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Assessing geoportals from a user perspective

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1. Introduction

Information economy is a powerful engine for growth, improving competitiveness and enabling jobs (The Lisbon Special European Council, 2000). It aims at improving citizens' quality of life and the environment. New digital goods and services are vital to developing information economies (The Lisbon Special European Council, 2000; see also The European Parliament, 2005). Information infrastructures are considered to be the backbone of information economies (Castells and Himanen, 2002). Within information infrastructures, geoinformation may be considered a special type of information. Geoinformation refers to all information that somehow is linked to the surface of the Earth.

The specialty of geoinformation has resulted in the emerging of Spatial Data Infrastructures (SDIs) or Geographic Information Infrastructures (GIIs) (see Masser, 1999; 2007). SDIs are network-based solutions which enable easy, consistent and effective access to geo-information and services offered by public agencies and others (see Van Loenen, 2006). As a result, they enable users to save resources, time and effort when trying to acquire new data sets (Rajabifard and Williamson, 2002). SDIs therefore play a crucial role in the management of geo-information and that pertaining to the administration of our societies. In the European Union, two Directives address access to and resue of public sector information: the PSI Directive (2003/98/EC) promoting re-use of Public Sector Information and the INSPIRE Directive (2007/2/EC) aiming to establish a European SDI, promoting exchange, sharing, access and use of (environmental) geoinformation and services across the various levels of public authority and across different sectors.

Large sums of money are and have been invested in SDI initiatives. Rhind (2000) estimated an expenditure of approximately $10 billion for the US SDI and $2 billion for the SDI of the UK. Worldwide around €120 million each year is spent just on the management of online portals at national level providing access to geoinformation (Crompvoets, 2006). Given this expenditure and society's interest in the effective and efficient use of public funds, it is imperative that these SDI services and initiatives should be assessed on their effectiveness and efficiency. Although the value of geoinformation comes from its use (Onsrud and Rushton, 1995), SDI assessment from a user perspective has been scant (see Crompvoets et al., 2008; Grus, 2010).

This article focuses on the assessment of one critical component of an SDI: geoportals. How much does a user benefit from the existence of a geoportal, and is there any emprirical evidence of the added value of a geoportal for the user? Students of Delft University of Technology (The Netherlands) following Master course 'Geomatics' were tasked to assess geoportals from a user perspective. Both geoportal theory and transaction cost theory were applied in this assessment research. This article presents the role of geoportals in SDIs (Section 2), the relation between the Web and SDI (Section 3), and introduces transactions cost theory (Section 4), in order to understand the context behind the assessment research. Finally, the case study research is presented (Section 5).

2. The role of geoportals in SDI

Spatial data infrastructures aim at enabling easy search for, access to and use of geoinformation. According to Williamson et al. (2003) an SDI consists of three key components that link the user to the data: the access network, the policies, and standards (see Figure 1).

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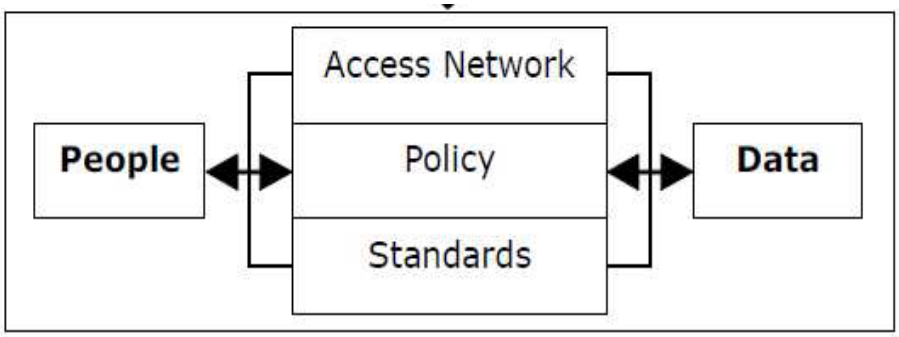

Figure 1: Nature and relations between SDI components (Williamson et al. 2003).

