Lyande Eelderink: Towards key variables to assess National Spatial Data Infrastructures (NSDIs) in developing countries

This research explores how to select a common set of measurable key variables that can be utilised to assess National Spatial Data Infrastructures (NSDIs) in developing countries. This is investigated, based on NSDI case studies of six different developing countries (Colombia, Cuba, Nepal, Indonesia, Nigeria and Ethiopia) from three different continents (Latin America, Asia and Africa).

Spatial Data Infrastructures (SDIs) are developed by many countries to better manage and utilise spatial datasets (Rajabifard, 2003). Although many countries claim that they are involved in SDI development, Masser (2005) asserts that these claims need to be treated with caution. Engagement in SDI development does not necessarily mean that the initiative will translate into a fully operational SDI over time. Nevertheless, during the last few years, considerable resources have been spent creating optimal SDIs (Crompvoets, 2003).

Developing countries are initiating projects for NSDI development as well. The main difficulties when establishing and implementing NSDIs in developing countries are related to the lack of appreciation, the lack of resources and trained personnel, inefficient bureaucratic processes, and the lack of data (Rajabifard & Williamson, 2003).

Up to now efforts to develop NSDIs have not been audited or evaluated systematically (Crompvoets, 2004). To address this gap, Wageningen University, Delft University of Technology, and the University of Melbourne in Australia, have embarked upon a project to develop a framework for worldwide assessment of NSDIs. The application of such a framework would support the establishment and implementation of efficient, effective and coherent NSDIs in both developed and developing countries.

Since each country is unique in historical, legal, economic, technological, cultural and institutional terms, the benefits gained and bottlenecks expected for the establishment and implementation of NSDIs are likely to be different as well. Hence, not only effective strategies for establishing and implementing NSDIs may be country-specific but also NSDIs themselves may be different for each country. In order to interpret such differences, this research assumes that a common set of measurable key variables to assess NSDIs is needed. The research problem is, therefore, how to define this set of key variables.

In this research, a considerable number of initial variables to assess NSDIs are identified based on critically reviewing existing assessment frameworks. After thoroughly reviewing the six case study countries, from the initially identified list of variables, a reduced list of measurable feasible variables has been developed. Following on from the review of the NSDI initiatives in the three continents and the critical analysis and comparison of the six case study countries, a set of common case study variables has also been derived.

Subsequently, a selected group of SDI experts has been consulted to give their opinion on the most important variables for assessment of NSDIs in developing countries out of the list of feasible variables. These expert variables have been compared and matched with the earlier defined case study variables.

Resulting from the analyses, the following set of key variables for NSDI assessment in developing countries could be selected: availability of digital data, capacity building, willingness to share, human capital, SDI awareness, delivery mechanism, funding, leadership, vision, institutional arrangements, socio-political stability, interoperability, metadata (availability), and initiatives connected to SDI in the respective country. Besides enhancing and innovating the implementation strategies of NSDIs in developing countries, the resulting common set of measurable key variables contributes to the development of the assessment framework.

Pieter de Graaf : Geographic information infrastructure and local land use plans; Research at the development of GII and DURP, and their mutual relation within Dutch municipal organizations.

Infrastructure is not only the hardware but encompass many more, such as the people involved. The geographic component of the information gives it extra value, but generating it is very costly. There are many different definitions of GII and it is useful to identify the vital components of which a GII consists. Based on the four GIS dimensions, humanware, orgaware, infoware and technoware different components of a GII can be identified. GII consists of dynamic conditions and possibilities offered to various types of users to generate, share, access, and use geographic information. The infrastructure consists of technical standards, the physical infrastructure, an institutional framework, a financial basis and awareness at the decision making and management levels. GIIs operate at different levels: from corporate to global. The final purpose to develop a GII is to improve decision making. Decisions require information and an optimal GII facilitates the access to current and accurate geographic information. Within governmental organizations the obligated authentic registers will be of increasing importance for the GII.
DURP stands for digital exchangeable spatial planning and is setup to modernize the spatial planning process by the Ministry of Housing, Spatial Planning and the Environment. The objectives of the stimulation programme are to make the spatial planning process more effective and efficient through digitalizing of the development, use and exchange of spatial plans, as well as to improve the involvement of citizens and to make the process more transparent. Municipalities are not yet obligated to digitize their local land use plans, but new legislation in the near future is suspected to change this.
Digital exchangeable spatial plans consist mainly of geographic information and are used by a lot of users within the municipal organization. Spatial planning on the local level, municipalities, is of great importance. Municipalities are responsible for developing local land use plans, which can be very detailed and have strong judicial value. That is why it is important to have the most up to date local land use plan. The relation between GII and DURP is clearly noticeable here.
The characteristics of this relation is the scope of the research. The integration of DURP within a GII will improve the efficiency and effectiveness of the use and development of the spatial plans within the municipal organization. Besides this the existence of a GII could influence the implementation of DURP, as well as DURP could influence the implementation or development of a GII. Between the different municipalities there are strong differences in the implementation of DURP.
This all leads to the following research question:
How does the implementation and development of geographic information infrastructure within the municipal organization relate to the implementation and development of digital exchangeable spatial plans?
Municipal organizations consist of two parts: the political and the official organization. The official organization is usually organized according to the concern model. Specialized decentralized sectors and on top a central concern staff and facilitating services. The sectors are each responsible for specific problem areas, for instance economy or social welfare. Currently most of the municipalities are developing from a company-orientated organization, where the focus is on results and performance to an environment-orientated organization, where the focus is on output and process. 'Turn over' of the organization or decompartmentalization of the sectors is needed to be able to serve the citizens in a better way.
Based on the two models of Graafland (1993) and Kok and van Loenen (2005), stages of development of geographic information provision within municipalities are identified. Currently most municipalities are developing from the stages 'local control' to 'infrastructure development' defined by Graafland. Local control is characterized by a development of standards, slight awareness for cooperation and the management level gets involved and tries to formalize internal relations. Infrastructure development is characterized by a start of authentic registers, change of organization and a more top down approach to support development of

