

INSPIRE State of Play: Generic approach to assess the status of NSDIs

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Abstract. The European Commission launched the INSPIRE initiative in 2001. With this initiative the European Union wanted to contribute to developing a European SDI. The aim of this infrastructure is to allow public sector users at the European, national and sub-national level, to easily share spatial data from a wide range of sources in an interoperable way so as to execute a variety of public tasks. In order to have a common legal basis throughout Europe, in 2004 the European Commission drafted a proposal for a Directive of: “Establishing an infrastructure for spatial information in the Community (INSPIRE)”. After intensive discussions between the Commission, the Parliament and the Council, the final directive was adopted on 25 April 2007.

From the very beginning it was recognised that INSPIRE should build upon the existing components of the emerging SDIs at a national and sub-national level. To have a better view on the status and development of these SDIs, in 2002 the Commission launched a study known as INSPIRE State of Play. 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 organisational, legal, funding and technical level. From this perspective, the State of Play follows a generic approach.

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 GSDI cookbook. On the other hand, some indicators are not meant to measure, but rather classify the SDIs according to the organisational approach. Between 2002 and 2006, the State of Play was repeated to make an assessment of the European situation over time. In 2006, the approach was reviewed in light of the INSPIRE Directive.

This chapter focuses on the methodology elaborated in 2002 and applied up until 2006. It discusses how the results can be read and used and gives the most important conclusions from the assessment itself. This chapter also outlines the strengths and weaknesses of the approach, and compared with other approaches. Finally, this chapter presents ideas to enhance the methodology in order to improve the assessment of SDIs at the European level.

8.1 INTRODUCTION

Environmental policy is one of the key policy areas in Europe and has certainly gained importance over the last decades. Environmental policy aims to preserve our environment and therefore needs to monitor and report on the status of different sectors including water, biodiversity, air quality, land use and climate change. Environmental policy involves all levels of government: from global to European, national, sub-national and down to the local level. However environmental policy also requires a cross-border approach to tackle phenomena that do not stop at national borders, such as flooding. In addition, other policy sectors need to consider environmental aspects including agriculture, transport, health and regional policy. In order to prepare, monitor and evaluate measures that protect our environment, all stakeholders involved should have ready access to a lot of data — statistical and scientific information, in situ measurements and spatial data. The latter are critical to assess the status of our environment in a well balanced way. In practice a lot of barriers exist which make the access to, and use of, spatial data very difficult.

The aim of INSPIRE is exactly to overcome the barriers that inhibit the widespread use of spatial information in Europe (Annoni and Craglia, 2005; European Commission, 2002). These barriers are

technological as well as organisational. Organisational barriers relate to coordination and cooperation, legal aspects as well as funding and pricing. Important barriers that can be mentioned are:

- important gaps exist in spatial data availability at national and European level; at the same time the same data sets are often duplicated, even within organisations;
- spatial data are not always harmonised, making it difficult to combine and to integrate in applications;
- a lack of documentation and metadata, or data about the data, making it difficult for potential users to assess whether the data are ‘fit for use’;
- data is difficult to find and not easy to access, often with many and complex procedures and agreements to be established before access is given or before data is obtained;
- spatial data is often expensive;
- sharing and (re)using of data is often not allowed, or the use of the data itself is limited with particular conditions in place.

In a first step the INSPIRE vision and principles were elaborated in a Memorandum of Understanding signed by three Commissioners – Margot Wallström, Environment; Pedro Solbes Mira, Economy and Monetary Affairs and Philippe Busquin, Research (European Commission, 2002). It was the first time that, at the highest political level, the importance of Geographic Information (GI) and the need for a European Spatial Information Infrastructure was recognised. Previous attempts like GI2000 (European Commission, 1998) did not succeed due to, amongst others, the lack of political support.

It was agreed upon that, in order to be successful, INSPIRE needs to have a legal basis so it was decided to prepare a Directive. Before doing so, the Commission, with the help of national stakeholders, prepared the so called ‘position papers’ to clarify the scope and content of the future directive. In 2002 five working groups were established to elaborate five position papers: reference data and metadata, architecture and standards, environmental thematic user needs, data policy and legal issues as well as implementing structures and funding (European Commission, 2002). In addition, an expert group, with two representatives of each member State, was established to monitor and guide the process and reach consensus (Annoni and Craglia, 2005). This process, of consultation and cooperation with all relevant stakeholders, has been pursued throughout the whole INSPIRE process and will also be key to implementing the Directive

by the Member States in the coming years (Craglia and Annoni, 2007).