A geoportal for geoinformation focuses on the facilitation of geoinformation discovery, access of data and related services (Crompvoets, 2006). It can be seen as a one-stop shop for geoinformation (Crompvoets et al., 2004). Through the provision of a one-stop-shop, significant cost reductions related to searching, assessing and accessing geo-information can be achieved (see Groot and Sharifi, 1994; Askew et al., 2005; Maguire and Longley, 2005; Beaumont et al., 2005).

The importance of geoportals in SDIs can be assessed if we consider the geoportals as the medium through which the users access the available information. We can imagine them as shopping malls (Crompvoets, 2006) in which spatial data from government agencies and private bodies are offered in a complete way so as the user does not have to visit different “shops”. As a result, geoportals have to be complete systems that will not only offer information but will also the ways the user could useuse them in an efficient way. Their aim is to significantly reduce the time necessary to find, access and assess data. A geoportal may also facilitate the exchange of data between public authorities, companies, commercial and professional users by clarifying the transaction conditions.

However, little is known about the user, his/her experiences related to geoportals and time saved when using these services. So far, the assessment of geoportals has mainly focused on the supplier or geoportal coordinator sides (see, for example Crompvoets, 2006; Crompvoets, 2007). In our research presented in this article we focus on the user´s experience using the methodology for measuring this experience on the basis of transaction costs as suggested by Poplin (2010).

3. The web and SDI

SDI 2.0 advocates argue that the SDI concept and objectives should not only consider SDI 1.0 activities, as a geoportal development may be categorised, but also the role of Web 2.0Internet may play in geoinformation exchange. In an extreme position one may argue that SDI can be implemented without including geoportals and can fully rely on existing search facilities on the Internet. However, according to Ellen Bates (2002), 107 billion dollars a year is spent by American companies on employees that spend their time trying to find the required information through the internet. This is mainly because the impulsive growth of the internet did not allow for standardization of the information put on the web, resulting into a lack of legislations and almost no consistency between the different websites. The internet has become like a whirlpool of all kinds of information, both relevant and irrelevant, with an enormous network of links between (sometimes total irrelevant) websites, from which the user has to filter the needed information. As Ellen Bates states, the internet gives the “illusion of an easy access”, it might seem easy to find information and access the website while it is in fact quite opposite. Such complexity can discourage potential users or buyers of a particular type of product. This directly influences providers of products; i.e. the more difficult it is for users to find their products, the less likely the provider) are willing to invest in the product assortment (for instance product quality) (Van Oort et al.).

However, in the context of geoinformation, no much empirical evidence is available supporting the claims of Ellen Bates or SDI 2.0 advocates. The transaction cost theory and its application for geoinformation might contribute to the assessment from a user perspective that may provide empirical data on the use of geoportals and the internet supporting to achieve the objectives of an SDI.

4. Geoinformation transaction cost

Transaction cost theory deals with the cost of transacting called transaction cost. Every trade, every exchange of a product is a transaction and entails costs that result from both parties attempting to determine the valued characteristics of the product or service that is a subject of exchange (North 1990). It takes resources to measure these characteristics and to define and to measure the rights that are transferred to the user with the exchange of the products. The cost associated with these efforts is considered to be the transaction cost (Williamson 1985; North 1990; Williamson and Masten 1995; Sholtz 2001). Coase (1937) is one of the authors that realised the importance of the transaction costs. North (1990) got a Nobel Prize for his work on transaction cost theory. Today the research is part of so called institutional economy.

