Spatial Data Infrastructures: Hype or Hit?

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SUMMARY

The emergence of Spatial Data Infrastructures (SDIs) is considered to be the major development in the GI-world the last ten years. Considerable amounts of money are invested in their development, and both political and commercial interest is growing worldwide. At the global level, intensive discussions are held on the development of a Global Spatial Data Infrastructure (GSDI). In The Netherlands, for instance, the national government has recently decided to invest 20 million Euro in the enhancement of Dutch SDI and its related research. The European Commission of EU has adopted in July 2004 the INSPIRE (INfrastructure for SPatial InfoRmation in Europe) proposal. Looking to all these developments, could we speak of a SDI-hype? Maybe more important for SDI-development is the question if this potential hype will evolve into a hit.

In this paper, these questions will be addressed. An overview of the current SDI developments is presented to introduce the main developments. Second, a classification framework to indicate developments as hype or hit will be presented. This classification framework consists of the following key indicators: Expectation, Subject attention, Stakeholder's involvement and Benefit justification. For each of these variables, the current SDI development are assessed and justified by giving examples. We feel that SDI development certainly shows hype aspects. The expectations are high, a strong increase in attention for topic is observed, stakeholder involvement is biased and the expected benefits are high. We hope and think, however, that SDI is moving from a slightly hyped development into a real hit.

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1. INTRODUCTION

The emergence of Spatial Data Infrastructures (SDIs) is considered to be the major development in the GI-world the last ten years. Considerable amounts of money are invested in their development, and both political and commercial interest is growing worldwide. At the global level, intensive discussions are held on the development of a Global Spatial Data Infrastructure (GSDI). In The Netherlands, for instance, the national government has recently decided to invest 20 million Euro in the enhancement of Dutch SDI and its related research. The European Commission of EU has adopted in July 2004 the INSPIRE (INfrastructure for SPatial InfoRmation in Europe) proposal. Looking to all these developments, could we speak of a SDI-hype? Maybe more important for SDI-development is the question if this potential hype will evolve into a hit.

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2. SDI DEVELOPMENT

It is always difficult to identify the driving force behind a certain development. Quite often it is a combination of factors. Most of major developments in world can be traced back to a combination of frustration, innovation and reputation with a high level of coincidence and good or bad luck depending on how the development is perceived by the society. For the SDI development a similar mix of driving forces can be identified.
A first factor is what we like to call organizational frustration with the exchange and sharing of spatial data. Let's go back in time to the mid 1980s and recall a development in Canada described by Groot (Groot, 1997) for harmonization of topographic activities between federal and provincial agencies:

> *" Their purpose was to facilitate the exchange of surveyed and mapped information in their respective domains, thereby eliminating duplication and improving the topicality of the maps and associated databases. At first the standardization was perceived, and also implemented, as a purely technical process: the standardization of the data definitions, the coding and the exchange formats. Over time, however, it became clear that the parties needed to agree on common policies with respect to the access, use and pricing. Furthermore, the two levels of government had to agree on the terms for users exploiting*

their respective data and how they would charge for this. Hence, it became increasingly apparent that, in terms of achieving the expected improvements in effectiveness and efficiency, the technical standardization had to be accompanied by standardization or at least harmonization at the institutional levels. This proved far more complex than expected"

It was during these Canadian experiments with transferring spatial data between federal and provincial organizations that the term infrastructure was used in relation with spatial data. In 1991 John McLaughlin(McLaughlin, 1991) introduced the term National Spatial Data Infrastructure as a way to organize and facilitate spatial data sharing. Since then a number a studies (CEC, 1995; Mapping_Sciences_Committe, 1993) appeared that reported similar problems and opportunities for sharing spatial data between organizations. The underlying reasons for the world–wide attention for spatial data sharing was the strong increase in the production and use of spatial data in 1970s and 1980s. Most national mapping agencies have converted their maps into digital databases and the wide use of geographical information systems (GIS) has resulted in the production of vast amounts of potentially reusable spatial datasets. Also satellite Earth observation systems started to produce huge volumes of spatial data.

