	Mapping Agency	DAQ	Executive	tomor.qela@mmph.org	x	x
13	Avdullah Berisha	Ministry	DBN	Middle management	avdullahberisha@hotmail.com		
14	Arben Rrecaj	Ministry	IPH	Middle management	arrecaj@hotmail.com	x	x
15	Hylkije Gollopeni	Ministry	IPH	Operational	kijagollopeni@hotmail.com		
16	Lendita Ajeti	Ministry	IPH	Operational	lenditaa@hotmail.com	x	
17	Faton Deva	Ministry	IPH	Operational	fatondeva@hotmail.com		
18	Ramush Hajdari	Ministry	IPH	Operational	ramushi2000@hotmail.com		
19	Bajram Hafexholli	Mapping Agency	DAQ	Middle management	bkafexholli_@hotmail.com		
20	Luan Nushi	Ministry	IPH	Executive	luan@hotmail.com	x	x
21	Agron Nagavci	Private	BLINI	Middle management	agron@hotmail.com		x
22	Argjent Nela	Private	ITEG	Executive	argjent.nela@iteg-kos.com	x	x
23	Abdurrahman Kuleta	Cadastre	KCA	Executive	A.kulet@kca-klic.com	x	x
24	Muzafer Çaka	Cadastre	KCA	Executive	muzafer_c@kca_klic.com		x
25	Skender Agolli	Private	Water	Executive	skenderagolli@hotmail.com		x

SDI Readiness index calculations for Kosovo (2007)

Factor	Decision Criteria		Box1	Box2	Box3	Box4	Box5	Box6	Box7	totaal	SRI
Organizational	Politician vision regarding SDI	Ov	0,00	0,00	0,00	0,00	0,40	0,75	0,60	1,75	**0,18**
Organizational	Institutional leadership	Ol	0,00	0,00	0,00	0,00	0,40	0,25	0,80	1,45	**0,15**
Organizational	Umbrella legal agreement(s)	Oa	0,00	0,00	0,00	0,00	0,40	1,25	0,40	2,05	**0,21**
Organizational index											**0,17**
Informational	Digital cartography availability	Ic	0,00	0,00	0,70	0,55	0,80	1,00	0,20	3,25	**0,33**
Informational	Metadata availability	Im	0,00	0,00	0,00	0,00	0,80	1,00	0,40	2,20	**0,22**
Informational index											**0,28**
People	Human Capital	Pc	0,00	0,00	0,00	0,00	0,40	1,25	0,40	2,05	**0,21**
People	SDI culture	Ps	0,00	0,00	0,00	0,55	0,40	0,75	0,50	2,20	**0,22**
People	Individual leadership	Pl	0,00	0,00	0,00	0,00	0,40	0,25	0,80	1,45	**0,15**
People Index											**0,19**
Access network	Web connectivity	Aw	0,00	0,00	0,00	0,55	0,40	0,50	0,60	2,05	**0,21**
Access network	Telecommunication infrastructure	At	0,00	0,00	0,00	0,00	0,40	0,50	0,70	1,60	**0,16**
Access network	Geospatial software availability	As	0,00	0,00	0,00	0,55	0,80	1,00	0,30	2,65	**0,27**
Access network	Own geoinformatics development	Ad	0,00	0,00	0,00	0,00	0,40	0,25	0,80	1,45	**0,15**
Access network	Open source culture	Ao	0,00	0,00	0,00	0,00	0,40	0,50	0,70	1,60	**0,16**
Access index											**0,43**
Financial Resources	Government central funding	Fg	0,00	0,00	0,00	0,55	0,40	1,00	0,40	2,35	**0,24**
Financial Resources	Return on investment	Fr	0,00	0,00	0,00	0,00	0,80	0,75	0,50	2,05	**0,21**
Financial Resources	Private sector activity	Fp	0,00	0,00	0,00	0,00	0,40	0,50	0,70	1,60	**0,16**
Financial index											**0,20**
SDI readiness Index											**0,26**

SDI Readiness index calculations for Kosovo (2010)