In 2003 a broad public consultation took place to receive feedback and input from the broader GI and environmental community. Also in 2003, an extensive impact assessment took place (Craglia, 2003). Both initiatives were meant to give INSPIRE the necessary foundation within the Member States and helped to define the scope of INSPIRE. For example, it was decided to focus INSPIRE on spatial data that can be used for environmental policies, and specific policies that have a direct or indirect impact on the environment. In Mid 2004, the proposal for a directive of the European Parliament and of the Council — *Establishing an infrastructure for spatial information in the Community (INSPIRE)* — saw light (European Commission, 2004). After intensive discussions within and amongst the member States, the European Parliament and the European Commission, a joint text was agreed upon and published in the Official Journal on 25 April 2007 and was entered into force on 15 May 2007. From this date member States have two years to transpose the European legislation into national legislation, the so called transposition phase. In the meantime, five drafting teams, with a total of 75 experts, were established to elaborate on implementing rules for data specifications, metadata, services, data sharing and monitoring and reporting. These implementing rules will be published as decisions once approved by the INSPIRE Committee, a body of representatives from Member States. While the Directive itself gives the general principles, the implementing rules will define how member States must implement these principles.

One of the key aims of the INSPIRE Directive is not to start from scratch but to build on the existing (components of the) European NSDI. This aim was recognised from the very start and is explicitly mentioned in the Directive — *Inspire should be based on the infrastructures for spatial information that are created by the Member States* (European Commission, 2007). However in 2001 there was not a complete view of what existed in the member States. As a result the commission decided to initiate a study, the so called INSPIRE State of Play, which aimed at assessing the status and development of 32 European NSDI (27 Member States, 4 EFTA countries and Turkey). The study started in 2002 and is still ongoing with annual updates. The aim is to replace the study with a monitoring and reporting system based on the implementing rules that will be published as a decision, to be applied by the member States.

8.2 SDI STUDIES AND ASSESSMENTS

Since SDI initiatives emerged in the nineties, there has been an attempt to describe them and, in a few cases, to monitor their development. These attempts however have been very diverse and with different goals in mind. Lucasz Grus describes these different approaches (see chapter 5) as assessments which concentrate on one aspect of SDI, or focus on one region/particular countries, or those that are restricted to conceptual models. Grus states that assessments and SDI evaluation initiatives are difficult because of differences in understanding what SDIs are or should be, and due to the fact that SDIs are complex and by their nature very dynamic (Grus et al., 2007). Grus argues that SDIs should be treated as Complex Adaptive Systems (Grus et al., 2006) and therefore proposes a multi-view framework for assessing SDIs around the globe in order to have a more flexible choice, depending on the objectives of the assessment and the goals to reach.

There are several researchers and other people that have described existing SDI initiatives and the approaches are indeed very different, particularly because they had, or have, different goals. Some authors focused on the qualitative description of SDI initiatives or parts thereof (Onsrud, 1998; Masser, 1999; Craglia et al., 2002; Van Orshoven et al., 2003-2004; Vandenbroucke and Janssen, 2005-2006; Delgado-Fernández and Crompvoets, 2007), where others paid more attention to the methodology with, sometimes, particular cases or countries studied (Stuedler, 2003; Delgado-Fernandez et al., 2005; Kok and Van Loenen, 2004; Van Loenen, 2006; Rodriguez-Pabon, 2005; Grus, 2006-2007). What can be noticed is that besides the attempts from Onsrud and Masser, most attempts are quite recent. Almost all the approaches are descriptive and try to compare NSDI or classify them.

Besides the scientific world, some SDI organisations also tried to monitor and/or assess their activities. However these approaches are also quite diverse. The sub-national SDI of the Flemish region in Belgium (called GIS-Vlaanderen), which was set up in 1994, developed a system of indicators to describe the progress of the SDI as compared to the objectives set out in their five year strategic and implementation plans (GIS-Vlaanderen, 2001). More recently Spain decided to establish an observatory to monitor the status and development of IDEE , the Spanish SDI (IDEE, 2006). The Norwegian SDI has implemented a more advanced system of

indicators to evaluate the status of their National SDI (Vandenbroucke, 2008a). Importantly the idea of a specific body for observing and monitoring at the European level was already described by Annoni and Salvemini in 2003 (Annoni et al., 2003).

At the time the INSPIRE State of Play (2002) was initiated, there was no clear and ‘ready-to-use’ framework available for assessing an SDI. Therefore a pragmatic and more generic approach was proposed. The study team first looked in more detail into similar studies performed in other regions in the world, for example Australia and New Zealand (ANZLIC, 1996; 2000), Canada (Geoconnections, 2002) and the US (FGDC, 1996; 2002). For Europe, the Geographic Information Network in Europe (GINIE) provided a good starting point (Craglia et al., 2002; 2003).

