Accessibility of GI for Public Participation
A Danish-Italian comparative study

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SUMMARY

This paper reports an ongoing comparative study on the accessibility of Geographic Information at public authorities' websites in Denmark and Italy. The purpose of the study is twofold; to give an idea of the latest development and diffusion of GI on public authorities websites, and to identify critical factors for success or failure of the applications. First part of the study therefore consists of a mapping of the level of accessibility of GI in the two countries as a comparative analysis. The focus of the mapping is mainly on the use of geographic information as support to citizens' involvement in spatial e-government and planning processes. Then, in the reminder of the paper, a comparative analysis is proposed outlining similarities and divergences in critical success factors in the two examined domains.

KEYWORDS: *e-government, GI accessibility, Public Participation, Planning Support Systems*

INTRODUCTION

e-Government and digitally supported tools for participation and decision making are issues that continue to attract attention from the political sector as well as the scientific community. In the 2003 Ministerial Declaration from the e-Government Conference in Como (e-Europe, 2003), the Ministers of the EU member states concluded: *«While the number of good practises is growing there remains a need for better understanding and assessment of the impact and role of e-Government and for effective benchmarking to give policy makers evaluation elements for their decisions. Therefore Ministers called for focussed academic research and continued monitoring with existing indicators based on more qualitative benchmarking methods. »* The present study can be seen as an attempt to achieve a better understanding of critical success factors and failure within a specific part of the e-Government, namely the online access to Geographic Information (GI) in general, and its implication for the support of spatial planning in particular. Throughout Europe, Public Authorities (PA) at all administrative levels offer access to GI via their WEB-sites. These PAGIWEB (Campagna & Deplano, 2004) may vary in themes and overall scope (Laurini, 2002), but they can all be considered and used as means for the general public to gain insight in their geographical setting and physical surroundings, and thereby improving the basis for possible involvement in participatory planning processes. These activities may span from general public service delivery to sophisticated Public Participation GIS (Craig et Al, 2002) It appears from a functional and technological perspective, that the functionalities and general quality of these PAGIWEB vary a lot, from simple static maps and images to advanced geoinformation tools. The study presented here therefore has two overall purposes:

1. to give an overview of the latest development and diffusion of PAGIWEB by monitoring their number and characteristics , and
2. to identify critical factors of success and failure of the applications by analysing the different geopolitical contexts of the best practices found.

The study consist of a comparative study of the PAGIWEB situation in Denmark and Italy. Much of the national legislation that concerns issues such as spatial planning, public participation, e-government, and on the use of public sector information is shaped by regulations from the EU. Although national implementations of these regulatives vary the similarities may be greater than the differences. A comparison of the way the public authorities handle their communication with the citizens in the two countries therefore might be used for identifying useful hints for applications design and development; if institutional, economical or technological factors that prove to be critical for success and failure turn out to be different in the two countries suggestions for future solutions might appear clearer by the comparison. If the factors turn out to be identical the call for a common solution will be the more apparent.

EXISTING STUDIES ON PAGIWEB IN DENMARK AND ITALY

Earlier studies and monitoring of PAGIWEB in Denmark has been reported by Arleth (2000) and in Italy by Campagna & Deplano (2002, 2003, 2004). At the overall level of general diffusion of e-government, national and European statistics give a rather consistent view of the situation in the two countries. In most e-government benchmarking statistics Denmark is placed in the top (or top 5) while Italy is in the lower middle of the European spectrum. The same picture is shown in statistics concerning general use and diffusion of ICT (such as internet access per household, diffusion of broadband connection and the like) with an exception in the number of mobile phone subscribers per 100 inhabitants, where Italy is the European lead. (Eurostat, 2004) (Fsk, 2004)

A TAXONOMY OF PAGIWEB

PAGIWEB most often are established as a consequence of the regular administrative tasks of the respective public authority. Although, as noted above, these tasks in their essence do not vary too much between the two countries, their organisation might. To understand this it is necessary to consider the configuration of the public sector in the two countries.

