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Geoportals in Selected European States: A Non-Technical Comparative Analysis

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Abstract

Geo-Information (GI) professionals, researchers and users have constantly proclaimed the potential of GI in facilitating more adroit and effective solutions to a wide variety of problems across today's modern society. However, the successful application of Geo-Information (GI) to a wider cross-section of today's society requires that GI is made available for sharing and reusing. For GI to be shared and reused on a large scale it must be easily accessible and assessable in an efficient and user-friendly format.

To facilitate the sharing and reusing of GI many countries are implementing Spatial Data Infrastructures (SDIs). A key component of an SDI that facilitates accessibility and access to GI datasets is a Geoportal. In general, a Geoportal acts as a gateway to digital GI content and services made available within the concept of an SDI. The Geoportal achieves this goal through the linking of GI oriented websites and databases. These websites may be local, regional, national, for niche markets, public or privately owned. Within the context of an SDI it is propagated that there should be a single entry point (a National Geoportal) to GI content and services for a nation.

Although the technology and standards are generally in place for the creation of national Geoportals to support sharing and reuse of GI, we are yet to see large scale implementation of effective National Geoportals across Europe as proposed by the INSPIRE Directive (Guimet, 2005). In addressing this issue the authors investigated Geoportals and the policies governing their implementation and maintenance in five European countries [France, Germany, Spain, United Kingdom and Norway] (van Loenen et al., 2007). In this paper, we will review different levels of Geoportals—local, regional, and national—across these five European States to determine their functionality, capabilities and the extent to which they support the sharing and reuse of GI. The paper closes with an overview of whether the Geoportals studied are contributing to the development of an European Spatial Data Infrastructure as proposed by the INSPIRE-initiative.

Introduction

The expected usage of Geo-Information (GI) as a tool to assist in the provision of more effective solutions to the diverse problems of the information society can only be achieved if GI is made more readily available for sharing and reuse. For GI to be shared and reused—within the context of Directive 2007/2/EC (INSPIRE Directive) and Directive 2003/98/EC (PSI Directive)—on a large scale there should be in place infrastructures to support easy and efficient access. In recognition of this fact many countries have implemented Spatial Data Infrastructures (SDIs) to facilitate the sharing and reusing of GI. A key component of an SDI that facilitates access to GI and GI services is a *Geoportal*. In general, a Geoportal acts as a gateway to digital GI content and services made available within the concept of an SDI. More specifically, a Geoportal may be defined as an Internet or intranet entry point with the tools for retrieving metadata, searching for GI, visualising GI, downloading GI, disseminating GI and in some cases the ordering of GI services (i.e., facilitating GI commerce) [Maguire and Longley, 2005; Tait, 2005; and Fisher, 2006]. The Geoportal achieves this goal through the linking of GI oriented websites and databases. These websites may be local, regional, national, niche markets, and can be either publicly or privately owned. Within the context of an SDI it is propagated that there should be an entry point (a *National Geoportal*) to the following network of services—facilitating access to GI across an entire nation—discovery services, view services, download services, and transformation services [Article 11 (1) Directive 2007/2/EC]. The premium version of this National Geoportal is expected to serve as a one-stop shop providing access to GI content and GI services so that they can be easily shared and reused. To provide this facility effectively and efficiently, an ideal National Geoportal should have access to the majority if not all GI portals, GI datasets, and GI services within a nation whether privately or publicly owned.

Although the technology and standards are generally in place to support the creation of National Geoportals, we are yet to see large scale implementation of effective National Geoportals across Europe as proposed by the INSPIRE Directive [Guimet, 2005]. In addressing this and other issues associated with access to GI in Europe, the authors investigated Geoportals and the policies governing their implementation and maintenance in five European countries (France, Germany, Spain, England and Norway) [van Loenen et al., 2007]. One of the objectives of the investigation was to identify and analyse the socio-political and economic issues affecting the implementation of Geoportals within the aforementioned European States. This paper will present a concise summary of the investigation in the format of a review and analysis of different levels of Geoportals—local, regional, and national—across the five European States studied and their interaction with the INSPIRE Geoportal.