8.3 METHODOLOGY

As we discussed in the previous section, methodologies for assessing an SDI should differ depending on the goals of the assessment. Questions such as, do we want to know more about the status of the SDI; where does our SDI stand (eventually as compared to defined objectives)? Do we want to know its characteristics; which type of SDI do we have? What is its development; how does our SDI change over time? Or do we even want to know its (potential) impacts; what is its economical impact, what is its societal impact? (See also Grus et al., 2007; Georgiadou et al., 2006; Giff, 2006; Lance et al., 2006)

In case of the INSPIRE State of Play, the European Commission wanted to know the status of the NSDI and its development over time. They wanted to know if we can speak about different types of SDIs in the European context. Based on these objectives, an approach and methodology was elaborated. It was then decided to collect and structure information on the five components of the GSDI Cookbook and take the description of the ‘ideal SDI’ in the Cookbook as a type of baseline (Nebert et al., 2000; 2004).

8.3.1 General Approach

Furthermore, it was decided not to work with a questionnaire or survey but to apply a desktop study in a step-by-step manner. The reason for this approach was the assumption that the richness and variety of the NSDI development could be better captured through a desktop study rather than doing this through a rather static survey. We were not interested only in ‘what’, but also in ‘how’ people,

organisations, a state, ..., is doing things, and therefore partially capturing the cultural and social aspects to better understand the process. The following steps were adhered to (see Figure 8.1 for a schematic overview of the approach):

In late 2002 an exhaustive list of items, according to how the SDI could be described, was compiled. This list was based on the reference characteristics of the five components of an SDI (Legal Framework and Funding Mechanism, Geographic data – that is: Reference and Core Thematic Data, Thematic Environmental Data –, Metadata, Access Services, Standards) as identified in the final version of the position papers from five of the INSPIRE working groups (European Commission, 2002). These agreed characteristics resulted in a checklist for which the relevant elements could be extracted from the consulted information sources. After rearranging, the list was used as the template for the description of the SDI in the reports on each of the studied countries.

The description of the status of the NSDI was performed in two stages. In the first stage (September to December 2002), the country reports compiled were based on the consultation of various web sites, documents and project references that were readily accessible. Most resources were gathered from the internet. At that time 294 documents could be detected along with numerous web site pages. However, since at that time, for some countries, almost no information could be found in this way, some key persons were contacted. Unfortunately this level of contact could not be achieved for all countries in the limited time and budgetary frame. In addition, a list of information sources was sent to all INSPIRE Working Group members to receive feedback about its completeness and sporadically new data sources could be identified. This process resulted in 31 country reports (Switzerland and Liechtenstein were combined in 1 report) beginning of 2003 and means that in every country at least one NSDI, or NSDI-related initiative, was found. In each initiative the consulted information sources were listed in the last chapter of the country report.

In the second stage (April to June 2003), the country reports were submitted to experts in each of the 32 countries. The experts were identified through the INSPIRE Expert Committee (for information on this Committee see Annoni and Craglia, 2005). In some countries, the report was handed over to other organisations and persons for further

updating. In this way, for most of the reports, corrections and updates were provided.

It was decided to visit nine countries — Belgium, The Netherlands, Germany, France, Finland, Hungary, Italy, Switzerland and the United Kingdom — to obtain more detailed information on how the NSDI was working, the problems encountered, plans and visions (see Figure 8.1). These visits were also meant to validate the information gathered through on-line sources, documents and experts. Through these visits some extra information could be collected which, where relevant, was added to the country reports of Spring 2003. In 2006, three other countries — Spain, Sweden and the Czech Republic — were visited to evaluate the progress in more detail.

The resulting country reports were used as a basis for the 2004 update which in turn was used to produce the 2005 and 2006 update. For each update additional information was gathered through the experts from the INSPIRE expert committee, visiting relevant websites, reading strategic and other relevant SDI documents and through information collected during workshops and SDI related activities (e.g. EC GI&GIS workshops, currently called INSPIRE conferences). In the meantime, spontaneously, several stakeholders from different countries also sent new information. For each update the previous version of the report was modified with important changes highlighted (in a change table and in the text itself).

The next step of the assessment was interpreting the results in the country reports (see Figure 8.1). It was decided to work with indicators in order to translate the structured information of the reports into structured information in the form of matrices. The input is from the countries studied, while the processing, or interpretation, and assessment is done at the EU level.