Italy

Italy covers about 300.000 sqr kms and has 57,3 mio inhabitants. There are four levels of administration; national, regional, provincial and municipal. The 20 regions are responsible for regional strategic policy development. Differences among them arise from regional autonomy which allow for different regional planning regulatory frameworks. The regions are also responsible for landscape planning. Within regional frameworks, municipalities (more than 8000) are responsible for land use planning and management at a local level. At an intermediate level, the provinces (more than 100) coordinate the municipalities and develop wide area strategies and sector development projects.

Denmark

Compared to Italy (and to most other European countries) Denmark is a small country, both in terms of area: 43.000 sqr kms and number of inhabitants: 5,2 mio. In terms of these measures Denmark is almost comparable to an Italian region. Denmark has three administrative levels; national, regional (the counties) and municipal. The national level provides the legislation and marks out the overall strategic framework for the development of the country. The 14 counties are responsible for handing larger environmental issues and everything concerning planning and administration of non-urban areas; costal areas, nature preservation and restoration, agriculture, natural resources, water quality etc. Urban planning and development are handled by the 270 municipalities.

As it appears, the administrative units of the two countries are of different sizes, and the allocation of planning and administrational tasks differs too. In fact, the legislation concerning the planning and area management issues varies even among the regions of Italy. Hence, an obvious question is,

if a comparison is meaningful at all? To this question, the authors have adopted this view, expressed by Umberto Eco:

"Ce lo hanno detto in molti, e tanto forse basterebbe a non indurci a trattare in modo omogeneo ciò che omogeneo non è. Ma ogni vertigine di disomogeneità può essere nominata come campo unificato quando esibisca al proprio interno una rete di somiglianze di famiglia. Tra queste occorrerà pure districarsi." (Eco, 1998)
 (Many told us this, and that should perhaps be enough to hinder us from treating something as being homogeneous, when it is not. Nevertheless even the most stunning heterogeneity can be characterized as being in a state of unity, if internally it shows a network of family similarities. And should one not try to disentangle oneself from those, at least?)

 In case of the Danish and Italian PAGIWEB one main characteristic is the purpose of serving the general public with Geographic Information, and by doing this facilitating the citizens' need for information related to planning processes. Although only a small subset of available PAGIWEB has been realised with the direct purpose of facilitating a participatory planning process, they can all be used as such by the public, and can therefore be evaluated and classified according to this task. Web-based information systems that aim at supporting planning processes and participation are known by the term WPSS (Peng, 2001) or web-based PPGIS (Carver, 2001), (Weiner et al., 2001). A taxonomy aiming at defining the level of service of a WPSS was proposed by (Peng, 2001). An adaption of this taxonomy to reflect a reality with a less extensive implementation of public participation is thoroughly described in (Campagna & Deplano, 2004) and used for the comparison in the present study. The used taxonomy has the form of a bidimensional matrix whose variables are content and technology, called CTM (Content/Technology Matrix). The content levels, C1-C4 varies from general information concerning an area or territory, over planning documents, raw downloadable data to bidirectional informational tools. The Technology axis comprises 5 steps, T1-T5, moving from static maps in html or PDF documents via more and more sophisticated and dynamic tools to advanced WPSS functions. The two axis' form 20 cells each comprising a characteristic combination of information content and applied technology. As shown by (Campagna & Deplano, 2004) with regards to the Italian case study using the CTM it is possible to classify the PAGIWEB in a way that makes comparison easy between institutional levels, between different countries and in different timesteps. Table 1 shows the C and T levels of the matrix and the generated matrix cells.

THE CLASSIFICATION
 The classification of Italian and Danish PAGIWEB is based on comprehensive surveys of websites of Danish and Italian public authorities performed by the two authors respectively. To assure coherence and consistency between the Italian and Danish classification a calibration of the interpretations and range of each of the CTM cells was made between the authors prior to the Danish survey. Descriptions of typical cases of the cell values was agreed upon, and examples of border cases was forwarded for further calibration of the mutual understanding of the definitions.