infrastructure. This transition is a shift from demand driven to supply driven and from controlled bottom-up to controlled top-down. The corresponding stages of the GII development model are from the end of the 'stand alone' stage, to 'exchange and standardization on technical level' and to the beginning of the stage 'intermediary'. Finally, when considering information provision within municipal organizations it all turns down to the field of tension between a sector and a corporate approach.

The implementation and development of DURP is researched in the selected municipalities. The start of DURP is mainly triggered by external events. Together with the digitizing and making exchangeable of the local land use plans comes standardization. The Information Model Spatial Planning (IMRO) is developed to offer each municipality the same set of standards. Although the IMRO standards leave space open for own interpretation, it is a first step in improving the spatial planning. Many of the investigated municipalities initiated the digitizing together with updating of outdated plans. Municipalities are covered by a large amount of local land use plans, often more than 200. Many plans are joined together, to approximately 30 or 40, and the current situation is recorded. The plans are lay down in object-based geographic information files, in which the regulations and explanations are linked to the planned objects. These projects are mostly supported by the GII coordinating department to help implementing the object-based method of working, together with the ICT department which supports the acquiring and integration of the software. Redesigning of the work processes within the development of a local land use plan and setting up managerial control for the continuation of the standard processes and output are important factors for a successful implementation of DURP.

This research did not reveal an observable pattern between the level of development of GII and DURP within the investigated municipalities. The relation must especially be found in human and organizational aspects. Knowledge at the GII coordinating departments has in many cases supported the setup of the digitizing of spatial plans. The object-based method of working, familiar to the GIS community, has caused a culture shock within the departments responsible for spatial planning. Another human aspect is the awareness for sharing geographic information. The possibility of other departments to consult spatial plans through the GII will motivate them to share geographic information as well and to keep the information up-to-date. The vital standardization needed for the digitizing of the spatial plans can be used as an example towards other work processes and information sources. For the generation and dissemination of information through a GII, it is important that all the work processes are optimal designed for the exchange and use of geographic information. Exchange requires standardization.

Although there is no relation between the development of the two aspects, GII and DURP are certainly intertwined with each other. The information generated by digital spatial planning is often shared through the GII and a lot of the information required within the spatial planning process is obtained through the GII. In most of the researched municipalities, DURP is integrated within the GII. In other words the GII facilitates an important part of the input and output of information within the spatial planning process.

SC Chong :
Towards a 3D Cadastre in Malaysia An Implementation Evaluation

Traditional cadastre is based on division of land into 2D surface parcels, upon which ownership rights are subsequently registered. Nevertheless, the rights to a parcel are always in 3D as land use would be impossible if confined only to the 2D flat surface. However, most 2D registrations are found to be adequate as long as the whole column of space (cujus est solum ejus est usque ad coelum et ad inferos) belongs to a person or a ground of persons.
Intensive use of land and technological advances have made it possible to have many different types of uses simultaneously above and below one another. Examples of such multiple use of space (or stratified properties) include the apartment complex, tunnel, utility cable and pipeline criss-crossing under the surface and underground mining. The legal situations in such stratified properties can no longer be portrayed effectively on flat surfaces, as several persons, either as owner(s) or rights or interests holders, now hold the same parcel of land simultaneously. The introduction of the third dimension (hence the so-called 3D cadastre) is deemed necessary in order to provide efficient means to register and to provide the legal status of these factual situations as in the real world. Cadastre is always related to land. Being an essential tool in administering the man-land relationship, it is continually evolving in response to the dynamic nature of this relationship within the particular society. As a developing nation, the choice of an appropriate Malaysian 3D Cadastre depends upon its local conditions. It should be able to protect land rights effectively, efficiently, simply, securely and affordably.

