

Multi-view SDI assessment of Kosovo (2007-2010) - Developing a solid base to support SDI strategy development

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Abstract

This paper presents the Multi-view assessment of SDI status in the Republic of Kosovo performed in 2007 and in 2010. The main objective of this research was to assess the SDI of Kosovo and to define the driving forces needed to support SDI strategy development.

The research assesses the status of SDI implementation of Kosovo using SDI readiness Index (Delgado et al., 2005); INSPIRE State of Play (Vandenbroucke et al., 2008) and Maturity Matrix as assessment (Kok en Van Loenen, 2005) approaches. Each approach treats the assessment of SDIs from a different view and context and so with a different purpose in mind. 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.

This research has led to 6 driving forces selected to support development strategy of SDI at national level in Kosovo.

Keywords: SDI, Kosovo, Multi-view assessment, Readiness Index, Maturity matrix.

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1 INTRODUCTION

The assessment and evaluation of SDI initiatives is difficult due to a number of reasons. Many researchers have tried to assess SDIs (Cromptvoets, 2006; Delgado-Fernandez and Cromptvoets, 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.

In order to improve the SDI development of Kosovo, this paper 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.

1.1 Republic of Kosovo

Republic of Kosovo has about 2.2 million inhabitants in an area of about 11.000 km². 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.

Kosovo declared independence on 17 February 2008. Currently, about 80 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.

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 plan including decentralization issues also impacting the land administration. One of the Governments aims is to take steps towards European integration.

1.2 Background of Kosovo's SDI

The awareness for SDI was extremely low in the first years after the violent conflict in Kosovo. 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 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.

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.

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 for the whole territory of Kosovo (spring 2009). Production of rather simple topographic vector maps would, in addition to the existing cadastre maps, aerial photos and digital terrain model (DTM), be marked as the start of developing a sustainable National Spatial Data Infrastructure for Kosovo in compliance with the EC INSPIRE Directive.

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.

2 SDI ASSESSMENT OF KOSOVO

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.

2.1 SDI readiness Index

SDI-readiness approach (Delgado, 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.

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 SDI readiness Index approach is applied in Kosovo in two time periods: in summer 2007, when this research started; and in summer 2010. 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. 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 10 questionnaires is considered to be representative, considering the fact this was a targeted research, and the research results are to be considered valid.

SDI readiness index assessment in 2007

First SDI readiness Index assessment was held in summer 2007. In this period we 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.

All the statements have been organised in a database in order to be able to track and revert changes and perform data manipulations needed to calculate the SDI Readiness Index. Selected 10 statements were organised in 7 boxes related the 7 possible levels of answers according to the questionnaire. 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.

At the end the SDI Readiness Index of Kosovo for 2007 is calculated as presented in table 1 and figure 1.

Factor	Decision Criteria		SDI Index
Organizational	Politician vision regarding SDI	Ov	0,18
Organizational	Institutional leadership	OI	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	PI	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

Table 1: 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.

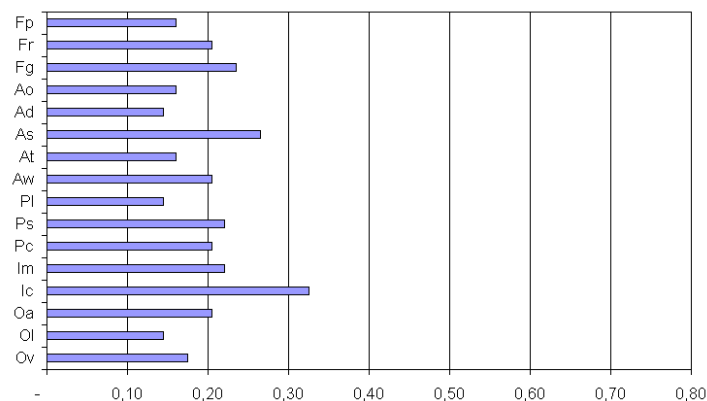


Figure 1: 2007 SDI Readiness Index of Kosovo

This result is in the same time very important for Kosovo seeing that this is the 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.