A second factor that drives SDI is technology development and innovation.

The rapid development of Internet in the 1990s has stimulated the development of fast physical infrastructure for the exchange of data worldwide. For a smooth exchange of data general Information and Communication Technology (ICT) standards and protocols were developed. This had also its impact on the spatial data community. In 1994 a consortium of companies, governmental agencies and universities, called the Open GIS Consortium (OGC), was formed. This consortium has as a goal the delivery of open interface specifications, which can be used worldwide to ease spatial data sharing and the development of services. Also the international Organization for Standardization (ISO) starts with standardization activities for Geographic information in 1994 and software companies started to release products that facilitate data sharing.

A third factor which had a strong impact on SDI development was the Executive Order 12906 signed by President Bill Clinton on the 11th April 1994 entitled " Coordinating Geographic Data and Acquisition and Access: the National Spatial Data Infrastructure". In this order the main tasks to be carried out and time limits were set for the development of initial stages of the National Spatial Data Infrastructure in the US. Among the tasks were, the establishment of a National Geospatial Data Clearinghouse and the National Framework for Spatial data. This order raised immediately the political visibility of spatial data infrastructures, not only in the US but also internationally. The European Union started to formulate its SDI strategy in 1995 by the document 'GI2000: toward a European geographic information infrastructure' (CEC, 1995) and many other countries followed. Crompvoets and Bregt (Crompvoets&Bregt, 2003) showed that around 2002 about 120 countries have started activities which can be classified as SDI initiatives.

A forth factor is the increasing role of spatial data in decision making. The need to integrate spatial data from different sources gain momentum due to the growing attention at the end of the previous century for sustainable development. Assessment of policy measures on their environmental, social and economical impacts requires integration and analysis of spatial

data. In order to perform these analyses quickly, new (spatial) data collection was often not an option, and reuse of existing spatial data was heavily stimulated. Many organizations and countries experience similar organizational and problems and challenges as presented before in the Canadian case.
So, in summary we see that a combination of 1) a high supply of digital spatial data; 2) strong increase in the need for spatial data and spatial data sharing; 3) technological developments and innovation, espessially the introduction of web-services; and finally 4) political attention and leadership are the main drives behind the SDI developments that we are facing today.

3. GENERAL HYPE AND HIT CHARATERISTICS

In order to determine whether a trend of activity can be considered as hype or a hit we define four main evaluation criteria. In Table 1 these are presented. In the context of this publication hype is defined as an activity or development that is believed to be very successful, while a hit is very successful.

Table 1. Evaluation criteria for hype or hit.

Criteria	**Hype**	**Hit**
Expectations	Unrealistic	Realistic
Attention	Strong increase	Balanced
Involvement Stakeholders	Few	All relevant ones
Benefits	High, not proven	Proven

The first criterion is the overall expectation. In the case of hype phenomena the expectations are high and some times extremely high. In the past we have seen such unrealistic high expectations with in introduction of for instance railways, electric light and Internet. People expect that these new technologies were influencing the society tremendously and even change social structures and create a better world. After some years a more realistic view on the role of the technology developed and useful ones were incorporated in the society; they became a real hit (e.g. railways) , while others vanished and were not adopted. A good example of a hype is the development of the Internet. At the end of the previous century the expectations where extremely high, until around 2000 the Internet bubble burst. A “cooler” period followed, nevertheless Internet can be considered as a hit.
The second criterion is the attention given to the subject. In a hyped situation a lot of attention by the popular press is given to the subject. Frequently no new information is presented and lot of reuse of existing information can be found. Balanced opinions or critical reflections on the development are scars. Often the number of scientific publications on the subject does not show this sharp increase.
As third criterion the involvement of the stakeholders can be mentioned. In a hype case only a limited number of stakeholders are pushing the development. When we again take the Internet as an example, we saw that in the first years (new) companies and venture capital were the main drivers. Now the Internet technology is used intensively by many stakeholders.
The last criterion are the benefits of the development. In a hype case the expected benefits are sky high, but they are not actually proven. Just think of the new Internet companies who

were only losing money, while the banks continues to support them with loans, just because the expected benefits in the future were high. In the case of a hit the benefits are really proven.