Factor	Decision Criteria		Box1	Box2	Box3	Box4	Box5	Box6	Box7	totaal	SRI
Organizational	Politician vision regarding SDI	Ov	0,00	0,00	0,00	0,00	1,20	0,75	0,40	2,35	**0,24**
Organizational	Institutional leadership	Ol	0,00	0,00	0,70	1,10	0,80	0,75	0,20	3,55	**0,36**
Organizational	Umbrella legal agreement(s)	Oa	0,00	0,00	0,00	1,10	1,20	0,75	0,20	3,25	**0,33**
Organizational index											**0,30**
Informational	Digital cartography availability	Ic	0,00	0,00	0,70	1,65	1,20	0,50	0,10	4,15	**0,42**
Informational	Metadata availability	Im	0,00	0,00	0,00	0,55	0,80	0,75	0,40	2,50	**0,25**
Informational index											**0,34**
People	Human Capital	Pc	0,00	0,00	1,40	0,55	0,80	0,50	0,30	3,55	**0,36**
People	SDI culture	Ps	0,00	0,00	0,00	1,10	1,20	0,75	0,20	3,25	**0,33**
People	Individual leadership	Pl	0,00	0,00	0,00	1,10	0,80	0,75	0,30	2,95	**0,30**
People Index											**0,32**
Access network	Web connectivity	Aw	0,00	0,00	0,00	0,55	1,20	0,50	0,40	2,65	**0,27**
Access network	Telecommunication infrastructure	At	0,00	0,00	0,00	0,55	1,20	0,75	0,30	2,80	**0,28**
Access network	Geospatial software availability	As	0,00	0,00	0,00	0,55	1,60	0,75	0,20	3,10	**0,31**
Access network	Own geoinformatics development	Ad	0,00	0,00	0,00	0,00	0,40	0,75	0,60	1,75	**0,18**
Access network	Open source culture	Ao	0,00	0,00	0,00	0,00	0,40	0,50	0,70	1,60	**0,16**
Access index											**0,50**
Financial Resources	Government central funding	Fg	0,00	0,00	0,70	1,10	0,80	0,75	0,20	3,55	**0,36**
Financial Resources	Return on investment	Fr	0,00	0,00	0,00	1,10	0,80	0,75	0,30	2,95	**0,30**
Financial Resources	Private sector activity	Fp	0,00	0,00	0,00	1,10	1,20	0,75	0,20	3,25	**0,33**
Financial index											**0,33**
SDI readiness Index											**0,36**

8.2 Appendix B – SDI Readiness Index questionnaire

I. ADMINISTRATIVE DETAILS

I.1 ORGANIZATIONAL INFORMATION

Name of organization: Type of Organization (Secretariat Ministry, state entity, university, institute, company, etc): Name of director: Mailing Address : Telephone(s): Website address:

I.2 PERSON WHO COMPLETED THE QUESTIONNAIRE

Name: Position: Organization: Mailing Address: Telephone(s): Email:

II FACTORS THAT INFLUENCE THE NATIONAL SDI-READINESS

II.1 O*rganizational factors* (Vision, institutional framework, legal framework). This view includes organizational factors that influence the readiness of the SDI-initiative.

II.1.1 Vision A practical and organizational issue to take is the development of a vision, detailing a vision of the desired future and a clear sense of how SDI components could serve that future and help to realize it. This also involves setting clear priorities and defining a strategy or policy to accomplish this vision. (check (X) one box only)

	Extremely high vision regarding the importance and development of the national SDI (maximum level of government participation in defining a strategy of the national SDI)
	Very High vision regarding the importance and development of the national SDI (important ministries are strongly involved in setting strategies for the national SDI)
	High vision regarding the importance and development of the national SDI (vision formulated forms a crucial starting point for launching the national SDI)
	Medium vision regarding the importance and development of the national SDI (a formulated vision does exist, but has low impact on the development of the national SDI)
	Low vision regarding the importance and development of the national SDI (a vision is being formulated)
	Very Low vision regarding the importance and development of the national SDI (a few sectors show interest in having a vision)
	No vision exist as well as no intention exist to formulate a vision regarding the importance and development of the national SDI

II.1.2 Institutional leadership. This factor refers to the leadership within the institutional framework. (check (X) one box only)