SDI readiness index assessment in 2010

In the summer of 2010 we defined again the SDI readiness index of Kosovo. Not all key experts from 2007 were available for this new assessment (seven participated in 2007 assessment). The questionnaire was sent by email to all participating experts. The same calculation model built earlier is used to calculate the SDI Readiness Index of Kosovo for 2010 as presented in table 2 and figure 2.

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

Table 2: 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.

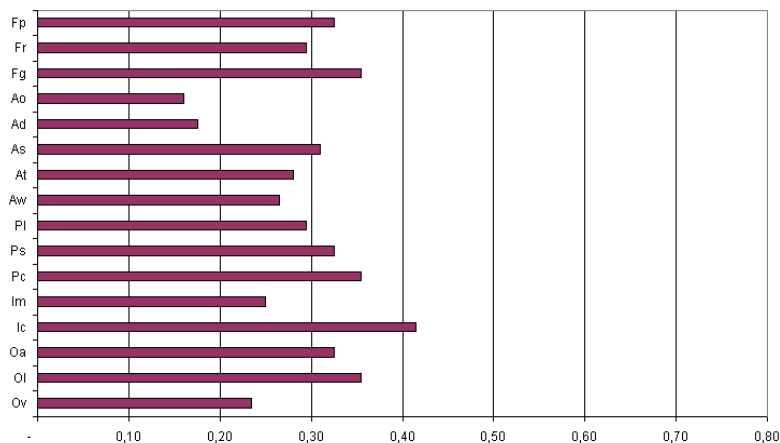


Figure 2: 2010 SDI Readiness Index of Kosovo

The comparison of SDI readiness index 2007 and 2010

Based on the data gathered, the following results were obtained.

			SDI R2007	SDI R2010	SDI R-delta
Organizational	Politician vision regarding SDI	Ov	0,18	0,24	0,06
Organizational	Institutional leadership	OI	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 3: 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.

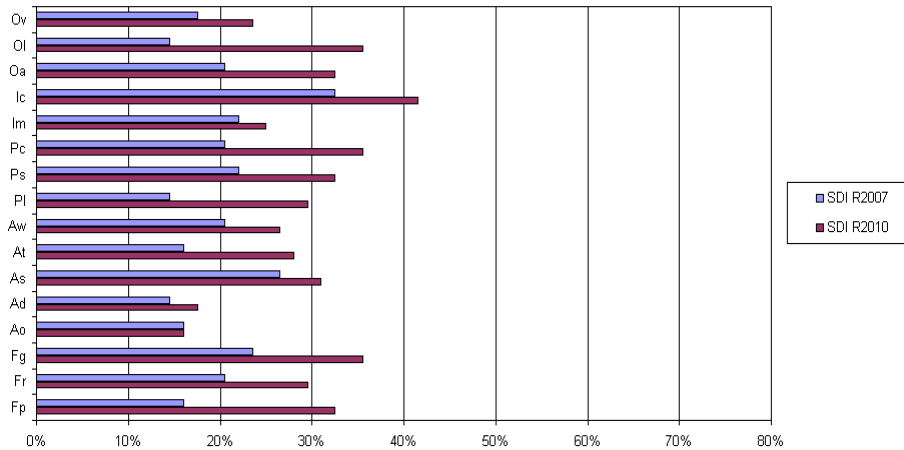


Figure 3: Comparison between decision criteria SDI readiness index in Kosovo for 2007 and 2010.

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 4: SDI Readiness Index in Kosovo 2007 and 2010.

This comparison of the SDI Readiness Index of Kosovo over time (table 4) 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 is represented in figure 4.

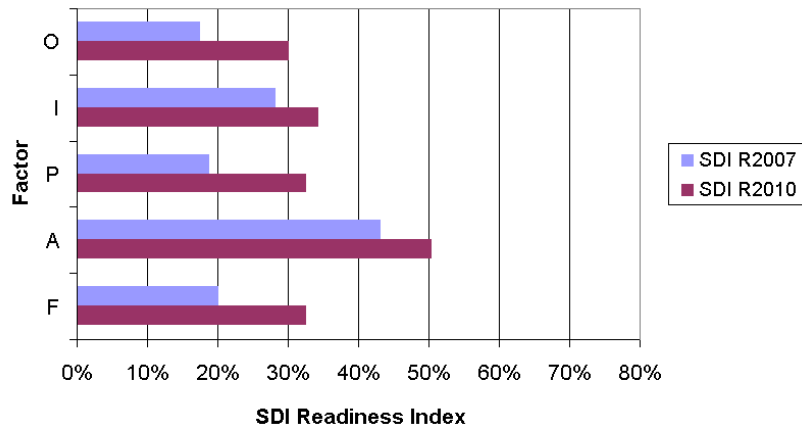


Figure 4: Comparison between factors and SDI readiness index in Kosovo for 2007 and 2010.