4. THE SDI CASE

If we now apply this evaluation framework on SDI, what do we observe?
First, the expectations. If we observe some of the more policy oriented publications, SDI is highly propagated as the solution for problems in the geo-information domain, such as the duplication of spatial data collection, the lack of spatial data availability. On some web-sites even the critical role of SDI in poverty reduction is mentioned. Overall the expectations are quite high, especially in the more policy oriented meetings.
The attention for SDI shows a strong increase over the last ten years. This attention is mainly in popular and professional magazines, such as GIM. The number of scientific publications on SDI is still limited. A search on the term "spatial data infrastructure" in GEOBASE, an abstract database from ELSEVIER for geographical and related sciences, yields 52 publications. The first publication is from 1989, and 32 of the 52 are published after 1999. Moreover, the attention for SDI on conferences shows a sharp increase. On regular GI conferences the topic SDI has become a common session item and the special conferences on SDI, such as this Global Spatial Data Infrastructure (GSDI) attracts more and more visitors. The attention for SDI of the GI-user is, however, still limited and the SDI-awareness among the general public is small.
If we look at the stakeholder's involvement some changes over the last ten years can be observed. At the beginning only a few groups took to initiative to start the discussion and development of an SDI. The main initiators were the national mapping organizations, especially those with research and development departments and national GI councils. In Canada for instance the SDI developments were initiated by the federal and provincial surveying and mapping organizations(Groot&McLaughlin, 2000) and in the Netherlands by the Dutch council for geo-information (RAVI). After a few years also the GI-industry became interested in the topic and starts to develop tools for SDI. Large GI-companies such as ESRI and Intergraph even started a grant programme for the stimulation of SDI developments worldwide. Research interest for the topic started to emerge around 2000. And now several geomatics/geo-information departments of universities are involved in aspects of SDI research. Also the management and politicians became more and more interested due to the promised increased efficiency and effectiveness of the (national) spatial data resources. At present is seems that most of the relevant stakeholders (GI-producers, GI-companies, politicians and standardization organizations) are involved in SDI development. One group is still underrepresented: the GI-users.
Finally, the benefits of SDI. Not many studies in the world are done on the (expected) benefits of SDI. A Dutch study (RGI, 2003) indicated that every euro invested in SDI after a few years yields 10 euro of benefits. Also extended impact assessment studies for the INSPIRE programme in Europe showed significant benefits. Both studies indicate high benefits. But the underlying calculations of these studies are predominantly based on estimated and extrapolated parameters. The benefits are not proven.

5. CONCLUSIONS AND RECOMMENDATIONS

If we combine the reviewed hype or hit characteristics for SDI into one overall conclusion, we feel that SDI development certainly shows hype aspects. The expectations are high, a strong increase in attention for topic is observed, stakeholder involvement is biased and the expected benefits are high. However, it is our feeling that gradually a more realistic view on SDI evolves. Besides success stories, also publications on mistakes start to appear. Scientific research on SDI and the impact assessment of SDI on society starts and more and more stakeholders become involved. We hope and think that SDI is moving from a slightly hyped development into a real hit. Governments consider SDI more and more as a critical framework for their sustainable development.
The transformation from hype to hit is not automatic. For some developments also the transformation from "hype to pit" is possible. In order to avoid this potential pitfall it is necessary that:

- SDI is really seen as an infrastructure for which continuous attention and financial support is more important that periodically project funding;
- GI-supplies are willing to share their spatial data;
- SDI awareness among GI-users is increased;
- The GI-users become more involved in SDI developments, because intensive use of SDI's is finally the only real reason for its development;
- More scientific research is done on SDI, because only science can provide the more or less objective mirror that reflects on the current situation and stimulates its development and finally;
- More tangible SDI results.

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