The Italian survey
 The first Italian PAGIWEB survey was carried out in 2001 (Campagna & Deplano, 2002) and was updated in 2002/2003. Initially a quantitative and qualitative study on the diffusion and consistency of GI/GIS in Italian Local Authorities has been proposed offering a first insight focused on GI/GIS exploitation in the applications supporting Public administration (spatial) e-government initiatives. At the end of the survey the set of analyzed websites counted the 20 regions, 31 provinces and 44 municipalities chosen on the basis of a three steps scanning search (Campagna & Deplano, *ibidem*) with respectively 7, 9 and 36 basic GI-based or full featured online GIS applications. The spatial

distribution of GI-based web applications at regional level showed a certain homogeneity in the central and northern part of Italy, while the southern part faced the total absence. However these findings are currently in counter trend especially at the regional level where many Regions are developing new Spatial Data Infrastructure (SDI). Among them the Region of Sardinia is promoting the development of the Regional SDI according to the INSPIRE (www.inspire.org) principles. At provincial and local level the distribution showed a similar pattern while at local level a fairly homogeneous distribution was evident in the central-northern part of the country. After a second survey which extended the original set to a geographically more comprehensive set of 126 applications, the CTM methodology was developed, applied (Campagna & Deplano, 2004) and further extended (Campagna & Deplano, 2003).

Content\Technology	T1: Web browsing, static maps (HTML and PDF)	T2: Interactive map images	T3: Highly interactive, dynamic maps, mulitimedia, 3D, VRML	T4: Basic web-GIS functionality, search, query and analysis	T5: Advanced web-GIS functionality, 2 way communication
C1: General information of city or area, turistmaps etc	C1T1	C1T2	C1T3	C1T4	C1T5
C2: Plans and planning information, information about environment and nature	C2T1	C2T2	C2T3	C2T4	C2T5
C3: Raw data, downloadable in GIS or table format	C3T1	C3T2	C3T3	C3T4	C3T5
C4: analysis tool, focused bidirectional information flows	C4T1	C4T2	C4T3	C4T4	C4T5

Table 1. The elements of the CTM – Content/Technology Matrix. After (Campagna & Deplano, 2004)

The overall study showed several interesting results. Information and services proposed at the three levels differ as well as the technology used to develop communication protocols which are essentially one-way type. Public access to the public sector information is sometimes given to digitally support traditional informative task in planning and development. At the regional level this is true especially with regards to medium-to-large topographic and thematic data which are usually produced at that level. In few examples (the Regione Emilia Romagna online cartographic service was found innovative in that) data are available for download. The provinces, responsible for sector development, offers a wider variety of different applications even though at this institutional level PAGIWEB are generally rare and their variety make it difficult to identify common categories. While

some applications were found at the provincial level which give access to topographic and cadastral database like at the regional level some other propose different thematic information concerning planning system and other cultural and environmental issues. At the municipal level most of the applications are oriented to present master plans publicly for consultation; some applications are very basic in terms of data management and technology, whilst some other are developed enough to offer complete communicative frameworks. In the first case websites just offer the main planning documents such as zoning map and regulation, while in the latter many themes, analysis and query functions are available for the users. Table 2 reports the results of the survey at the municipal level. The set chosen for the analysis comprehends 60 samples including all major municipalities for each region and those having a population bigger than 100.000 inhabitants. At the time the survey was conducted first in 2001 only few examples of municipal web-gis were found within an extra set of minor municipalities excluded by the survey set. These few cases were very small municipalities within the same region which implemented very similar functionalities suggesting the presence of some institutional or marketing facilitating factor acting in the area.

Content\technology	**T1**	**T2**	**T3**	**T4**	**T5**
C1	8	5	8	2	0
C2	2	2	6	6	3
C3	0	1	0	2	0
C4	0	0	0	0	0

Table 2 Results of the survey at the municipal level, number of examples

The Danish survey

The Danish survey was performed in 2004. Access to Danish municipal websites was achieved through general portals, one for municipal websites generally, and one specifically for websites with GI about nature, environment and planning offered by the counties (Miljøportalen). In case of the municipal websites, on each a search was made based on keywords (such as planning, maps, GIS). The structure and organisation of the municipal websites was very heterogenic, and PAGIWEB was found in the most surprising subsections of the websites, as well as in more foreseeable places. Based on this experience, it can not be guaranteed that all instances of PAGIWEB at the municipal level have been detected in the Danish survey, but since a total number of 270 municipal websites had to be examined, a time limit of 45 minutes spent on each municipality was set.