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 effective horizontal communication and top-bottom planning approach are still missing in Kosovo. 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.

2.2 INSPIRE state of play

This paper 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.

Based on existing frameworks, procedures and literature review, the SDI of Kosovo is carefully investigated and compared with the five case study countries.

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.

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 5 contains a summary of the information compiled for the SDI in 5 case studies. An attempt by the we 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 (dark blue), partial (light blue) or no agreement (yelloww) with the statements about the SDI-building blocks (table 5).

		I. 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	Dark Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue	Light Blue
Lithuania	LT	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Luxembourg	LU	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Slovenia	SL	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Latvia	LV	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Kosovo	KO	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue

Table 5 - 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 6 with different scores.

	2007	I. Organisational issues						II. Legal issues and funding								III. Data					IV. Metadata					V. Access and other services						average		
		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
Slovenia	SL	100%	100%	100%	0%	0%	0%	100%	50%	50%	0%	100%	0%	100%	100%	100%	0%	0%	100%	100%	100%	100%	100%	100%	100%	100%	100%	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%	100%	50%	58%	
Lithuania	LT	100%	100%	100%	0%	0%	0%	100%	100%	0%	50%	100%	0%	50%	0%	50%	50%	100%	100%	50%	50%	100%	100%	50%	100%	50%	0%	0%	100%	0%	0%	0%	50%	47%
Luxembourg	LU	100%	50%	100%	50%	0%	50%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%	100%	0%	0%	100%	0%	50%	50%	0%	50%	50%	0%	0%	0%	0%	100%	50%	36%
Latvia	LV	100%	50%	100%	0%	0%	0%	100%	0%	50%	50%	100%	0%	0%	0%	0%	50%	100%	50%	0%	100%	50%	50%	0%	0%	0%	0%	0%	0%	0%	0%	50%	100%	34%
Kosovo	KO	100%	50%	100%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	50%	50%	100%	50%	0%	100%	100%	50%	50%	0%	0%	0%	0%	0%	0%	50%	50%	33%	

Table 6, Normalised results of 5 case countries and Kosovo SDIs for 2007

As can be derived from table 6, 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.

Figure 5 presents the assessment results of the 5 SDIs using the INSPIRE state of play approach.

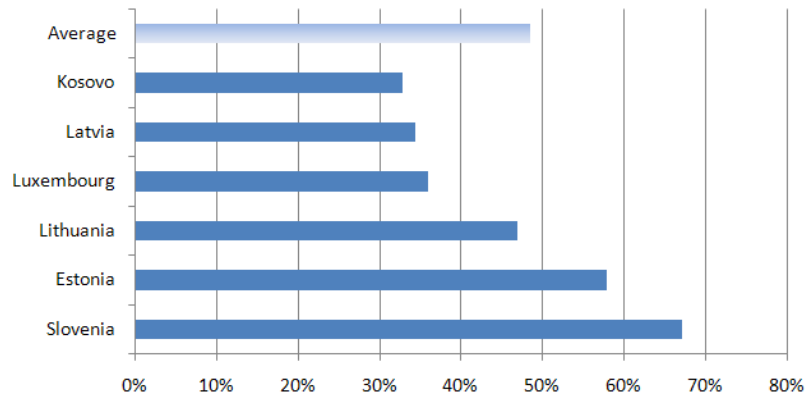


Figure 5: INSPIRE SoP scores per case study (in %)

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%.

2.3 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.

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 proactive 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 was 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.

Our motivation 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.

SDI Slovenia

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 7 summarises the conclusion for Slovenia presented by defining the stage (★) of Slovenian 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 7: Maturity of Slovenian SDI

SDI Kosovo

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 8 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 GI	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 8: 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 figure 6.