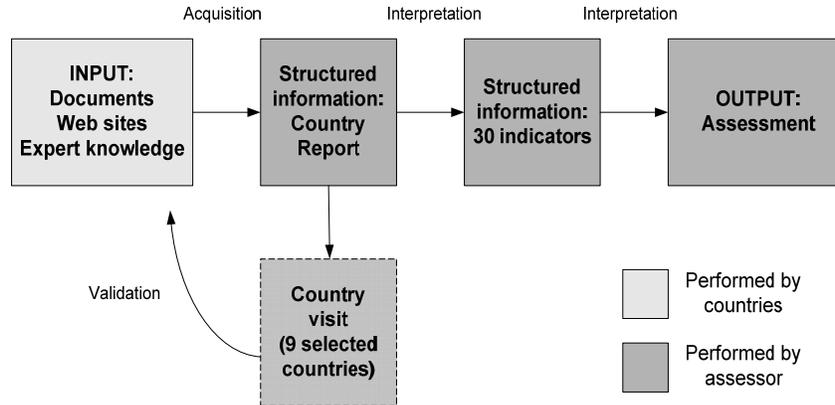


Figure 8.1: Assessment work flow for the INSPIRE SoP

8.3.2 Defining 30 indicators

Based on the country reports, a methodology was developed to assess the status of the NSDI and to compare them. The presented items in the reports relate to a number of organisational issues and to the five generic components of an SDI, as valid for the period studied (Nebert et al., 2000; 2004). The components can be considered as the building blocks of the SDI under study. The items, or building blocks, are expressed as statements or indicators (see Table 8.1 and 8.2) and the assessment of the SDI-initiative studied has been made in terms of whether: (1) it is in full agreement with the statement, (2) in partial agreement, (3) not in agreement or (4) there is insufficient information available for assessing the level of agreement. From the 30 indicators, seven describe the organisational aspects, nine describe the legal framework and funding, six relate to reference and thematic data, three to metadata, three to access services and one to standards and environmental issues respectively. The assessment was then carried out by interpreting the resulting matrices and describing the major conclusions in a summary report (Van Orshoven et al., 2003-2004; Vandenbroucke et al., 2005-2006).

The assessment was carried out annually between 2003 and 2007 and resulted in an assessment matrix for each year that provides the results for all 32 countries and the 30 indicators studied. Change matrices have been elaborated in additional tables highlighting the new or corrected information which has been collected and the progress some countries have made in developing their NSDI. Change

matrices exist for 2004-2003, 2005-2004, 2006-2005, 2007-2003, 2005-2003, 2006-2003 and 2007-2003. In section 8.3.4, we discuss the results of this analysis.

In 2006 the indicators were reviewed to bring them more in line with the ongoing developments of INSPIRE and to improve the clarity of some of the statements used. Two indicators were added, regarding network services since at the time of the start of the study. There was no mention made of transforming and invoking services (as is the case in the INSPIRE Directive) although this did not have an impact on the assessment exercise itself. We discuss monitoring and reporting under the INSPIRE Directive in more detail in chapter 16 of this book: *“INSPIRE Directive: Specific requirements to monitor its implementation”* (Vandenbroucke et al., 2008).

Although one can not say that in 2003 fully operational NSDIs existed in Europe, in each country at least one SDI-initiative — with one or more of its components in place or under construction — could be assessed. In several countries, including Belgium, Germany and Spain, significant sub-national initiatives were also deployed and, where relevant, they were described in the country reports in addition to describing the initiative(s) at the national level. In other words, the assessment at the national level took into account these sub-national developments. Until 2005 a national assessment for Belgium was missing since only three sub-national SDIs existed in parallel.

8.3.3 Typology of countries

The primary goal of the typology, as elaborated for the 2003 report and repeated each year, is to recognise the different types of SDI for assessment and their potential contribution to developing and implementing a successful European SDI. In the typology we emphasised the matters of coordination, since coordination is tackled in different ways according to the political and administrative organisation of the country. The way an SDI-initiative is coordinated is undoubtedly one of its most pertinent characteristics (see also Burrough and Masser, 1998; Masser 1999; 2005). A distinction was made between those NSDIs that were led by National Data Producers (NDP) and those where this was led by an important user or users association. This is the first level of the typology.