The Case Study

With the support of the Netherlands' Ministry of the Interior, the authors investigated the GI access policies of five European States (France, Germany, Spain, England and Norway). The purpose of the research was to use results of the investigation into public sector GI access policies to identify methodologies to stimulate the re-use of public sector GI in the Netherlands in an efficient manner. For more in-depth reading on this aspect of the study and the general report see Giff et al. (2007) and van Loenen et al. (2007).

In addition to GI access policies the research also addressed Geoportal activities in the five States to determine their organisational structure, functionality, capabilities, access policies, and the extent to which they support the sharing and reuse of GI within the context of the INSPIRE and PSI Directives. In this respect, the case study focused mainly on the non-technical issues associated with the implementation and maintenance of different levels of Geoportals. The information obtained from the case study was analysed to determine the different socio-political and economic issues that may be acting as barriers to the large scale implementation of effective Geoportals—specifically National Geoportals—across Europe. This paper focuses on the extent the analysed Geoportals are adhering to the principles set forth by the INSPIRE Directive.

Geoportal

As mentioned previously, a Geoportal may be defined as an Internet or intranet entry point with the tools for retrieving metadata, searching for GI, visualising GI, downloading GI, disseminating GI and in some cases the ordering of GI services [Maguire and Longley, 2005; Tait, 2005; and Fisher, 2006]. These applications are achieved through an assembly of architecture groups (users' applications, catalogues, web services, networks, and GI) that provides a community-wide access point to distributed GI and GI services [Alameh, 2003]. For more information on the architecture groups see Guimet, 2005; Bernard et al., 2004; Alameh, 2003; and Percival, 2002. A Geoportal often serves a specific community, offering the personalized views required by that community [Alameh, 2003]. However, Geoportal at the national level should be interoperable using standardised software interfaces to connect to the many spatially related services offered by the different providers. That is, a National Geoportal should connect the different theme Geoportals within a nation and thus, provide a single entry point to all GI related datasets and services across the nation. A National Geoportal is a key feature of a National Spatial Data Infrastructure.

Geoportal Activities in Europe

The current Geoportal activities in Europe are in part inspired by the INSPIRE Directive. The INSPIRE Directive was enacted to promote and govern the sharing and reuse of public sector GI across Europe through the implementation of a European Community Infrastructure for Spatial Information (INSPIRE). A key component of any SDI is a Geoportal and the Directive addresses the implementation of a European Geoportal in recital 20 and article 15. These two sections seek to establish a European Geoportal which will act as an entry point to all the Geoportals of the Member States. Although the Directive does not require Member States to have a National Geoportal, it is recommended that the INSPIRE Geoportal links to the Geoportals of the Member States through each National Geoportal. The Directive does, however, require the establishment

of a network of several types of services as described by NSDT, (2007) and mentioned in the paper's introduction [Article 11 (1) Directive 2007/2/EC].

To this end, the majority of European States are undergoing numerous Geoportal activities at different levels of society to facilitate the sharing and reuse of GI and ultimately comply to the INSPIRE Directive (Directive 2007/2/EC). The following section summarises the activities at the national level of the States investigated and also key activities at other levels. The summary forms the basis for the analysis on whether or not these activities are in compliance to the INSPIRE Directive.

Geoportal Activities in Germany

The Geoportal activities at the nation level in Germany fall under an e-Government initiative called "Bund-Online 2005". The GI component of this initiative is the Interministerieller Ausschuss für Geoinformationswesen (IMAGI)—Inter-ministerial Committee for Geo-Information—projects. The IMAGI project provides funding for a number of GI related initiatives including the federal (national) Geoportal (GeoPortal.Bund). GeoPortal.Bund (www.geoportal.bund.de) was implemented in October 2005 as the central point of entry for GI searches, GI visualisation, and to support GI and e-commerce at all levels of German society. GeoPortal.Bund is coordinated by the Federal Agency for Cartography and Geodesy and is linked to the Geoportals of all the Länder. GeoPortal.Bund provides users with two key services; a viewing service that allows users to view key datasets (e.g., Nationale Geodatenbasis) and a metadata service (GeoMIS.Bund; Grünreich, 2004). GeoMIS.Bund—www.geomis.bund.de—is a metadata service that allows users to search the metadata of the GI made available through GeoPortal.Bund. This includes datasets from 18 federal organizations participating in the IMAGI project and some datasets from the Länder. The searching and viewing services of GeoPortal.Bund are available free of charge to all users. However, downloading is not yet available through GeoPortal.Bund and thus, the pricing policies on the datasets are left up to the custodians. These policies usually range from free to market value (cf. the IMAGI framework directive on the uniform regulation for data delivery and fees (Rahmenrichtlinie des IMAGI für "Entgelte und Abgabebedingungen für Geodaten" cited in http://www.ec-gis.org/inspire/state_of_play.cfm).