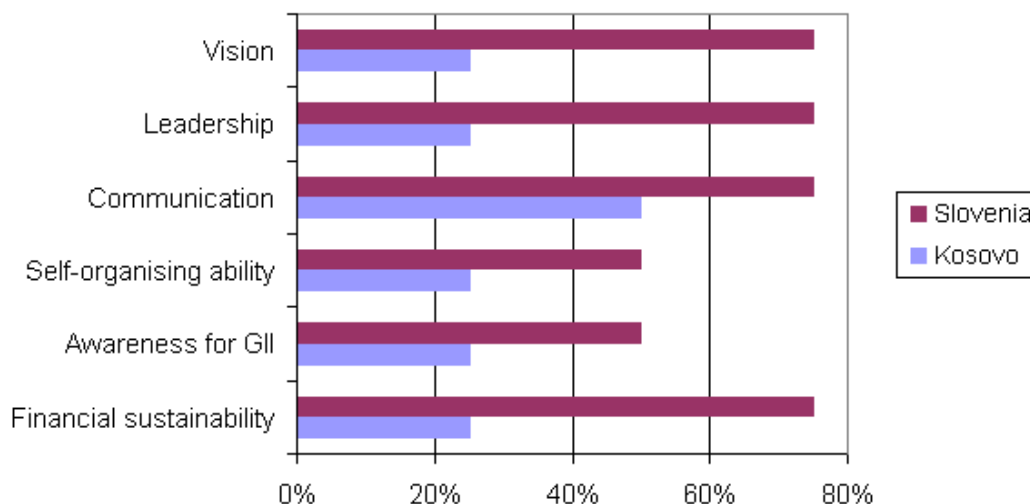


Figure 6: Maturity matrix approach scores for Slovenia en Kosovo (in %)

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.

3 DISCUSSION OF THE RESULTS

By applying the multi-view assessment framework we 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 we expected to create a much broader and more comprehensive picture of SDI of Kosovo. In that way the assessment is more objective because we are 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 9 and figure 7 presents the final results of the application of multi-view SDI assessment of Kosovo.

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

Table 9: 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%.

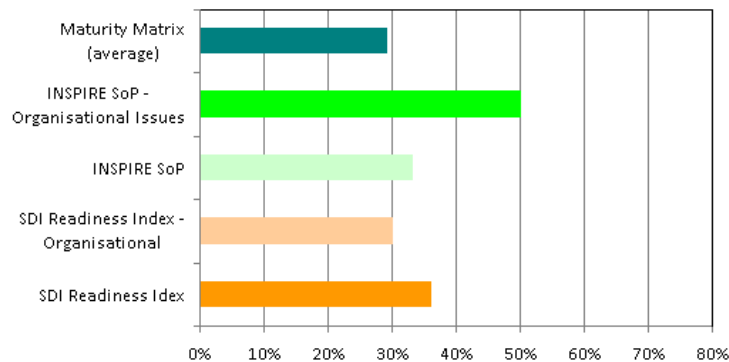


Figure 7: Multi-view approach scores for SDI of Kosovo (in %)

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%).

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.

3.1 The driving forces of SDI in Kosovo

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. 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: *SDI Awareness, Political Support, Coordination & Cooperation, Financing certainty, Communicate the benefits and Appointment of the SDI champion.*

As shown in figure 8 each of 6 defined driving forces are aiming on the particular aspect of Organisational development of SDI in Kosovo.

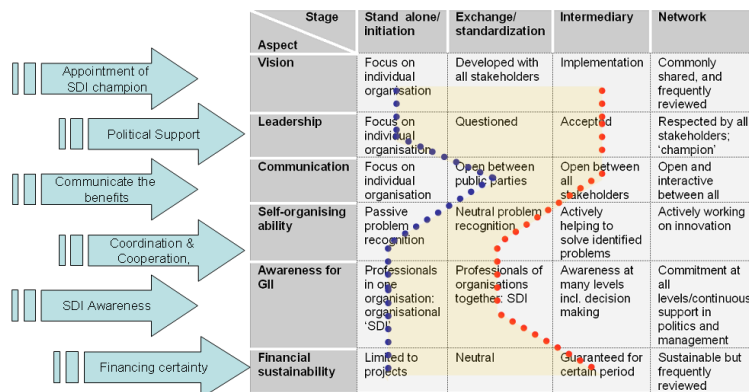


Figure 8: Driving forces projected in the Maturity matrix

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).