171 municipalities offered some kind of PAGIWEB on their website, ranging from basic static maps in local plans and municipal plans in PDF documents to advanced web-GIS applications with feedback tools. The results on the municipal level are shown in table 3.

Content\technology	**T1**	**T2**	**T3**	**T4**	**T5**
C1	2	0	1	0	0
C2	94	11	12	37	3
C3	0	0	0	4	0
C4	0	0	0	0	0

Table 3 Results of the survey at the municipal level, number of examples

The results on the county level are shown in table 4. All 14 counties have implemented web-GIS to provide plotowners, agricultural consultants, property handlers, windmill owners, municipal authorities and other professionals with updated information about regulations and zonings in the rural area. The functionality and level of sophistication of the county PAGIWEB varies slightly but they are all in the lower right part of the CTM. Although some of the counties had more than one application each county is only classified once, as was the case with the municipalities, according to the highest achieved level of content and applied technology. Not surprisingly the standard and sophistication of the county PAGIWEB are generally higher than the municipal applications. 10 counties offer their GIS data freely for download in XML/GML or software specific formats (MapInfo or Arcview). In the download sections the counties usually also links to freely downloadable GIS-viewers like ArcExplorer or MapView. These services are partly a consequence of the Aarhus convention (UN ECE, 1998) that assures citizens in ratifying countries free access to data concerning their local environment. Formally seen this obligation is already fulfilled by the web-GIS, and the download option provides citizens with the necesarry skills for a valuable extra basis for participating in planning processes. The download option only covers data that the county itself produces, as copyright agreements for the basic maps usually do not make such a free service possible.
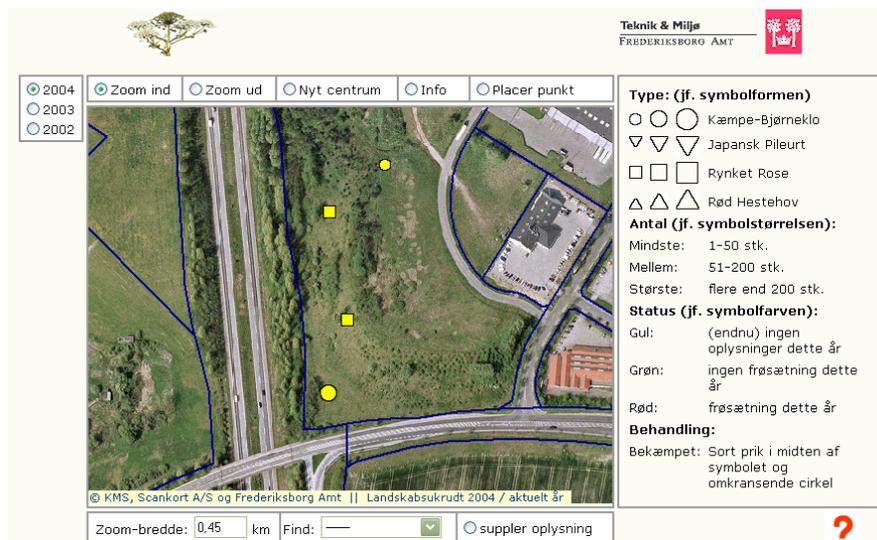

Figure 1 Online tool for registering occurrences of i.e. hogweed. The citizens can place a marker where the weed has been observed and supply additional textual information about the observation.

4 counties have applications where the citizens are encouraged to make online registrations of occurences of hogweed and other kinds of weed that spread vigorously in the uncultivated parts of the rural areas, see figure 1. These are so far the only instances of PAGIWEB where the citizens can act directly as data suppliers. A number of the municipal web-GIS' as well as most of the county web-GIS offers functions for "redlining"; digitalisation or marking of an area in the map and provides guidance on how to attach a screenshot of such a redlining to an email to the administration, for comment and questions. In this way the citizens can augment their comments and questions with GI, but they do not directly supply the application with new information content as it is the case in the hogweed registration. With the evolving WMS and WFS technology it must be expected that

functionality where the citizens can digitalise and submit GI directly online will be an obvious part of future PPGIS, and for that development a closer examination of the experiences with the hogweed registrations should be made.