	Maximum leadership of one or more institutions that coordinate the activities relating the national SDI
	Very High leadership of one or more institutions that coordinate the activities relating the national SDI
	High leadership of one or more institutions that launch the crucial activities relating the development of a national SDI
	Medium leadership of one or more institutions that coordinate partly the activities relating the national SDI
	Low leadership of one or more institutions that start to set up the institutional framework
	Very Low leadership of one or more institutions that show interest to set up the institutional framework
	No leadership of one or more institutions

II.1.2 Legal framework. This factor refers to the creation of a legal environment that leads to a national SDI being legally embedded. The legal framework of a SDI consists of legal instruments such as laws, policies, directives and commitments. (check (X) one box only)

	Maximum level of legal support to the national SDI-initiative (existence of a legal framework that support legally the SDI at a maximum level)
	Very High legal support to the national SDI-initiative (applying legal instruments that motivate strongly all the activities relating the national SDI)
	High legal support to the national SDI-initiative (an established legal framework that support the national SDI is under construction)
	Medium level of the legal framework (existence of a framework, but it is incapable to support the national SDI)
	Low legal support to the national SDI-initiative (creating legal instruments isolated that might support the national SDI)
	Very Low legal support to the national SDI-initiative (not existing legal instruments at a national level, but at organizational or sector level, which have a very low impact on the national SDI)
	No existence of any legal framework (including instruments) that might support the national SDI-initiative

II.2 Information factors (digital cartography availability, metadata availability) refers to the availability of core spatial datasets and metadata.This view includes SDI-content factors that influence the readiness of the SDI-initiative.

II.2.1 Digital Cartography availability This factor refers to the availability of core spatial datasets in digital format crucial for the national SDI. (check (X) one box only)

	Maximum availability of core spatial datasets in digital format (e.g. geodesy, elevation, cadastral, administrative boundaries, hydrography, transport, ortho-images, place names)
	Very High level of core spatial datasets in digital format (availability of core spatial datasets with an appropriate scale level that cover the whole country (e.g. geodesy, elevation, cadastral, administrative boundaries, hydrography, transport, ortho-images, place names))
	High level of core spatial datasets in digital format (availability of core spatial datasets with an appropriate scale level that the main regions of the country (e.g. geodesy, elevation, cadastral, administrative boundaries, hydrography, transport, ortho-images, place names))
	Medium level of core spatial datasets in digital format (partial availability of core spatial datasets at levels that are insufficient for being a decisive factor)
	Low level of core spatial datasets in digital format (availability of some core spatial datasets for some regions in the country (e.g. geodesy, elevation, cadastral, administrative boundaries, hydrography, transport, ortho-images, place names))
	Very Low level of core spatial datasets in digital format (availability of very few core spatial datasets (e.g. geodesy, elevation, cadastral, administrative boundaries, hydrography, transport, ortho-images, place names))
	No availability of any core spatial datasets in digital format

II.2.2 Metadata Availability. This factor refers to the content of the national SDI.(check (X) one box only)

	Maximum availability of metadata describing spatial datasets
	Very High level of metadata availability describing spatial datasets
	High level of metadata availability describing spatial datasets
	Medium level of metadata availability describing spatial datasets
	Low level of metadata availability describing spatial datasets
	Very Low level of metadata availability describing spatial datasets
	No availability of any metadata describing spatial datasets

II.3 Human resources (human capital, SDI education/culture, individual leadership). This view includes human factors that influence the readiness of the SDI-initiative.

II.3.1 Human Capital This factor refers to the education, knowledge and skills of citizens of the country. This factor might have an influence on the national SDI-developments. Information will be taken from UN statistics report.