3.2 Prioritizing the Driving forces of Kosovo.

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. Figure 9 could be seen as an understandable roadmap towards future sustainable development of the SDI in Kosovo.



Figure 9: 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.

4 RECOMMENDATIONS

To contribute the improvement of a solid base to support SDI strategy development of Kosovo we have formulated the following recommendations:

- The SDI of Kosovo 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 SDI 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.
- 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.
- 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.

REFERENCES

- Anderson, B (2008), Business plan 2009-2014 and Development Strategy 2009-2011 for The Kosovo Cadastral Agency and The Cadastral sector in Kosovo”
- Ažman, I., Petek, T., (2009). “Spatial Data Infrastructure at the Surveying and Mapping Authority in Slovenia”. 3rd INSPIRE conference. Netherlands
- Bačić, Ž. (2009). Process of Transition and SDI: Interaction, effects and the role of the NMCA,
- Craglia M. and M. Campagna (2009). Advanced regional spatial data infrastructures in Europe. Luxembourg: Office for official publications of the European Communities.
- Crompvoets, J., A. Bregt, A. Rajabifard, I. Williamson, (2004), Assessing the worldwide developments of National Spatial Data Clearing House, In International Journal of Geoinformation Science, Vol 18, no. 7, pp 665-669 London, Taylor & Francis.
- Delgado, et al, 2005, Assessing an SDI Readiness Index. In FIG Working Week, 2005, and GSDI-8, From Pharaohs’ to Geoinformatics, Cairo, Egypt. April 16-21 2005.
- Eelderink, L., (2006), Towards key variables to assess National Spatial Data Infrastructures (NSDI) in developing countries. GIMA, MSc thesis, ITC, Enschede, the Netherlands May, 2006.
- Fernández, T. D., Lance, K., Buck, M. and H. Onsrud (2006). “Assessing an SDI readiness index”, From Pharaohs to Geoinformatics. FIG Working Week 2005 and GSDI-8, April 16-21 2005, Cairo, Egypt.
- Grus, L., Crompvoets, J., and Bregt, A. (2007), Multi-view SDI Assessment Framework. In International Journal of Spatial Data Infrastructures Research, pp 33-53..
- INSPIRE STATE OF PLAY REPORT, (2007), Homepage of Infrastructure for Spatial Information in Europe..
- Kok, B. and B. van Loenen (2005). "How to assess the success of National Spatial Data Infrastructures?" Computers, Environment and Urban Systems 29: 699-717.
- Lipej, B and Modrijan, D (2010) “NSDI IN THE CONTEXT OF INSPIRE – SLOVENIA’S STATE OF THE ART AND PRIVATE SECTOR CHALLENGES”, International Conference SDI 2010 – Skopje; 15-17.09.2010
- Masser, I. (2006). What's special about SDI related research? International Journal of Spatial Data Infrastructures Research, 1: 14-23.
- Nobert, D (2008) SDI Cookbook, Wiki version, September 2010,
- Nushi, B., (2010), “Multi-view SDI assessment of Kosovo - Developing a solid base to support SDI strategy development”. GIMA, MSc thesis, TU Delft, The Netherlands November, 2010.
- UN (2005), UN Global E-government Readiness Report 2005: From E-government to E-Inclusion, UN e-government survey 2005.
- UN (2008), UN Global E-government Readiness Report 2008: From E-government to E-Inclusion, UN e-government survey 2008.
- Van Loenen, B. and E. van Rij (2008). “Assessment of Spatial Data Infrastructures from an organizational perspective”, in A multi-view framework to assess spatial data infrastructures. Melbourne: University of Melbourne. pp. 173-192.
- Van Loenen, B. (2006). Developing geographic information infrastructures; The role of information policies. Dissertation.
- Vandenbroucke, D. and K. Janssen (2008). Spatial Data Infrastructures in Europe: State of Play 2007. Leuven, Belgium.