Table 8.1: Indicators for organizational, legal and funding aspects of the NSDI

I. Organisational issues		
Level of SDI	1	The approach and territorial coverage of the SDI is truly national
Degree of operationally	2	One or more components of the SDI have reached a significant level of operationally
Coordination	3	The officially recognised or de facto coordinating body of the SDI is a National Data Producer, i.e. a National Mapping Agency 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
	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 containing specific FOI legislation for the GI-sector
Legal protection of Geographic Information (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 licenses 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 8.2: Indicators for technical aspects of the NSDI

III. Reference Data & Core Thematic Data		
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 interconvertible
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 reference data and core thematic data		
Availability of metadata	23	Metadata are produced for a significant fraction of geodatasets of reference data and core thematic data
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 reference data, core thematic data and their metadata		
Metadata	26	There are one or more on-line access services for metadata on reference data and core thematic data
Data	27	There are one or more on-line access services for reference data and core thematic data
Web mapping	28	There are one or more web mapping services available for reference data and core thematic data
VI. Standards		
Standards	29	The SDI-initiative is devoting significant attention to standardisation issues
VII. Thematic environmental data		
Thematic Environmental data	30	Thematic environmental data are covered by the described SDI-initiative or there is an independent thematic environmental SDI

SDI led by National Data Producers (NDP). From the more complete description of the status of SDI for 2003, it was obvious that in almost every European country one organisation of the NDP type (NMA, Land Survey Service, Cadastral Agency) is present and having the formal mandate to, amongst others, maintain the national geodetic reference system, produce topographic reference data and often coordinate data production and dissemination with other players. As a result the NDP has an implicit mandate to set up an SDI, albeit mainly from the producers' perspective and we considered this as the most basic level of SDI. At the second level of the typology the involvement of the users was assessed. User communities may or may not be active in steering committees and/or advisory boards for the NDP and NSDI. A GI-association may or may not exist, be active or not be active.

Table 8.3: Discriminating factors for building the typology of the SoP

Level I	Level II	Level III
Led by a National Data Producer (NDP)	Users involved	Operational
		Partially operational
		Not operational
	Users not involved	Operational
		Partially operational
		Not operational
Not led by a National Data Producer (NDP)	Formal mandate	Operational
		Partially operational
		Not operational
	No formal mandate	Operational
		Partially operational
		Not operational

SDI not led by National Data Producers (NDP). We distinguished countries with NDP type of GI-coordination from those where, of course NDP are also present, but where the NMA or another traditional data producer is not the main coordinator of the NSDI. In those countries the SDI is rather driven by a council of Ministries or administrative departments, a GI-association or another type of partnership of, mainly, data users. Fundamental to this type of SDI-initiative is that the participants are willing to share each other's spatial data and those acquired from third parties, and to also remove the obstacles that prevent this sharing. From this perspective, participants are mainly users of GI which is acquired from the data

producers. The initiative may result in a joint framework for negotiation of SDI-participants with the data providers for optimal conditions including data characteristics, conditions or licenses for use and re-use, price and access. Such partnerships may be based on: (1) a formal mandate or law and (2) no formal mandate (mostly voluntary contributions or ad hoc agreements). Given this basis the existence or absence of a formal mandate is considered at the second level of the typology.

In order to make the typology also useful for monitoring purposes, the **degree to which the SDI is operational**, is taken into account and is the third level of the typology. The latter is a rather subjective (overall) assessment of the degree of development of the NSDI, which is based on the assessment of the building blocks of the SDI as described in the assessment tables (i.e. technological as well as organisational). It does not mean that all components of an ‘ideal’ SDI are in place. It rather means that the production of GI is coordinated, at least to a certain extent, and that users of GI are supported in finding and re-using GI through SDI-mechanisms. It also means that at least parts of the technical components are in place (data, metadata and services).

By comparing the classification of the NSDI of 2003-2006, major changes in the characteristics of the NSDI could be easily identified as shifts between classes of the typology. It was obvious however that the simple and broad nature of the typology could not lead to the detection of subtle changes.

8.3.4 Results of the assessment

For a detailed discussion on the results of the assessment and the status of the NSDI in the 32 European countries studied we refer to the paper “*INSPIRE SoP: Development of the NSDI in 32 European countries between 2002 and 2007*”, presented at GSDI-10, St Augustine, Trinidad (Vandenbroucke, 2008b). We only explain here how the matrices and country reports were used to draw major conclusions which are given in summary at the end of this section. As an example, the assessment matrix for 2005 is provided (see Figure 8.2), along with the change matrix for 2003-2005 (see Figure 8.3). From 2006 onwards, the matrices are slightly different because of reviewing the indicators in light of implementing the INSPIRE Directive (see section 8.4).