In addition to the GeoPortal.Bund there are a number of other Geoportals facilitating access to GI and GI services across different levels of German society. A key Geoportal providing access to nationwide GI is the *Geocatalog* Service (www.Geocatalog.de). It is coordinated and maintained by CeGI (public-private sector partnership) and a private company Conterra GmbH respectively. Geocatalog Service provides users with the tools to search and view GI, GI services, and GI application from both public and private sector GI providers. Access to GI within the Geocatalog Service varies from free search on all datasets (i.e., metadata) to free of charge viewing of selected datasets (e.g., Bundesamt fuer Naturschutz, and Stadt Muenster). Downloading from the Geoportal is not available to the public; instead, the public is directed to the custodian of the dataset of interest.

Further to the Geoportals offering national coverage, all the Länder (States) of German have their own Geoportal providing access to GI mainly within their jurisdictions. For example, in North

Rhine Westphalia (NRW) *TIM-online* (www.tim-online.nrw.de) was developed by the State Mapping Agency (Landesvermessungsamt [LVA]) and provides on-line access to its topographic information (e.g., DTK10, aerial photos, and DGK 5). The policies governing access to TIM-online are summarized as follows: viewing of all dataset is free; the public may download non-reference datasets free of charge; and the download of the reference is available for a fee stipulated by the custodians. The feedback of the user community has shown a high interest in the use of the services of TIM-online. Another Geoportal of interest in NRW is *Geodatenzentrum of NRW*. This portal finds its basis in the Cadaster Act (*Katastermodernisierungsgesetz [KMG]*) and was also established by the LVA. Its aim is to provide an insight into the work of the Liegenschaftskataster and to distribute widely GI and GI products of the Liegenschaftskataster [article 15 (1) KMG]. Although the KMG does not specifically state that Kreise (districts within a State) are obliged to provide their data, all 54 Kreise of NRW have signed a contract with LVA for the provision of their data. This indicates the willingness of the Kreise to participate in the Geoportal and thus, increasing the effectiveness of this state portal.

Geoportal Activities in France

In France the National Geoportal is called *Le Geoportail* (www.geoportail.fr). *Le Geoportail* is funded in part by Central Government through the Direction Générale pour la Modernisation de l'Etat (DGME) initiative and Institut Geographique National (IGN). The aim of the DGME initiative is to provide both the public and private sectors and the citizens of France with easy access to key French GI on or below the surface of the earth. The responsibility of the coordination, implementation and maintenance of the Geoportail is undertaken by three government agencies; the DGME (coordinator), Bureau de Recherches Géologiques et Minières (BRGM) [development of the catalogue section] and IGN (creating the viewing and downloading section).

The Geoportail is divided into two main components, *Le Geocatalogue* for locating GI and GI services, and *Le Visualiser* for viewing and downloading GI [Didier, 2007]. Le Visualiser is further subdivided into two sections, a viewing section and a service section. The viewing section provides users with the tools to view and manipulate GI—located by Le Geocatalogue—free of charge. While, in the service section, users are provided with two options: 1) A free download section where GI that are made freely available can be downloaded and 2) A business section to support e-commerce where users can purchase GI and GI services which are not made available free of charge [Didier, 2007]. The purchasing of GI and GI services can be done directly through the Geoportail or from the custodians. In summary, the Geoportail provide users with a three fold access policy that facilitates greater usage of GI. Firstly, there is free viewing of all the GI made available through the Geoportail. Secondly, there is the possibility to download free of charge GI that are made available for free by the custodians. Thirdly, the Geoportail access policy provides users with the opportunity to participate in GI commerce by making GI and GI services available for purchase through the Geoportail or by providing the information on where these GI and GI services can be purchase. For more in-depth reading see van Loenen et al., 2007.

