Applying the Multi-view Spatial Data Infrastructure Assessment Framework in several American countries and The Netherlands

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Abstract Chapter five focused on the theoretical bases to assess the Spatial Data Infrastructure (SDI) and presented a Multi-view SDI assessment framework. The framework needs to be tested in order to evaluate its applicability to assess SDIs. Testing will also indicate the strengths and weaknesses of the framework. In this chapter we present the results of applying the framework to assess 11 National Spatial Data Infrastructures in American countries and The Netherlands by using the SDI-Readiness approach, clearinghouse suitability, the INSPIRE state of play and the organisational approach. The simultaneous application of four assessment approaches instead of one result in a more complete and more objective SDI assessment result. The results show that the Canadian, Colombian and Mexican SDIs score, on average, relatively higher than the other National SDIs analysed.

18.1 INTRODUCTION

The multi-view assessment framework is intended to facilitate the evaluation of SDIs. The multi-view framework consists of a number of assessment approaches that are applied simultaneously. The framework has a flexible structure that is it allows the adding of new assessment approaches. Moreover, the multi-view assessment framework allows the evaluator to assess an SDI from the viewpoint that fits the user's assessment purpose best, for example knowledge, development and accountability assessment purpose (Grus et al., 2006).

The framework has to be tested to become fully operational. The aim of the testing phase is to check the applicability of the framework for assessing SDIs. The results of this test should identify the potential strengths and weaknesses of the framework design and methods used.

This chapter is structured as follows: section 18.2 describes the methodology that has been used in order to apply and test the framework; section 18.3 presents and discusses the results of the framework application and is followed by section 18.4 that contains the conclusions of this study.

18.2 METHODOLOGY

The multi-view assessment framework was applied to 10 National SDIs in the Americas, being Argentina, Brazil, Guyana, Canada, Chile, Colombia, Cuba, Ecuador, Mexico and Uruguay and one European National SDI, The Netherlands. This set of countries was chosen to illustrate the application of the framework, since all the needed data was collected in the same period of time that is between February and June 2008. The Dutch National Spatial Data Infrastructure (NSDI) was included in the sample set, because the project to set up and test the multi-view SDI assessment framework originated from the Dutch Program 'Space for Geo-Information'.

The simultaneous application of multiple assessment approaches is important because of the dynamic and constantly evolving nature of SDI. Moreover, a simultaneous measurement with several assessment approaches guarantees that the results of the assessment can easily be related and compared. At the time of measurement four assessment approaches were operational and were applied at the same moment in time: SDI-readiness approach, clearinghouse suitability approach, INSPIRE state of play approach and the organisational approach. The

SDI-readiness approach (Delgado-Fernández, 2005) aims to measure the degree to which a country is prepared to deliver its geographical information to the community. This approach focuses on measuring the following aspects of SDI readiness: organisational, information, access network, human resources and financial resources (see Chapter six for a more detailed description of this approach). The clearinghouse suitability approach examines the status of the existing national spatial data clearinghouses around the world. The approach focuses on the systematic description of 15 clearinghouse characteristics described by Crompvoets et al. (2004) (see Chapter seven for more information about this approach). The INSPIRE state of play assessment approach is an adapted version of an approach to measure the status of NSDIs in the European Community (SADL, 2006). This approach measures a number of organisational issues and seven generic SDI-components: organisational aspects; the legal and funding framework; spatial data; metadata; access and other services; standards and thematic environmental data (see chapter 8). The organisational assessment approach (Kok and Van Loenen, 2005) identifies, describes and compares the current status of the organisational aspects of the NSDI. This approach assesses the following organisational components: leadership; vision; communication channels and the self-organising ability of the sector. Based on the assessment of those organisational components, the country can be assigned to one of the four stages of institutional development: stand-alone; exchange; intermediary and network (see Chapter nine for more information on this approach).

The collection of data describing each NSDI was performed by means of a survey. The survey consisted of questions which related to the four assessment approaches used in this measurement. The questions could be answered by indicating one of the predefined answers, by giving a short answer to a specific question, by stating yes or no or by expressing an opinion by typing a free text. The survey was sent to SDI coordinators in each country. SDI coordinators were considered the appropriate persons to answer the survey questions because they answered survey questions on behalf of an authorised SDI institution. Furthermore, they have the broadest and most complete knowledge about SDI activities in the country. The SDI coordinators were contacted by e-mail.