How do we to read the assessment matrix? The matrix for a particular year gives an instant overview of the overall development of

the NSDI in the 32 countries. One can easily see the indicators for which there is no information or for which information does not allow for conclusions to be drawn, that is that the information is unclear. For organisational and technological indicators this lack of clarity is less the case. It is, for example, clear that for legal and funding indicators a lot of information is missing or the information does not allow an assessment. Other conclusions might also be drawn. In almost all countries (29 of 32), the “approach and territorial coverage of the SDI is truly national” (I.1) and in 2 of the 3 countries “one or more components of the SDI have reached a significant level of operationally” (I.2). In 20 of the 32 of the cases, it is a NDP agency that is leading the NSDI (I.3), while only in 5 countries a national GI-association is involved (I.5). Another striking conclusion is that in 21/32 countries, the long-term financial security of the SDI initiative is not secured at all (I.15).

At the technical level, one can see a good development of reference and thematic data sets, metadata and access services, especially in the former EU-15. On the other hand, only in 10 out of 32 countries the “concern for interoperability goes beyond conversion between different data formats” (I.20). Most SDI initiatives devote significant attention to standardisation issues (I.29) and in almost half of the countries thematic environmental data is covered by the SDI initiative (I.30). Therefore conclusions can be drawn from reading the whole matrix (overall view), or by reading the indicators separately. Conclusions can also be drawn by comparing countries or groups of countries, or by reading the scoring of the indicators for particular countries. In general, the EU-15 seems to have more developed SDIs although the differences with the 10 Member States that joined the EU in 2004 are less important. There are more important differences with the new Member States Romania and Bulgaria which joined the EU in 2007. Even if the indicators ‘indicate’ a certain state of development, one has to be careful to draw ‘hard’ conclusions at the country level since some of the indicators are not expressing a ‘good’ or ‘bad’ situation (for example the way the NSDI is coordinated) but are rather used to classify the country (its typology). In order to be able to ‘score’ the individual countries, the reviewed methodology (2006) foresees a more quantified approach for one of the indicators that is for I.2 (see section 8.4).

The change matrices give information about the changes over time. From the change matrix 2003-2005 (see Figure 8.3) one can see that (not taking into account the Belgian federal level) in not less than

143 cases, a score could be given to the indicator because more information or clearer information became available. For 55 indicators, scoring 'improved' (more in agreement than before). In a few exceptional cases the score was in less agreement which is the case for Portugal where the organisation leading the NSDI changed in 2004 (the NMA is leading the NSDI since then). However this change does not mean that the situation in Portugal is worse than before. Also here, we should interpret the scoring on organisational set-ups very carefully as it is also evident that changes occurred for all the components, but especially with regard to the access services (I.26-I.27) and the overall maturity of the NSDI initiatives (I.1-I.2). The change matrix also allows analysing the changes per country and for this we refer to the article of GSDI-10 (Vandenbroucke, 2008b).

In the same article a detailed description is given on the status of the NSDI development. We only list here the major conclusions regarding the developments between 2003 and 2006 (also based on the content of the country reports).

- In 2003 a fully developed NSDI with all components (organisation, legislation and funding; data; metadata; access services; standards; environmental information) did not exist. In 2007 the situation has changed, influenced by the INSPIRE initiative. The NSDI are becoming more and more mature.
- In the beginning, the degree of coordination and the intensity of cooperation were rather weak. In 2007, the regional and local levels are more and more involved and there is more cooperation among stakeholders.
- Only in a few exceptions, we see private sector involvement in 2002-2003. It is therefore mainly the public sector that drives NSDI development, such as the modernisation of government and e-government initiatives. In 2007 the private sector starts wondering what will be the implications of INSPIRE (if any) and if SDI development will see new market opportunities for them.
- In 2003, there were, with only a few exceptions, no legal initiatives and almost no specific SDI funding was foreseen. While all countries started preparing the transposition of INSPIRE into national legislation in 2007, there is still limited attention for funding which is confirmed by a survey of EuroGeographics (EuroGeographics, 2007).

- While in 2003 there are still important data gaps, data harmonisation is weak and (standardised) metadata is not common at all, we see in 2006-2007 that data and metadata are becoming more and more available, and that standards are introduced progressively. Harmonisation remains an important issue.
- In 2003 the number of access services in Europe (discovery services, mapping services, etc) is rather limited and most of them are web mapping services (WMS type of services). By the end of 2007 we see a spectacular development of web mapping services and more and more web feature services.
- The analysis of websites, geo-portals, documents and experts input, revealed that components of the NSDI live in isolation from mainstream ICT and even from other GI activities in the beginning. This integration, or uptake of the infrastructure in the day-to-day (existing) work processes and the GI data flows, is still weak in 2007.