In addition to the Geoportail there are a number of other Geoportals facilitating access to GI across different levels of French society. Some of the key Geoportals providing access to GI at the national level are the IGN's portal (the national mapping agency) providing access of core datasets; BRGM's portal providing access to environmental GI; eaufrance's portal providing

access to GI relating to water resources, wetlands and their usage in France; and prim.net's portal providing access to GI relating to risk/hazard management.

Geoportal Activities in Norway

An important part of the realization of the Norwegian National Spatial Data Infrastructure takes place via the Norge Digitalt program. This is a national program for co-operation on the establishment, maintenance and distribution of digital GI, which has to be seen in the wider context of the e-government plan *e*Norway. An important activity of Norge Digitalt is the establishing of the National Geoportal GeoNorge (www.geonorge.no) [Strande, 2006]. The responsibility for the coordination, implementation, and maintenance of GeoNorge lies with Statens Kartverk the Norwegian National Mapping and Cadastral Authority. GeoNorge is funded through a partnership program, mainly, amongst the public sector with a few private sector members and commission received from the sale of GI and GI services. GeoNorge is divided into two sections, a members' section where only the partners of GeoNorge and ND are allowed access and a non-members' section which is open to the public.

As a national portal, GeoNorge offers users the tools to locate, view, and manipulate GI datasets through its web mapping services and also, the capabilities for ordering and downloading GI [Mellum, 2004 and Strande, 2006]. Policies governing access to GeoNorge may be divided into two main categories based on its members and non-members sections of GeoNorge. Firstly, there is the access policy for the members' section that facilitates locating, viewing and downloading of GI free of charge. Secondly, there is the access policy for the non-members' section (i.e., the public section) which stipulate that users are allowed to locate and view all the available datasets free of charge. However, downloading in the non-members' section can either be done free of charge (where GI are made available for free) or for the price recommended by the custodian. GI within GeoNorge that are available for free download are all the public sector owned GI that are in raster format, and all thematic data [van Loenen et al., 2007]. The purchasable GI can be bought through the commercial component of GeoNorge, which is operated by Norsk Eiendomsinformasjon a public limited company. In addition, purchasable GI discovered through GeoNorge can also be bought from the custodians in most cases (notable exception is Statens Kartverk's GI).

Other portals providing access to GI across different levels of Norwegian society include the AREALIS' portal providing national access to environmental GI and land use information; the Statens Kartverk's portal providing access to key GI datasets; the MAREANO's portal providing access to marine GI; and the Norwegian Water Resources and Energy Directive's portal (NVE) that provides the citizens of Norway with access to water resources and energy related GI. In addition to the portals listed above a number of municipalities do operate GI related portals (e.g., Baerum and Hole municipalities) [Strande, 2006].

Geoportal Activities in Spain

In Spain, the name Infraestructura de Datos Espaciales de España (IDEE) is synonymous to both the national SDI and the National Geoportal. The National Geoportal IDEE (www.idee.es) the entry point to the national SDI, is coordinated by three GI organisations, the Consejo Superior Geográfico, the Comisión de Geomática, and the Grupo de Trabajo de la IDEE (Working Group

for IDEE). IDEE was implemented in 2004 and is funded by the different levels of government in Spain and the public sector. IDEE facilitates access to GI through seven service sections;

- The Catalogue Service which is a tool for searching, downloading and displaying metadata (currently the search is limited to National Geographic Institute's datasets);
- The Map Viewer which allows users to view and overlay GI made available for this type of function (limited GI analysis function);
- Data Download which allows for the downloading of only the Geodetic Networks (i.e., Geodesy, Boundary Line and EuroGlobalMap);
- The Gazetteer for searching the National Geographic Institute's (NGI) datasets for referenced geographical names;
- The CORINE Service facilitating the search for information pertaining to land cover in Spain;
- The Measuring of Altitude Service that allows users to measure the heights of points or zones on digital models; and
- The Coordinate Transformation service.