Transaction cost of geoinformation and the attempts to measure and quantify it is a novel idea. The first experiments were done in 2009 (Krek 2009a, Krek 2009b, Poplin 2010). The main idea is based on transaction cost theory and applied to geoinformation. Geoinformation trade is a transaction which involves data and service providers on one hand, and geoinformation and data users on other hand. In the process of exchange of geoinformation product the potential users and providers have to agree on the characteristics of the geoinformation product which is the subject of trade, and on the conditions of exchange. In this process of communication the geoinformation transaction costs incur on both sides; on the geoinformation provider´s and the potential user´s side (Krek 2003, 2004, 2009a, 2009b, Poplin 2010). In this research we aim at concentrating on the potential user and the cost of transacting which we call Demand Geoinformation Transaction Cost (DGTC). The DGTC is the cost covered by the potential user related to the exchange of geoinformation. It is primarily the cost of the time spent on searching for the geoinformaiton provider, contacting the organisation, inquiring characteristics of a specific dataset, acquiring it, and testing the fitness of use in a specific application. We summarised the potential user´s activities as follows:

- Activity 1: Searching for the geoinformation provider includes a. searching for the providing organisation and b. searching for the responsible contact person
- Activity 2: Inquiring about the general conditions of the exchange
- Activity 3: Inquiring about the specific conditions of the exchange; phone or E-Mail includes a. inquiring about the pricing policy and b. inquiring about the availability of the dataset
- Activity 4: Defining the exact characteristics of the geoinformation product includes defining the features of the dataset, understanding the offer and explaining the need
- Activity 5: Acquiring and testing the geoinformation product: free sample data acquisition and storage, testing the “fitness of use”
- Activity 6: Reading the documentation about the trade conditions and pricing: reading and understanding the conditions of use and pricing policies

All these activities undertaken by the potential user require investment into the process of search and acquisition of the information about the geoinformation and trade conditions. After the phase of testing, the potential user can decide whether she wants to acquire the geoinformation or not. After a dataset has been acquired, it needs to be integrated with the user’s software and possibly linked to other datasets. Only after this process has been finalised successfully, the user can start using the dataset for the intended task.

Backx (2003) has captured the concepts related to geoinformation search and acquisition in Figure 2. He explains that before a data set can be used, the user must pass through the two outer rings as shown in figure 2. A user should first be aware of the existence (the outer Known ring) of a data set in order to be able to obtain it (the middle Attainable ring). Transaction cost theory as applied to geoinformation by Krek (2009a; 2009b; Poplin 2010) quantifies all three rings including the fitness of use test. A geoinformation that is difficult to find will result in a thick Known ring which in terms of transaction cost theory means that the measurement geoinformation transaction cost will rise (an user has to spend more time in searching for the data). Measurement geoinformation transaction cost is the cost related to search for an appropriate geoinformation and geoinformation provider, to verification of the geoinformation quality and possible transformation to the needed format. A data set which is easy to find (thin Known ring) but difficult to obtain (thick Attainable ring) will result in low measurement transaction cost but a high enforcement transaction cost as defined in North (1990). The enforcement

cost of geoinformation is the cost related to negotiating for the conditions of trade such as price of the geoinformation, enforcing agreements, protecting copyright, and defining the right to use and distribute the acquired geoinformation product or service (Poplin 2010).

Figure 2. The concentric skin model of Backx (2003)

The geoinformation transaction cost appears also on the supplier's side. The supply geoinformation transaction cost (SGTC) is the cost imposed on the geo-information provider. Supply geoinformation transaction cost (SGTC) is related to explaining the complex rules about the acquisition of geo-information, the use of data and its copyright issues. The communication happens either via email or phone and can be very costly for the providing institution. However, this article concentrates on measuring the potential user's transaction cost being aware that the cost exists on the supplier's side as well.

5. Geoportal assessment from a user perspective: Case study research

In order to be able to asses the value of geoportals from the user's perspective we designed a serious of experiments. In Spring 2010, 13 MSc students of the Geomatics curriculum of Delft University of Technology were assigned to assess geoportals. This was performed through four tasks:

(1) Each student conducted a literature study on both (geo)portal theory and transaction cost theory. Based on the literature study, the requirements for geoportals were developed. These criteria were discussed, and a final list of assessment criteria was agreed.
(2) Each student applied this list of criteria to assess 2 portals of their choice, a list of existing portals was provided for some guidance. The geoportals were assessed on a scale 1 (very poor) – 5 (excellent).
(3) After the (theoretical) assessment, the students assessed a geoportal from a transaction cost perspective.
(4) Finally, the overall results were discussed and experiences were reflected. The selected criteria and results were discussed with the focus on the outcomes and whether they justify investments in geoportals worldwide.