II.3.2 Culture/Education on SDI. This factor refers to the capacity building and the awareness of the impact of spatial data on the well-functioning of society, including businesses, public entities and academic institutions may ease the efforts to participate in the SDI and to acquire funding for SDI development. Investment of significant resources to build capacity and to raise community awareness of spatial data and technologies such as courses, workshops and seminars are important in order to realize the full potential of SDIs. (check (X) one box only)

	Maximum level of SDI-culture and education (capacity building) among the stakeholders
	Very High level of SDI-culture and education (capacity building) among the stakeholders
	High level of SDI-culture and education (capacity building) among the stakeholders
	Medium level of SDI-culture and education (capacity building) among the stakeholders
	Low level of SDI-culture and education (capacity building) among the stakeholders
	Very Low level of SDI-culture and education (capacity building) among the stakeholders
	No existence of any SDI-culture and education (capacity building among the stakeholders

II.3.3 Individual leadership (champion). A very critical issue of SDI development is leadership. SDIs need a champion, or an entity which promotes, and coordinates the development of a SDI. This leader has to initiate an agenda building process and start to bring the community together. A leader can be appointed by a formal mandate, often a political support. A leader can also emerge from existing coordination activities, or from the achievements and enthusiasm of respected individuals. This factor relates to the presence or no presence of such leadership in your SDI-initiative.

(check (X) one box only)

	Existence of absolute individual leadership
	Very High individual leadership
	High individual leadership
	Medium individual leadership
	Low individual leadership
	Very Low individual leadership
	No existence of any individual leadership

II.4 Access networks and technology (Communication infrastructure, web connectivity, availability of commercial or inhouse spatially-related software, Use of Open source services).

The access networks and technologies are critical from a technical perspective to facilitate the use of data and services by people. They seek to facilitate access to relevant data sources and spatial information services by anyone, anywhere. This view includes technological factors that influence the readiness of the SDI-initiative.

II.4.1 Communication Infrastructure. This factor will be taken from UN statistics.

II.4.2 Web Connectivity. This factor will be taken from UN statistics.

II.4.3 Availability of commercial or inhouse spatially-related software. This factor refers to the level of commercial or inhouse software availability that forms a key aspect of a SDI.

(check (X) one box only)

	Maximum availability of commercial or inhouse spatially-related software that fits the demands of the national SDI
	Very high level of availability of commercial or inhouse spatially-related software
	High level of availability of commercial or inhouse spatially-related software
	Medium level of availability of commercial or inhouse spatially-related software
	Low level of availability of commercial or inhouse spatially-related software
	Very Low level of availability of commercial or inhouse spatially-related software
	No availability of commercial or inhouse spatially-related software

II.4.3 Use of Open source services. This factor refers to the level of the use of Open source (free of cost) services. (check (X) one box only)

	Only Open source services are used for all services needed within a SDI
	Very high level of the use of Open source services
	High level of the use of Open source services
	Medium level of the use of Open source services
	Low level of the use of Open source services
	Very Low level of the use of Open source services
	No use of Open source services

II.5 Financial resources (governmental funding, funding by means of cost recovery, private and enterprise funding).

This view focuses on the sources of funding in order to develop a SDI. Funding is needed in order to finance for example SDI-management and coordination costs, institutional framework, legal environment, hardware, (commercial) software, capacity building, metadata preparation, and data collection. Funding is a complex issue with many stakeholders and different funding arrangements. This view includes the funding factors that influence the readiness of the SDI-initiative.

II.5.1 Governmental funding. This factor refers to the government's role (level) as source to finance the national SDI-initiative. (check (X) one box only)

	The national SDI is only funded by the government and no other funds are needed.
	Very High level of funding by the government to finance the national SDI-initiative
	High level of funding by the government to finance the national SDI-initiative
	Medium level of funding by the government to finance the national SDI-initiative
	Low level of funding by the government to finance the national SDI-initiative
	Very Low level of funding by the government to finance the national SDI-initiative
	No funding by the government to finance the national SDI-initiative

II.5.2 Funding by means of cost recovery. This factor refers to the level of funding the national SDI through the application of policies regarding cost recovery. (check (X) one box only)

	The national SDI is only funded by means of the application of policies regarding cost recovery and no other funds are needed.
	Very High level of funding by means of the application of policies regarding cost recovery
	High level funding by means of the application of policies regarding cost recovery
	Medium level funding by means of the application of policies regarding cost recovery
	Low level funding by means of the application of policies regarding cost recovery
	Very Low level funding by means of the application of policies regarding cost recovery
	No funding by means of the application of policies regarding cost recovery