Another application worth mentioning is the 3D-model of North Jutland. In October 2002 the 3D-application was launched, using the TerraExplorer from Skyline software systems. In this application the users can fly above and investigate the entire region of North Jutland visualised in 3D by an orthophoto mosaic draped on a dhm. The application enables the user to "fly" from one address to another, circle round specified targets and navigate freely in 3 dimensions. Buildings are extruded from the orthophoto as blocks, based on polygonal information from technical maps. This gives a rough but yet realistic impression of the surroundings. Different themes can be applied to the model, such as tourist information (with links to relevant webpages), bicycle routes, nature camp sites for hikers etc. But the model was also used for visualising different scenarios in the planning process of a large wind mill farm. In combination with electronic meetings these scenarios were valuable suppliments to the more traditional means of debate and participation in the planning process.

Content\technology	T1	T2	T3	T4	T5
C1	0	0	0	0	0
C2	0	0	0	2	2
C3	0	0	0	6	4
C4	0	0	0	0	0

Table 4 Results of the Danish survey at the county level, number of examples

Spatialisation of the resulting CTMs are made to make direct visual comparison easier. Moreover, as the number of municipalities, regions and counties in Italy and Denmark differs, what might result from a direct comparison of the resulting CTM is merely a reflection of that fact. Instead the cell densities of the CTMs are calculated. The resulting view (figure 2) is showed for the municipal level in Denmark (left) and Italy (right), with each dot representing a cell in the matrix.
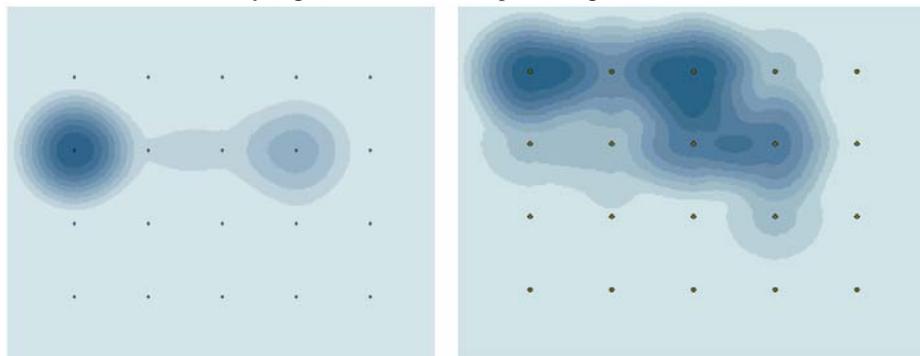

Figure 2 Spatialisation of CTM for Danish (left) and Italian (right) municipalities. Dark areas show high concentrations, light areas are empty or almost empty. The legends of the two spatialisations are not identical, as the number of samples they are based on differ, see tables.

The Danish CTM at the municipal level is based on 171 PAGIWEB out of a total of 270 municipalities, the Italian CTM is based on 60 occurrences of municipal PAGIWEB. In spite of the

differences in the two sets' size, it may be assumed with good approximation that in both cases the sets are representative on the national distribution patterns which are the item for the current comparison.

WHAT DOES THE CLASSIFICATION SHOW?

 As it appears from figure 2 the result of the spatialisations are remarkably different. The spatialisation of the Danish municipal level CTM results in a very uniform shape with the main weight centred on the C2T1 cell and a smaller accumulation around C2T4. Briefly, this shows that the Danish municipalities who offers PAGIWEB either do this in the form of master plans and local plans in PDF-documents, or as relatively advanced municipal web-GIS' including planning zones and related information and documents. Some municipalities have both a master plan in PDF and a web-GIS and in that case they are categorised in the higher of the two categories. The web-GIS' found at the municipal websites are very similar in structure and functionality and must be considered a reflection of the products the GIS-vendors currently offer. There are only a small handful of firms selling these solutions in Denmark, and it can not be concluded from this first survey whether the functionality the web-GIS's encompass reflects the needs and commands from the municipalities, or rather that it shows what the vendors are capable of delivering. A small number of municipalities have developed their own systems (or developed further the standard solutions) to better meet the requirements of a planning information and participation system. An example of this is the municipality of Aalborg that offers access to statistical information, gives tools for analysis based on the users own preferences, and in addition offers the data for download in tabular formats.