The total scores of each assessment approach are presented as a percentage of the maximum possible score. The reason for presenting the scores as percentage values is to make the assessment results of

different approaches easily comparable with each other. Furthermore, the measurement scales of each assessment approach have different range so normalising the results to percentage values makes the results more understandable. The maximum score possible to get in each assessment approach is treated as 100 per cent. It is important to mention that for the purpose of this study we translated the four stages of the organisational approach into percentage values. The scores of 25, 50, 75 and 100 per cent indicate respectively the following stages: stand-alone; exchange; intermediary and network. Additionally, we calculated an average percentage score for each approach's assessment results to give a simple reference value to judge if the country is below, or above, the sample average.

SDI coordinators might be biased in their judgments of their SDI because they can have an interest in showing the better picture of the SDI. It is therefore important to test the biasness of the coordinators' answers. For this purpose we used the clearinghouse suitability approach and 15 national clearinghouse characteristics, the same as in the survey, were measured in an independent way, which is the person who collected the information did not know the answers of the coordinators. The collection of data describing each national clearinghouse was performed by visiting clearinghouses websites. The results of this test were correlated with the results obtained from the SDI coordinators answers.

The assessment approaches were used in this research, and that is part of multi-view assessment framework, are supposed to measure different SDI aspects. However there might be some overlap of indicators among several approaches. Overlapping indicators may measure the same SDI aspects which may cause unnecessary effort and a redundancy of information. It is therefore recommended to check how far the four assessment approaches correspond with each other. The correlation coefficient is a measure of the relationship between two variables (Isaaks and Srivastava, 1989). We therefore regard measuring the correlation coefficient between the assessment results of each assessment approach pair as a proper way to verify how far each of the two assessment approaches correspond with each other. A weak relationship between assessments approaches would means low redundancy in what is being measured.

18.3   RESULTS AND DISCUSSION

The intention of applying the multi-view assessment framework was to test its applicability to assess NSDIs. Figures 18.1, 18.2, 18.3 and

18.4 present the assessment results of the 11 NSDI by using the four assessment approaches mentioned before: SDI-readiness, clearinghouse, state of play and organisational.
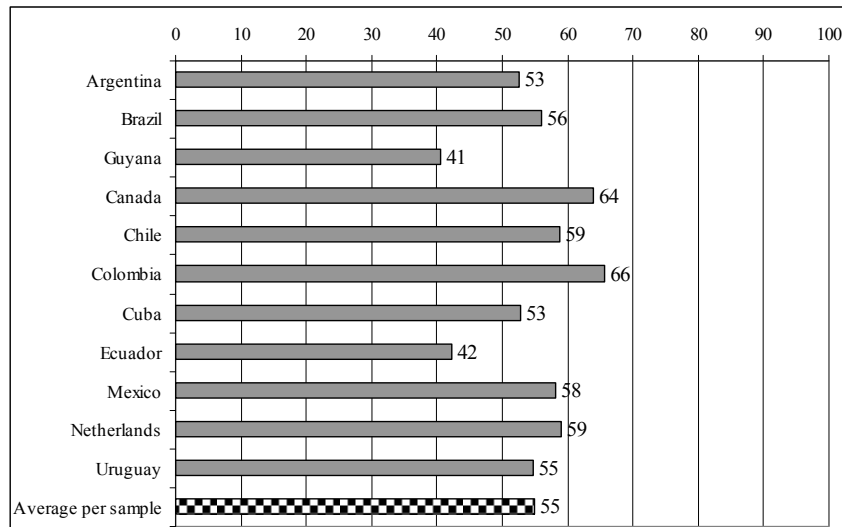

Figure 18.1: SDI readiness approach scores per measured countries (in %)

Figure 18.1 presents the assessment results of the 11 SDIs using the SDI-readiness approach. The results show that Canada and Colombia are above the sample average and score respectively 64% and 66%. The Guyana and Ecuador scores indicate that these two countries are the least prepared to deliver its geospatial data to the community. All the other countries do not deviate much from the sample average.