Currently, the public can use the services listed above free of charge. For more details on the seven service sections of the IDEE see IDEE, (2007).

Other key Geoportals providing access to GI and GI related products and services at the national level are: Centro Nacional de Información Geográfica (www.cnig.es), Instituto Geográfico Nacional (www.ign.es), Geoportal de Comarcas Cinegéticas (http://161.111.161.171/ComCine/) and Geoportal del Atlas Virtual de Distribución de Aves (http://161.111.161.171/atlas/).

Geoportal activities in Spain are not limited to activities at the national level but can also be seen at the regional and local levels. One of the more active Geoportal at the regional level is Infraestructura de Dades Espacials de Catalunya (IDEC) the Geoportal of the region of Catalonia. IDEC (www.geoportal-idec.net) is coordinated by the Institut Cartogràfic de Catalunya and funded under the Catalan Strategic Plan for the Information Society and the European Regional Development Fund [Guimet, 2005]. IDEC is divided into two main sections; a Data Catalogue section that facilitates GI search and a Map Viewer section that allows users to view and overlay GI made available through the IDEC (limited GI analysis). Some of the secondary sections are the market place and the yellow pages. For information of Geoportal activities at the local level in Catalonia see Guimet (2006).

In addition to IDEC other active Geoportal at the regional level are Territorial Information System of Navarre (SITNA), the Geoportal of Navarre (IDENA), and the Geoportal of Andalucía (IDEAndalucía).

Geoportal Activities in England

Currently there is no National Geoportal in England serving as a single online access point to English GI and GI services. However, online access to key GI can be obtained through the Ordnance Survey (OS) website, but the access is limited to OS business partners only. The Geoportal that best fit the concept of a National Geoportal in England is *Gigateway*. Gigateway is a metadata service that provides users with three search tools: 1) A Data Locator that allows users to discover the metadata of the datasets registered with Gigateway; 2) A Data Directory which is an online database of organisations supplying GI, GI products and GI services in the United

Kingdom (UK); and 4) An Area Search that allows users to search for administrative information about a specific area by entering the postcode [Atkins, 2007]. Gigateway is funded by the Government through the National Interest Mapping Services Agreement and coordinated by the Association for Geographic Information.

Although on the implementation on the National Geoportal is limited, vibrant activities on theme Geoportal and GI websites can be seen across England and the UK in general. Some examples of these Geoportal activities are The National Land Use Database (www.nlud.org.uk), The National Land and Property Gazetteer (www.nlpg.org.uk), National Street Gazetteer (www.thensg.org.uk), National Land Information service(www.nlis.org.uk), e-Government Interoperability Framework (www.govtalk.gov.uk), Oil and Gas Portal (www.og.dti.gov.uk/portal.htm), World Heritage Site Portal (www.ukworldheritage.org.uk), UK Regeneration Information Portal (www.regeneration-uk.com), and MAGIC a website providing environmental GI (www.magic.gov.uk). For more details on Geoportals in the UK see Beaumont et al., (2005).

Summary of Activities

The case study identified that all five countries investigated had some form of initiative at the national level to facilitate GI search. In addition to the national initiatives the authors also identified numerous other functional initiatives at different levels of society in the countries investigated. These initiatives, in general, provided access to GI related to specific areas of the country or specific themes. See Table 1 for a summary of selected Geoportal activities identified by the case study.

Table 1: A List of Different Levels of Geoportals Identified by the Case Study

Country	National Geoportal	Geoportals Providing access to key datasets	Geoportals of Interest
Germany	GeoPortal.Bund GeoMIS.Bund	Geocatalog, TIM-online, and BKG	Geodatenzentrum
France	Geoportail	IGN, BRGM, and eaufrance	Prim.net and AdER network (GI sharing)
Norway	GeoNorge	AREALIS and Statens Kartverk	MAREANO and NVE,
Spain	IDEE	Centro Nacional de Información Geográfica and Instituto Geográfico Nacional	IDEC, IDENA, SITNA
England	No National Geoportal but Gigateway can be viewed as a portal for national metadata search.	Ordnance survey and National Land and Property Gazetteer (see Beaumont et el., 2005 for more)	Map on Tap and MAGIC

Comparative Analysis

Although the aim of the case study was to investigate the Geoportal activities at the national level the Geoportal activities at the different levels of society in the countries investigated were significant enough to discussed in this paper. In addition, the activities at the lower levels are important as these activities will contribute to the creation of more efficient and effective National Geoportals. However, in this section, the paper will only compare the activities at the national level—of four of the five countries investigated—using services offered and organizational structure of the Geoportals as the criteria. England will be left out of the analysis because the case study did not identify what could be classified as a National Geoportal in England.