Paola Peroni: CROSS BORDER SDI IN SOUTHERN AFRICA
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Need Assessment and Scenario Study for the Cross-Border Region between Mozambique, South Africa and Zimbabwe

The X-border Region (Region) between Mozambique, South Africa and Zimbabwe is currently the target of a number of international projects aimed at developing scientific knowledge and policies for sustainable use of natural resources. These projects, specifically, focus on building regional cooperation among public and private stakeholders and Organizations. Among others, the Region is currently the target of a CC-INREF Project (Project) led by Wageningen University and Research Centre (WUR) titled " Competing Claims on Natural Resources: Overcoming Mismatches in Resource Use through a Multi-Scale Perspective " .

The Project's main objective is the development of a multidisciplinary methodological framework, focusing in defining sustainable and more equitable use of natural resources. A wide variety of driving forces is leading to increased pressure on land and natural resources within the Region. Although each of the involved country has adopted different approaches to deal with environmental and social issues, nonetheless they are called to confront with common driving forces, playing their role at a trans-boundary level. With this in mind, the need for an X-border Spatial Data Infrastructure (X-SDI) aimed at serving and exchanging spatial data to, and between, involved stakeholders has arisen within the frame of the Project.

The main goal of this thesis is to identify and evaluate the scenarios within which an X-SDI can be developed and implemented, as well as to provide recommendations to support these processes. The research objectives of this work are as follows: 1) explore the need for an X-SDI to support the cooperation and negotiation process among stakeholders, 2) define the structure for the X-SDI development within the regional Institutional Framework, and 3) identify possible scenarios for implementing the X-SDI within the regional framework context, and make a comparison between them.
Three main research questions have been answered within the context of this work; they are listed below:
Research Question #1 : Is there a need for an X-SDI to be developed in order to support cooperation and negotiation among stakeholders?
Research Question #2 : What structure can be proposed for developing and implementing the X-SDI?
Research Question #3 : What are the results of the SWOT analysis carried out on the identified scenarios?
The adopted methodology to answer Research Questions as above includes an extensive research on available literature resources and collection of information relevant to the project by means of a User Needs Assessment carried out at some key organizations in southern Africa. Results of the extensive literature research and results of the User Needs Assessment have been used to identify the needs in term of an X- SDI, its characteristics and technical functionalities, as well as to identify three possible scenarios within which the X-SDI development process could take place. A SWOT (Strengths, Weaknesses, Opportunities and Threats) Analysis has been carried out for each of the identified scenario, highlighting driving forces and constraints embedded in each of the proposed alternative. A comparison study based on the SWOT Analysis results allows identifying a common set of elements for all the three considered scenarios based on which final recommendations to support the X-SDI development and implementation are drawn.

Roy Lammers: Creating temporal cartographic animations from an incomplete input of graphics

This research investigates how temporal cartographic animations can be created from an insufficient amount of input images. An animation shows a sequence of static images. Therewith the illusion of continuous change is established. This illusion, however, does not occur when the amount of images shown per second (frame rate) is too low. Since the number of available images is often not high enough to produce an animation of acceptable length with an appropriate frame rate, many new images need to be created in order to make an animation. These images can be created by performing an interpolation technique and by choosing the total duration of the final animation.
Many different maps exist and the point, line and polygon symbols on these maps can represent all kinds of phenomena. Besides that, these symbols can change in many different ways during an animation (e.g. rotate, shrink or move). Furthermore, when symbols in an animation change too slow, this change will not be noticed since humans are not able to perceive these changes.
Therefore, the main objective of the research is to investigate what the optimal techniques and durations are to avoid perceptual problems in all kinds of temporal cartographic animations, created from an insufficient number of input images.
The thesis contains three main parts. The first describes the types of animations that exist and the different ways in which objects can change during the animation. Spatial behaviour (the behaviour of the objects;
e.g. rotation or change in thickness of a line) and temporal behaviour (the behaviour of the phenomena in time; e.g. rough change like wind direction or smooth change like increasing population) are dealt with.
The second part contains the descriptions of interpolation techniques. A distinction has been made between interpolation for relatively simple changes (like growth of an object) and interpolation for deformations (changes in the shape of an object). It is shown how the results from the interpolation techniques can be visualized in graphs and how the techniques can be compared. Furthermore; the advantages, disadvantages, limitations and possibilities of the techniques are described. An initial suitable technique for the different phenomena and behaviours of the maps objects can be chosen based on these descriptions.
However, when the technique chosen is only based on the changing phenomena and its representation; problems of perception may occur since it is not known how fast the objects should change. These perceptual problems are dealt with in the third main part of this thesis. Here it is described that it is important to pay attention in order to see change. It is shown that the minimum speed of a changing object that is still capable of capturing the attention of the viewer depends on many variables. These variables are the sizes of the changing objects, the amount of the changing objects, the behaviour of the changing objects (described in the first part), the amount and types of surrounding graphics (background maps) and the characteristics of the viewer (e.g. experiences, education).
Tests animations have been created with different values for these variables which have been shown to people with different user characteristics. By interpolating and showing the results of these tests in graphs, it became possible to give an indication of the minimum rate of change for many types of animations.
Finally recommendations have been given to indicate the suitable techniques and settings for the duration when someone wants to create a temporal cartographic animation from an insufficient amount of input images.