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.

8.4 STRENGTHS AND WEAKNESSES OF THE APPROACH, REVISED METHODOLOGY

As explained in section 8.3, the approach and methodology applied in the INSPIRE SoP study is based on pragmatic considerations, taking into account the feasibility for carrying out the study in an operational way over several years, with a limited budget and burden for participating countries. The use of indicators is meant to structure and arrange the (already structured) information in the country reports in a format that allows for a straightforward assessment of the results. In this section we discuss the strengths and weaknesses of the original approach, as well as the revision that took place in 2006 to bring the approach more into line with the INSPIRE Directive.

8.4.1 Strengths and weaknesses

Table 8.4 gives the most important strengths and weaknesses as we have analysed during the review of the methodology in 2006 (Vandenbroucke, 2006).

Table 8.4 Overview of strengths and weaknesses in the SoP approach

Strengths	Weaknesses
Overall view on the status of the SDIs	Need for interpretation of the 'raw' information
Comparability of NSDI development at European level	No quantification (not at indicator level, not in the assessment)
Detection of changes over time	Thresholds for agreeing with a certain indicator are rather low

The approach made the study useful during the whole phase during the preparation of the INSPIRE Directive. The approach is also useful for the implementing the Directive which started in 2007 (European Commission, 2007). Countries collected information that is needed for monitoring their NSDI, they can, and do, compare with other countries and learn from them, they can see the 'weak points' and aspects to reinforce or consolidate etc. At the same time, at the European level, the SoP approach gives at least an overview of where we stand in Europe in relation to NSDI development. Although it is not meant to 'score' countries against each other, it gives an idea of where each country stands on the European scene.

One of the most important difficulties in the approach is that the system requires an interpretation in two steps, as illustrated in Figure 8.1. First the information from the countries is organised in the reports

according to a fixed template, but it is then necessary to interpret and translate the information into the 30 indicators. Second, the indicators are interpreted as well to assess the status at the European level, to make some conclusions and to prepare the recommendations for the INSPIRE implementation. Another problem lies in the fact that the indicators are not quantitative, but rather qualitative. Also the assessment itself is qualitative. Finally some of the indicators are using thresholds which leave room for interpretation or were set very low because in 2003, the NSDI was not very well developed yet (e.g. *“There are one or more web mapping services available for reference data and core thematic data”* (I.28), which means that we agreed with the indicator when one service existed).

Finally, the most important remark on the methodology is that it does not assess the NSDI from the point of view of the users of the infrastructure. On the one hand the methodology was not really meant to assess the NSDI, since the study aimed principally at getting an insight in the components of the infrastructure itself. Since the situation was, and still is very different in the 32 countries, it would have been very difficult to monitor the use of the infrastructure. In addition, very limited information was, and still is, available on the use of data, services etc. It is clear that more focused surveys like the study of Joep Crompvoets on the worldwide clearinghouses (Crompvoets, 2006) give more concrete information on the use of (part of) the infrastructures. In the INSPIRE SoP study information on the use of the SDI was requested through the reports, but very limited and useable information was obtained. It is also not so clear how you can easily capture this type of information in an operational way, that is on a permanent basis for all the countries and all the components of the SDI. Use cases will probably be the best approach although the INSPIRE Drafting Team for monitoring and reporting also tried to define an indicator which can provide this information in a more systematic way (see chapter 16 of this book).

8.4.2 Review of the approach and methodology

Based on this Strength/Weaknesses analysis, it was decided to revise the approach and methodology in light of the ongoing INSPIRE process. It was decided to review the reporting part and the indicators without changing the overall approach, especially to keep its comparability over time. The assessment and typology remains based on a system of indicators. These indicators are in their turn based on reports which contain all the basic information, and much more

detailed information on the way the NSDI is built, maintained and, to a certain extent, used. It also became clear that the reports by country should always be used in combination with the indicators, in other words that indicators alone will never give the whole picture. Reports make it possible to give examples of good practices, explaining in more detail what can not be captured by the indicators. It also remains important to have regular field visits to see the organisations and people behind the NSDI in person. These visits allow the capturing of how things are done, how people cooperate with each other, what type of problems are encountered etc.