In terms of services offered the three most common services offered by the National Geoportals were catalogue (for GI searching), viewing (for visualisation and analysis) and downloading (for GI acquisition). All the countries investigated had operative catalogue services with the exception of Spain whose Geoportal only offered limited catalogue service in the form of search on the National Geographic Institute's datasets. The catalogue services were considered operative if they were capable of searching the metadata of the available GI and providing the users with metadata on the GI of interest. With respect to viewing, the Geoportals of France, Norway and Spain provided users with tools capable of visualising GI and performing limited GI analysis. In Germany the viewing tool was a bit more advanced, offering more capabilities in the area of GI analysis. On the final criterion of downloading, the Geoportals of the countries offered different capabilities. For example, in Germany GeoPortal.Bund did not offer downloading capabilities to its users. Whilst, for the other three countries different levels of downloading services were offered, ranging from almost full downloading capabilities (the ability to download all the GI made available) in Norway to limited capabilities (the downloading of selected GI) in France and Spain. Table 2 provides a summary of the comparison of the Geoportal in terms of services offered.

Table 2: A Comparison of the Services Offered by Four National Geoportals in Europe

National Geoportal	Services		
	Catalogue	**Viewing**	**Downloading**
Germany ***(GeoPortal.Bund)***	Yes	Yes	Not yet available
France ***(Geoportail)***	Yes	Yes, limited analysis	Yes, of IGN datasets
Norway ***(GeoNorge)***	Yes	Yes, limited analysis	Yes of both public and private sector datasets
Spain *(IDEE)*	Limited searching	Yes, limited analysis	Only the Geodetic Networks

The organisational structure of a Geoportal is important as key aspects of this area—including coordination, funding and access policies are significant in determining its success or failure. That is, the organisational structure of a Geoportal can act as a driver or a barrier to its level of efficiency. With this in mind the National Geoportals of the countries investigated were compared using the criteria of coordinating body, Geoportal funding model, and access policies to determine their influence on the Geoportals.

The case study identified similarities and differences in the organisational structure of the National Geoportals. Table 3 summarises these similarities and differences and from the Table it can be seen that the largest differences were in the funding models and the access policies regarding downloading services. In Germany, France, and Spain the funding of the Geoportal was carried out by either the different levels of government directly and or public sector agencies. However, in Norway the funding model of the Geoportal was mainly the partnership model. The partnership models varied from partnerships amongst different public sector agencies to public-private sector partnerships.

In terms of the coordinating body, two countries France and Spain had three different agencies coordinating the implementation and maintenance of their Geoportals. Whilst Norway and Germany had a single agency responsible for the coordination of their Geoportals. The merits and demerits of the choices of organisational structure of the Geoportals investigated will be analysed in the next section. With respect to access policies it is worth mentioning that in Spain the IDEE access policies were free of charge mainly because of the limited GI available for viewing and downloading. The access policies of the other three countries are presented in Table 3.

Table 3: A Comparison of the Organisational Structures of Selected National Geoportals

National Geoportal	Organisational Structure				
	Coordinating Body	Funding	Access Policies		
			Search	View	Download
Germany *(GeoPortal.Bund)*	Single agency	Federal Government project	Free of charge	Free of charge	N/A
France *(Geoportail)*	3 agencies	Central Government and IGN	Free of charge	Free of charge	Custodians decide fees
Norway *(GeoNorge)*	Single agency	Public-private sector partnership	Free of charge	Free of charge	Mixed pricing ranging from free to market value
Spain *(IDEE)*	3 agencies	Different levels of Government	Free of charge **Limited**	Free of charge **GI**	Free of charge **available**