Figure 18.2 shows the assessment result of the 11 SDIs using the clearinghouse suitability approach. From the clearinghouse implementation perspective, the Canadian, Colombian and Mexican national clearinghouses are the most advanced. On the other hand, Brazil, Guyana and the Netherlands score the lowest (0%). The reason for the zero value is that the clearinghouses of these countries were not operational at the time of measurement.
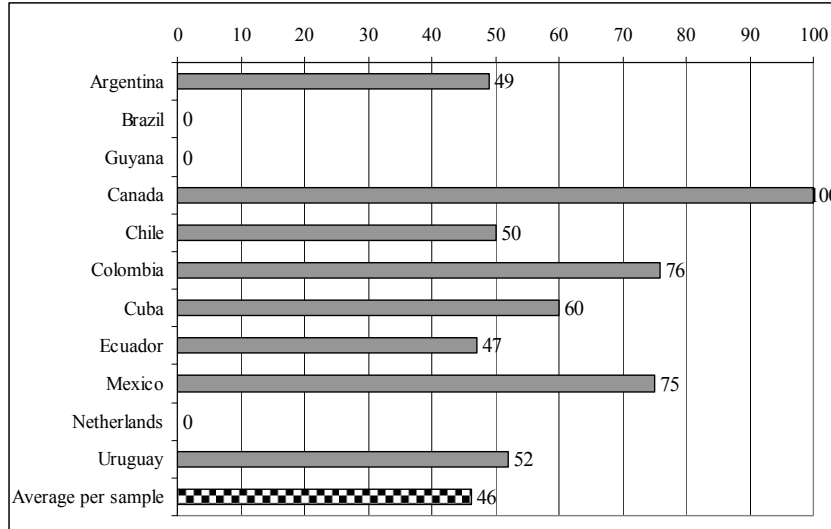
Figure 18.2: Clearinghouse suitability approach scores per measured countries (in %)
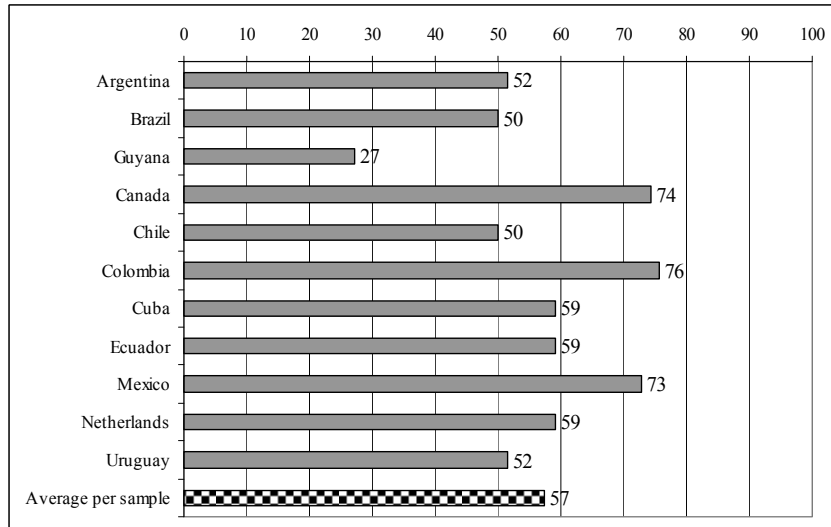

Figure 18.3: INSPIRE State of Play approach scores per all measured countries (in %)

Figure 18.3 presents the assessment results of the 11 SDIs using the INSPIRE state of play approach. From the INSPIRE State of Play assessment approach perspective three countries, that is Canada (74%), Colombia (76%) and Mexico (73%) score relatively higher