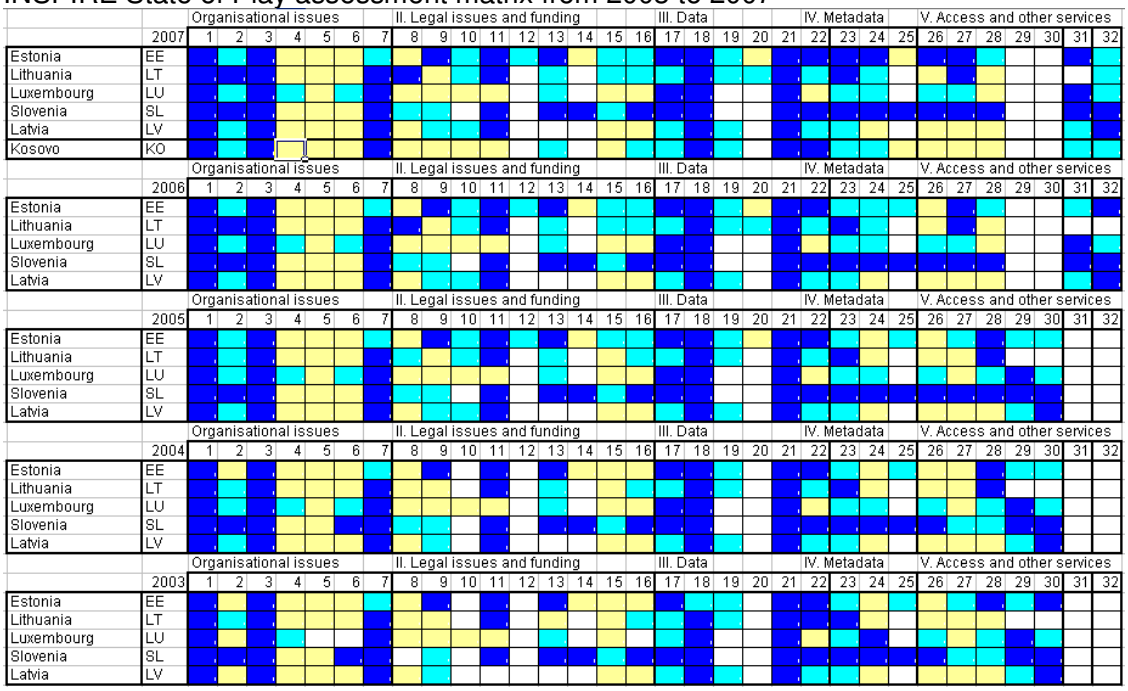
II.5.3 Private and enterprise sector funding. This factor refers to the level of contribution by the private sector and enterprises to finance the national SDI. (check (X) one box only)

	The national SDI is only funded by the private sector and/or enterprises
	Very High level of funding by the private sector and/or enterprises to finance the national SDI
	High level of funding by the private sector and/or enterprises to finance the national SDI
	Medium level of funding by the private sector and/or enterprises to finance the national SDI
	Low level of funding by the private sector and/or enterprises to finance the national SDI
	Very Low level of funding by the private sector and/or enterprises to finance the national SDI
	No funding by the private sector and/or enterprises to finance the national SDI