When revising the methodology, several aspects were taken into account. First of all the terminology was brought into line with the terminology used in the INSPIRE Directive (for example, speaking about themes of the three annexes rather than about core reference and thematic data). Second, certain indicators were quantified to make the assessment more reliable, such as indicating a figure between one and six for the degree of operationality (with a score for each of the six components, that is the five as described by the GSDI Cookbook and the environmental component). In the third place, the method for interpreting the indicators was made more explicit. Finally two more indicators were added in order to cover all the types of network services as described in the Directive (discovery, view, download, transformation and invoking services).

We end this section on reviewing the approach in 2006 by giving some examples of indicators that were revised in order to make interpretation easier:

- *“One or more components of the SDI have reached a significant level of operationality” (I.2).* In the original approach this indicator is fully agreed with if one of the components, as described by the GSDI cookbook, is in place (Nebert et al., 2000; 2004). As a result a distinction was not made between an SDI with all of the components in place and those that had only one component in place. It was decided to add a figure between one and six to indicate the number of components for which the SDI is well developed (organisational issues, data, metadata, access services, standards and environmental data, the majority of the indicators being in agreement).
- *“There is a legal instrument or framework determining the SDI-strategy or –development” (I.8).* Unfortunately it would

have been better to have an indication of whether a clear strategy document existed. Except for a few cases, the legal instrument did not exist at the time the study was launched. This is also normal since the transposition of the INSPIRE Directive will fill this gap and so the indicator narrows down to whether or not a strategic document for the implementation of a NSDI exists.

- *“Geodatasets exist which provide a basis for contributing to the coverage of pan-Europe for the INSPIRE-selected data themes and components”* (I.17). The problem with this indicator is that it is not quantified. The fact that ‘geodatasets exist’ is too vague. What is important to know is the territorial coverage (and eventually the per scale level). It was therefore proposed to start working with a table where data sets for each of the themes of the three annexes of the INSPIRE Directive are listed with their territorial coverage. This table will then be used as input to assess the indicator. This change however was not yet implemented in 2006.
- *“Metadata are produced for a significant fraction of geodatasets of reference data and core thematic data”* (I.23). The notion “... for a significant fraction ...” of the data is too vague. It is proposed to have a quantified threshold since data without metadata is difficult to use within an SDI environment. The threshold could be set at 90% however the only way to assess this is to collect information for all the relevant datasets, of all the themes of the annexes, of the Directive. Besides non existence of metadata for a dataset, it could be indicated if ISO or another standard is being used (for example coding of zero, one and two).

Besides the two additional indicators, for seven more indicators the collection of information is based on more precise or detailed information, and/or additional questions are to be answered in order to make the assessment more precise. We give one example to illustrate improving the precision through this method. There are three indicators that describe the way the coordination is tackled (see table 8.1: I3, I4, I5), however they do not clearly indicate whether one or more organisations, or a coordinating body/structure have a mandate to do so. Important questions to be answered when assessing the indicators are: *“is there a platform where on a regular basis the planning/work of the SDI is discussed with all the relevant*

stakeholders?” and *“is coordination a permanent activity?”* Therefore the indicators are left as they are, but these questions are taken into account during the assessment.

8.5 CONCLUSIONS

The INSPIRE SoP study has been initiated to support a political process, that is to guide the preparation and implementation of the INSPIRE Directive which aims to build a European Spatial Data Infrastructure. Since INSPIRE wants to build upon components of the NSDI, it was and is of utmost importance to know the status of their development. The INSPIRE SoP therefore differs (partially) from other assessment approaches which focus on (the potential) social and economic impacts, the benefits for its users or the scientific understanding behind the processes.

The INSPIRE SoP has proven to be a useful framework for making general assessments to receive the overall picture in regions such as Europe; to detect different approaches in the way of working in different countries and especially to see the development of the NSDI over time. It has also shown major drawbacks. Since the indicators are not quantified they need to be interpreted (and leaving room for this interpretation), while thresholds were originally set originally very low reflecting their underdeveloped status. Because of its specific objectives, it did not focus on assessing the usage of the NSDI.

Since 2006, the methodology has been fine-tuned to be more consistent with the requirements of the INSPIRE Directive. Some of the indicators are now quantified. It could be useful to also look into the quantification of the assessment itself, as has been done already by Tatiana Delgado for countries in Latin and Central America (Delgado et al., 2005; 2007). The reports remain very important, as are regular field visits. Reports are not only containers of information. The reports not only provide information on what, but also on how things are done. Field visits on the other hand give a clearer picture and understanding on why things are done and put the NSDI in perspective.

The INSPIRE State of Play is currently updated for 2007, but will gradually be replaced by a monitoring and reporting mechanism as defined by the INSPIRE Drafting Team for Monitoring and Reporting.

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