Key Findings

The success of a Geoportal can be measured with respect to the services—see INSPIRE Directive for a listing of key services—it offers to its users, and the quality and quantity of GI it assist its users to access. The investigation supports the hypothesis that the technology is available to support the effective implementation of Geoportals as all the countries studied had the technology in place to provide the services recommended by Article 11 (1) of INSPIRE Directive. However, although four of the five countries investigated had initiatives at the national level capable of providing the services recommended by the Directive not all the initiatives could be classified as fully functional National Geoportals. The case study indicate that the limited functionality of the

Geoportals is in part due to the organisational issues which restrict the coverage (quantity) of GI and GI related services that the Geoportals are capable of facilitating users to access. Again, the limitation these organizational issues imposed on the success of the National Geoportals investigated will be discussed in terms of the coordinating body, funding model and access policies.

The structure of the coordinating body and the agency(s) responsible can influence the number of participants in a Geoportal. An example of this can be seen in France where the case study identified that some public sector agencies were reluctant to participate in the Geoportail because IGN was a key member of the coordinating body. These agencies feared IGN as a coordinator would have too strong an influence on the nature of the Geoportail and may seek to commercialize its activities; while, they were more in favour of the sharing of GI for free (at least across the public sector).

The type of funding model used in the implementation of a Geoportal can also influence the number of participants and thus the quantity and quality of GI available. For example, if the public sector agencies are responsible for funding the Geoportal activities then they may be unwilling to participate because this would impose an additional burden on their already slim budgets. There is also a strong correlation between funding model and access policies. In that some models may include proceedings from the sale of GI as part of the funding and therefore, will influence access policies by imposing a fee on access to selected services. Access policies can limit the number of participants in that some GI custodians may require a fee for viewing and downloading their GI whilst, the policy of the Geoportal is free of charge as in the case of Spain. The opposite is also true, where custodians are for free distribution of GI but the policy of the Geoportal is to charge for downloading. In France it was seen that some GI custodians were reluctant in participating in the Geoportail because it offered a mix of free of charge (public goods) GI and commercial GI.

Another organizational issue worth mentioning that can influence the number of participant is the organizational culture of the custodians. That case study indicated that where the organizational culture was one of sharing and where partnerships were commonly used in the provision of GI solution, the participation in the Geoportal was greater. The Norwegian case best highlight this point, where the participants in GeoNorge had already participated in a number of GI related sharing projects and thus were willing to join GeoNorge because of their past experiences.

Conclusion

At the time of the case study France, Germany, Spain and Norway had National Geoportals with tools capable of providing users with searching, viewing, and in some cases downloading services. This was in compliance with Article 11 (1) of the INSPIRE Directive. However, although these countries were in compliance of the Directive, the functionality of their Geoportals were limited by the number of GI organizations that offered their GI for sharing and reuse through these National Geoportals. This finding was not limited to the National Geoportals as similarities were seen with the Geoportals at the other levels of society of the countries investigated.

From the case study it can be concluded that the success of a Geoportal will greatly depend on the number of participants (data custodians) it attracts. Participation will be influenced by the expected participant views of the organisational issues governing the operation of the Geoportal and therefore, organisational issues should be extensively debated before implementation. In this way, all the expected participants can contribute or influence the policies governing the operation of the Geoportal.

National Geoportals are important to the INSPIRE portal as the INSPIRE portal may rely on the National Geoportals of Member States to provide access points to national GI. However, the INSPIRE portal can also be organised in a manner that it proactively seeks these access points, for example from the GI custodians websites. This would be extremely useful if Member States are unsuccessful in establishing a National Geoportal. Further, the use of Geoportals/ GI may be promoted through links placed in other, more generic National Portals, such as the Netherlands' *overheid.nl* (government.nl) the central access point to all information about government organisations in the Netherlands.

In summary, the results of the case study clearly point to the fact that a Geoportal initiative can only succeed if it provides access to a wide cross-section of GI. This can only be achieved if the Geoportal offers incentives that are appealing or appealing enough for those that are expected to participate. That is, there should be in place multiple types of incentives capable of attracting and convincing GI custodians to participate in the Geoportal. In concluding, a Geoportal can only be successful if both the technical and organisational issues associated with its implementation are addressed.

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