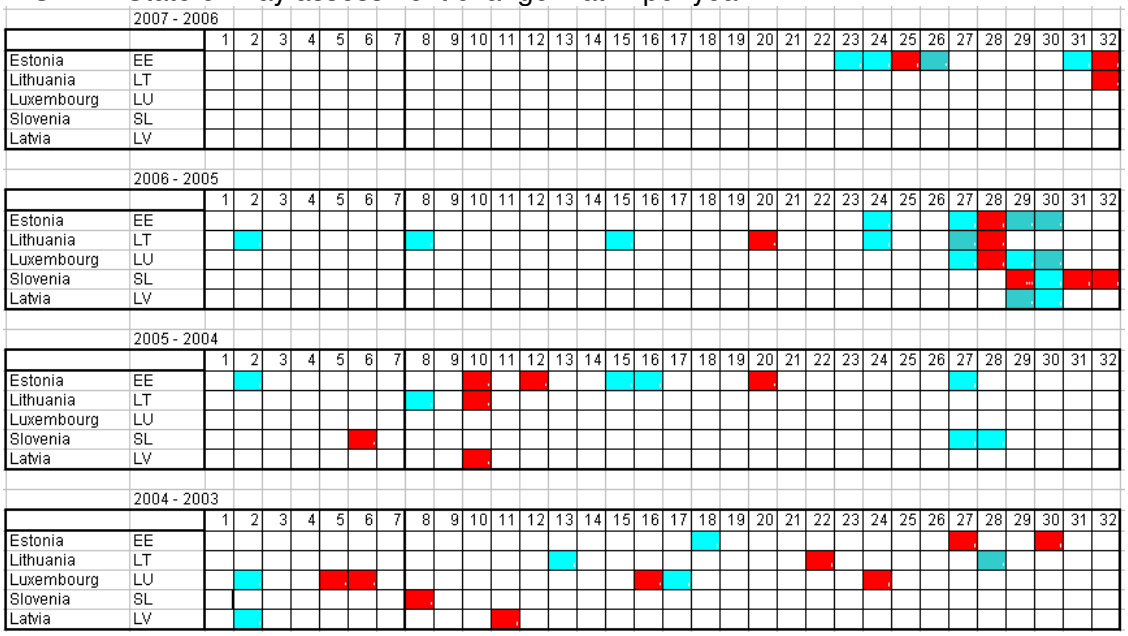
Thank you very much for your time in completing this survey.

8.3 Appendix C - INSPIRE State of Play from 2003 - 2007

INSPIRE State of Play assessment matrix from 2003 to 2007



INSPIRE State of Play assessment change matrix per year.



INSPIRE State of Play assessment matrix from 2003 to 2007 (Organisational Issues)

		Organisational issues						
	2007	1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							
Kosovo	KO							
		Organisational issues						
	2006	1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							
		Organisational issues						
	2005	1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							
		Organisational issues						
	2004	1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							
		Organisational issues						
	2003	1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							

INSPIRE State of Play assessment change matrix per year (Organisational Issues).

2007 - 2006		I. Organisational issues						
		1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							

2006 - 2005		I. Organisational issues						
		1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							

2005 - 2004		I. Organisational issues						
		1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							

2004 - 2003		I. Organisational issues						
		1	2	3	4	5	6	7
Estonia	EE							
Lithuania	LT							
Luxembourg	LU							
Slovenia	SL							
Latvia	LV							

Analysing Organisational Issues of INSPIRE State of Play assessment matrix from 2007

I. Organisational issues			EE	LT	LU	SL	LV	KO
Level of SDI	1	The approach and territorial coverage of the SDI is truly national						
Degree of operationality	2	One or more components of the SDI have reached a significant level of operationality.						
Coordination	3	The officially recognised or de facto coordinating body of the SDI is a NDP, i.e. a NMA or a comparable organisation						
	4	The officially recognised or de facto coordinating body for the SDI is an organisation controlled by data users Coordination						
	5	An organisation of the type 'national GI- association' is involved in the coordination of the SDI						
Participants	6	Producers and users of spatial data are participating in the SDI						
	7	Only public sector actors are participating in the SDI						

I. Organisational issues			EE	LT	LU	SL	LV	KO	
Level of SDI	1	The approach and territorial coverage of the SDI is truly national	100%	100%	100%	100%	100%	100%	100%
Degree of operationality	2	One or more components of the SDI have reached a significant level of operationality.	50%	100%	50%	100%	50%	50%	67%
Coordination	3	The officially recognised or de facto coordinating body of the SDI is a NDP, i.e. a NMA or a comparable organisation	100%	100%	100%	100%	100%	100%	100%
	4	The officially recognised or de facto coordinating body for the SDI is an organisation controlled by data users Coordination	0%	0%	50%	0%	0%	0%	8%
	5	An organisation of the type 'national GI- association' is involved in the coordination of the SDI	0%	0%	0%	0%	0%	0%	0%
Participants	6	Producers and users of spatial data are participating in the SDI	0%	0%	50%	0%	0%	0%	8%
	7	Only public sector actors are participating in the SDI	50%	100%	100%	100%	100%	100%	92%