than the other countries. Guyana has the lowest score of 27%. The other countries score close around the sample average i.e. 57%.
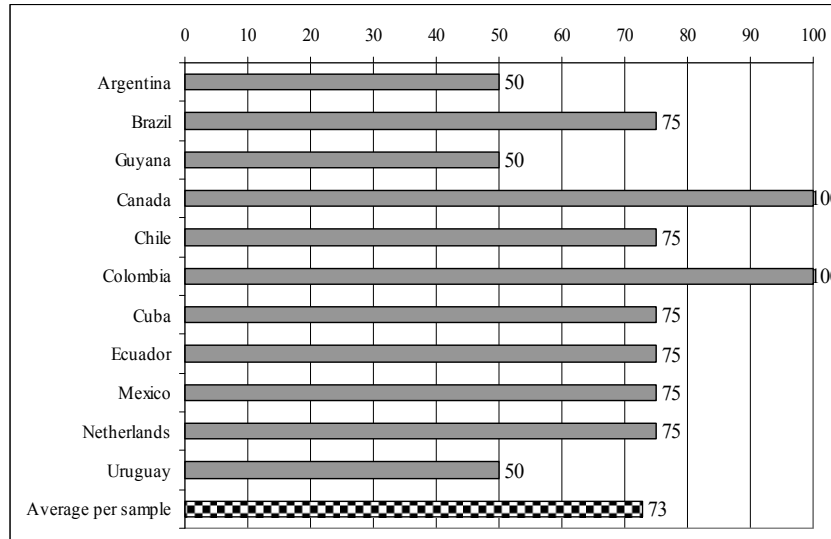

Figure 18.4: Organisational approach scores per all measured countries (in %)

Figure 18.4 presents the assessment results of the 11 SDIs using the organisational assessment approach. The results of applying the organisational assessment approach shows that only Canada and Colombia are currently in the most advanced organisational stage called, according to the authors of this assessment approach, the 'network' stage (Kok and Van Loenen, 2005). Argentina, Guyana and Uruguay are at the 'exchange' (equal to the score 50%) stage and all the other countries are at the 'Intermediary' (equal to the score 75%) stage.

Figure 18.5 presents the final results of the application of multi-view SDI assessment framework as a ranking of countries. The ranking was based on the average scores of all four approaches applied per each country. Canada, which scores on average in all approaches 85%, is the leader in SDI development among the measured countries. Colombia and Mexico also score in each assessment approach on average higher than the other countries. At the moment of measurement The Netherlands did not have an operational national clearinghouse. Therefore, because of the lowest score in Clearinghouse suitability approach, the Dutch SDI's overall score is below the sample average. It has to be mentioned however that a new version of the Dutch clearinghouse is likely to be available

at the end of 2008. Guyana's SDI scored the lowest in all four assessment approach and is evident in Guyana's last place in the ranking of countries overall. This ranking may help people working at the strategic level of SDI implementation, to compare their SDIs with those from other countries.
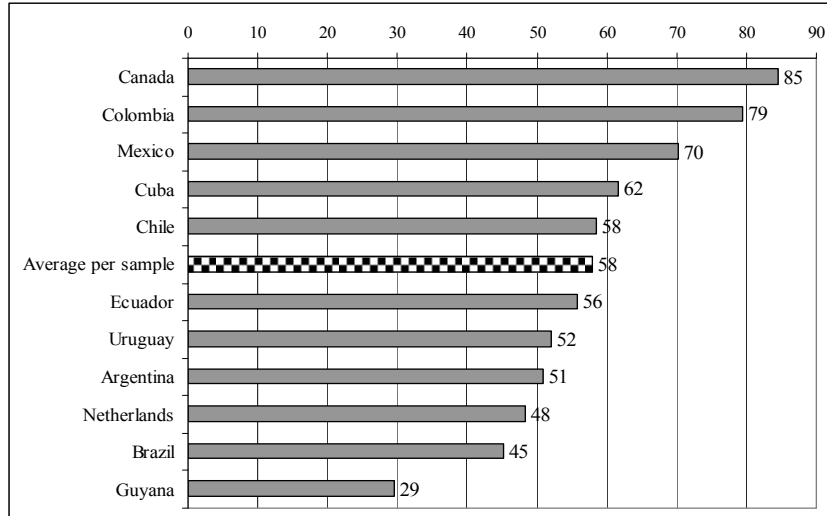

Figure 18.5: Average results in percentages from all assessment approaches

The simultaneous use of four assessment approaches allows for seeing a much broader and more complete picture of SDIs, which is of particular importance when assessing complex phenomenon such as SDIs. In that way the assessment is more objective because the evaluator is not limited to one view on an SDI. Furthermore using multiple assessment approaches allows for the identification of those SDI aspects that require more attention than others. For example, in the case of the Dutch SDI, it is necessary to put much more effort on developing and improving its national clearinghouse.