 The near-absence at the municipal level of Danish PAGIWEB in the C1 category is worth noticing, and two explanations come to mind. One is that very general purpose static maps might not have been identified as PAGIWEB in the survey. The other is that Danish municipalities that are aware of the importance of communicating via maps and GI very often focus this communication on themes related to planning and thereby move to category C2. Each municipality is only classified once and always in the highest achieved category of PAGIWEB found on the entire website.

 The spatialisation of the Italian municipal CTM shows a much broader picture. The fuzziness in the distribution zones and the fading homogeneity suggest an underlining trend towards an integration of technologies in order to deal with information-rich environments for the delivery of public services and dialog with citizens (Campagna & Deplano, 2004). It must be noted that most of the PAGIWEB found here are more related to other domains than planning, a fact that is reflected in a large accumulation at the C1 level. Plotted on a map the results of the Italian PAGIWEB survey show a tendency towards a divide between the northern and southern parts of the country, with the high technology levels (T3-T4) primarily present in the municipalities in the northern and central part. The results of the survey on the regional and provincial levels shows a similar pattern, emphasizing the risk that southern Italy may risk to become lagging behind in the process of implementing e-government especially at the local levels.

 A main conclusion on both the Danish and the Italian CTM is that in both countries the municipalities are concerned with providing access to information rather than offering tools for participation and two-ways communication online. However, a few examples of better practise exist but they are more often found at the regional/county levels.

 In Denmark, the higher sophistication of the county PAGIWEB compared to the municipal PAGIWEB is not surprising. The combination of physical size, complexity of tasks, and economic capacity in the counties were fundamental determinants in that the counties' departments for nature and planning were among the pioneers of GIS use from the very beginning, and that they still hold the lead of geo-tool implementation. In Italy a similar trend was found observing the local and the

regional levels. In Denmark moreover, a strong professional network between the GI-professional in the counties have further served to consolidate their leading position, taking advantage of synergetic effects of common data models, application development etc. The CTM clearly reflect this fact, and also shows a will from the counties to do more than just inform the public. This attitude should be adopted by the municipalities in the future, as the situation at present clearly shows a tendency towards informing the public rather than involving the citizens actively in the planning processes, at least when it comes to the implementation of relevant GI-based tools. As a matter of facts, this is not just a simple matter of implementing the adequate technology. When it comes to a thing like offering the municipal data freely for download, legal, institutional and economic hindrances block the way. 35 years of autonomy at the municipal level, and a huge variance in the size and capacity of the municipal administrations across the country have not led to a synergetic cooperation like the one at county level. In the near future the 270 Danish municipalities are being merged to 99, and the county level of administration will no longer exist. The administrative tasks of the counties are being transferred to the municipalities and to national centres of competence. How the picture of PAGIWEB diffusion will look like in two or three years is therefore a very open question.

CONCLUDING REMARKS AND FURTHER INVESTIGATIONS

The CTM classification method has proved to be a useful way to relatively fast build an overview of the diffusion of PAGIWEB. The scales of content and technology, C1-C4 and T1-T5 are nominal in nature but do also imply a clear progression towards more advanced tools and higher levels of interaction and participation. Although the allocation of the PAGIWEB to the specific cells in the CTM rely on judgement, and hereby is prone to a slight subjectivity, it is fairly easy to determine which cell a certain PAGIWEB falls into. Hence the resulting classification can be considered quite consistent and forms an adequate basis for comparison between the two countries. However, comparing absolute measures is not meaningful if the samples are not of an even size. Therefore the spatialisation of the CTM is a valuable tool to achieve a normalised result upon which analysis can be made directly. In this way the CTM classification method has helped answering the question of « What is out there ?», and in answering that question already forming the basis of a lot of questions of « Why ? » to be investigated further in the months to come.

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