The students could be considered as an international group of Master students of Delft University of Technology, well acquainted with geo-information and GIS. All of them master English, and their native language was Dutch, Chinese, Persian, Greek or Bulgarian.

Assessing the transaction cost

After the theoretical assessment, the students assessed the geoportals from a transaction cost perspective. They formed groups of two. One of those two would assess a geoportal by finding, assessing and accessing a dataset at their choice (Scenario 1). Since framework datasets are considered to be key in a SDI, the only requirement was that this dataset should be on the list of framework datasets as developed by Onsrud (1998). The other student was tasked to do the same experiment, but without using the geoportal (Scenario 2), which meant that he or she was searching for datasets through web search. The only condition was that it should be one of the key datasets

underpinning a SDI: a framework dataset. Students were required to keep track of the time spent on each transaction cost stage: i.e. finding, assessing and accessing the dataset. Further they were asked to perform as if they were students that need the data for a special assignment; thus non-commercial use. Table 1 summarizes the scenarios applied and the number of students involved in the experiments

Table 1: The number of experiments planned and the number of students involved in the experiments

Scenario	**Number of students**
Scenario 1 The students received information about the geoportal through which they should start searching for geoinformation	6 students
Scenario 2 The students not received any instructions where to search for geoinformation	7 students

The first preliminary results of the assignment are presented in Table 2. All together, 13 datasets were acquired by the students. This is a 50% score. 9 of the 13 successfully acquired datasets were found through a geoportal. Only 4 of the 13 successfully acquired datasets were acquired through a web search. In this regard a geoportal can be considered successful.

However, the average time necessary to acquire the datasets through a geoportal was a little longer than the average time through the web.

Table 2: First results of the geoportal and web search task

Succeeded total	13 datasets (out of 26)
Succeeded through a portal	9 (out of 12 datasets totally sought for through a portal)
Average time of those succeeded?	235 minutes
Succeeded without a portal	4 (out of 14 datasets sought for through the web)
Average time of those succeeded?	253 minutes

Table 3 shows some of the problems faced by the students while searching for the framework datasets.

Table 3: Problems experienced in acquiring geoinformation

Problem faced	**Due to**	**Where**
Contact portal manager failed	broken links, non existing email addresses, contact button inactive, redirected to someone else	Belgium, Denmark, Netherlands (RWS), France, Germany (BKG)
Who is responsible	Organisation of SDI	Belgium, Germany
Language	Response in language of portal manager No GoogleTranslate possible (images/ pdf etc) Pricing policy in local language only Licences in local language only Only homepage in English English keyword search failed	Netherlands, Denmark, Norway, Germany, France

Access policy	payment required terms of use unclear/ non-existent	Belgium, Arizona, Germany
No direct access	Registration required	Aizona (fax), Denmark, China, Belgium, Corine in Gemany
Limited data sets	only small scale data no to few datasets no metadata	INSPIRE, China, Germany/ Hessen, Netherlands (RWS)
No direct access	Response time provider	Netherlands (RWS): 7 days Germany: no response Germany (Rheinland): no response Netherlands (RWS): no response Belgium: no response
User friendliness	scrolling per institute endless clicking	Germany
Technical	big file size firefox not supported projections	
Limited data sets	data sets most relevant not in portal	CORINE, G-DEM, OSM, NOAA, NASA, NHD

6. Conclusions and further work

At this stage of the research it is difficult to suggest or draw conclusions based on the empirical research since the results have to be analysed in more depth. In the final paper, the experiences of the students will be cross-references and analyzed based on several key factors that might be relevant for the assessment of a geoportal: language, access policy, and organisation of the SDI, among other issues. The final paper will reflect to the role of geoportals and web search engines in SDI and provide recommendations.

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