The results of independent measurement compared with those given by SDI coordinators correspond closely with each other (see Table 18.1). The correlation coefficient between the two datasets is 0, 93. In the case of Argentina and Ecuador the independent measurement shows lower values (Argentina 43 and Ecuador 34) than the values given by the SDI coordinators (49 and 47 respectively). On the other hand the Brazilian NSDI coordinator reported that Brazil has no operational clearinghouse while our independent measurement shows that the clearinghouse exists and scores 38 points. For all other countries the scores were exactly the same.

Table 18.1: Comparison of the Clearinghouse suitability results between the SDI coordinators answers and independent measurement

Country	Score obtained by the SDI coordinators	Score obtained by the independent measurement
Argentina	49	43
Brazil	0	38
British Guyana	0	0
Canada	100	100
Chile	50	50
Colombia	76	76
Cuba	60	60
Ecuador	47	34
Mexico	75	75
Netherlands	0	0
Uruguay	52	52

The key difference between the four assessment approaches is that they address different aspects of the SDI. The SDI readiness approach focuses mainly on the pre-SDI aspects of the country's preparedness to embrace SDI. The three other approaches measure the actual aspects of an SDI. The clearinghouse suitability and organisational approach measure an SDI from two different perspectives: the first focuses on evaluating the national SDI data access facility and the second focuses on evaluating the organisational maturity of the SDI arrangements. On the other hand, the INSPIRE state of play approach evaluates several aspects of the SDI that are related to the INSPIRE directive.

Besides the differences, the assessment approaches are also to some extent similar. For example the clearinghouse approach, the INSPIRE state of play's access services component and technology components of the SDI-Readiness contain indicators that all relate to SDI access facility. Furthermore, an overlap may also exist between the organisational approach and organisational aspects of INSPIRE state of play and the SDI-readiness approach. It is highly probable that two or more assessment approaches contain similar indicators.

In order to verify potential similarities between approaches, we correlated each assessment approach in pairs. Table 18.2 shows the correlation coefficient between those pairs. The correlation of the assessment results between the assessment results of pairs one, three, four and five is relatively moderate or low. This might indicate that they measure different NSDI aspects and that there is not much

overlap in the collected information. In case of pair two and six the correlation coefficient is higher than the others and is equal to respectively: 0,75 and 0,81. The reason for this could be that, in the case of pair two, some indicators of the clearinghouse suitability approach and the INSPIRE state of play access service components that measure the same SDI aspects. Similarly, in case of pair six, the INSPIRE state of play assessment approach probably contains indicators that are similar to those from organisational assessment approach.

Table 18:2 Correlation coefficients between each assessment approach pair

Pair no.	Assessment approaches pairs	Correlation coefficient
1	Clearinghouse vs. Readiness approach	0,49
2	Clearinghouse vs. State of play approach	0,75
3	Clearinghouse vs. Organisational approach	0,58
4	Readiness vs. INSPIRE State of play approach	0,72
5	Readiness vs. Organisational approach	0,70
6	State of Play vs. Organisational approach	0,81

For further research it is recommended that the correlation between similar indicators or groups of indicators from different assessment approaches be calculated. For example, correlations between the clearinghouse suitability approach and the INSPIRE state of play approach's access facility component, along with the SDI-readiness technology component be calculated as there is a high chance that those components use the same indicators. In such a case the number of indicators used by the multi-view assessment framework could be reduced, which would simplify the framework's application.

18.4 CONCLUSIONS

The objective or this study was to apply the multi-view framework to assess national SDIs. The results confirm the applicability of the multi-view assessment framework to assess NSDIs. The assessment results show a broader and more complete picture of the ten American

and one Dutch SDI. The simultaneous use of the four assessment approaches allows for the identification of underdeveloped components of each SDI. The high correlation between results obtained from the SDI coordinators and those obtained by an independent measurement support a relatively high reliability of the data collection method used in the assessment. The results suggest that in some cases the assessment approaches overlap by measuring the same or similar SDI aspects. We therefore recommend the conduct of further study on the multi-view SDI assessment framework to diminish this overlap. We believe that the results presented provide some indication of the status of the SDIs. This belief is additionally confirmed by the similarity in findings of the different assessment approaches, that is there is no such SDI that would score very high in one approach and very low in another.

Acknowledgements

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