SHARING KNOWLEDGE IN SPATIAL INFORMATION MANAGEMENT

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ABSTRACT

Spatial Information Management (SIM) seeks for data, but also for knowledge base. The main categories of partners involved are Customers – Business – Government. What do they know / expect from each other? How do they cooperate / interact? We should know it and we should share our knowledge about it.
***S**patial **Data I**nfrastructure* has to be enlarged to ***S**patial **Information I**nfrastructure* and finally to a ***S**patial **Knowledge I**nfrastructure*. This paper focuses on a proposal to create focal point for a knowledge base providing information about the essential elements of SIM in different countries.
Providers have to shift their point of view to the consumer's perspective for understanding their daily challenges. All the different services and products would need much more coordination. Increasing the knowledge about "what is needed" and "how does it develop somewhere else" can facilitate a more harmonized development by increased awareness and opportunities for cooperation on multi-national projects which is shown by example.

1. INTRODUCTION-RELEVANT EXISTING ACTIVITY

In a "knowledge society" geo-products and geo-services are becoming more integrated and "intelligent" with the demand on organizations and their "knowledge workers". Infra- and supra-structures are developed –driven by demand- on different levels with interrelated components like communication networks, data infrastructure and e-business.

At a *global level*, the broad use of new information and communication technologies constitutes an important tool for Spatial Information capturing and handling focused on the environmental monitoring and the natural resources protection, an issue of first-priority importance for the management of the global world's raising problems, such as the rapidly increasing population and the accompanying increasing demands for agricultural production and water resources. There have been already underway several programs for implementing transnational geo-spatial data infrastructure, by government, military and commercial interests, which aim to improve quality of observations and interpretation, manage large quantities of global data, and communicate the results of global change research to the international community (Coleman & McLaughlin, 1997).

The provision of digital spatial data at the various mapping scales has started not only in North America, Europe and Australia, but in developing continents as well, which follow this activity closely.
An important example is the Global Mapping Project (started in 1998), which aims to an updated global environmental monitoring and to identifying future challenges. It is a global spatial database, of one-kilometer ground resolution, and is to be revised every five years. It's content is equivalent to conventional maps at a scale of 1:1,000,000, and the version 1.0 for six countries is since the year 2000 available, via internet (Une et al, 2001). And by the year 2002 a more homogenized and geometrically corrected digital map 1:200,000 may be generally available.

From a *European point of view*, an improved access to information can also largely benefit the European integration process. The initiation of IT systems in all levels of public administration, the establishing of common standards and the creation of a networking environment will improve the quality of life in all fields, such as: environmental services, transport/ communications, health, education, employment, economic growth/ businesses, cultural heritage.
According to the "EU Green Paper on Public sector information in the Information Society (IS)", January 1999, public sector information in all above mentioned fields can be of

- Administrative nature, which relates to the function of government and administration, i.e. laws, court cases, Parliamentary information etc, or
- Non-administrative nature, which relates to information of the outside world that is collected during the execution of public tasks, i.e. *geographic/ spatial information*, statistical information, information about business, etc.

It is often claimed that more than 80% of the public sector information has a geographic dimension in that it is referenced by address or location. The importance of raising the awareness both among the population and the key decision makers in the political arena/ senior government officials of the opportunities opened up by spatial information and its associated technologies and new collection/ handling/ sharing developments has been one of the main objectives of relevant associations on international level like UN (www.un.org/Depts/Cartographic/english/htmain.htm), FIG (www.fig.net/) and ISPRS (www.isprs.org). On European level associations such as: EUROGI (www.eurogi.org/), EuroGeographics – former CERCO + MEGRIN (http://www.eurogeographics.org/), highlighted that issues at numerous meetings, publications and relevant projects, such as: the framework for the first stage of establishing a geographic information strategy at a European level (EUROGI, 2000); the EUROMAP project (www.megrin.org/ PROJECTS/PETIT/Petit.html/), which deals with homogenized and geometrically adjusted European digital maps at national scale coverage; the CORINE project which considered the requirements for geographic information for environmental issues in Europe (http://etc.satellus.se/he_data/index.htm); the effort towards the creation of a European Reference Data set, etc.

At *national and local level*, the promotion of the IS within each country also facilitates the creation of tools for modern, more democratic states via opening of the public sector and the improvement of relations between the state and the citizens, safeguarding citizens' rights, pluralism and the freedom of expression and access to the information in a

competitive environment. The Government Information Age programs that are now underway have tightly monitored timeframes for implementation and as a result are putting into place the hard and soft infrastructures that enable e-government, e-business, and e-citizen to become a reality. Examples for that development can be found under: www.imagi.de/, http://nationalatlas.gov/, www.auslig.gov.au/asdi/. There are also interesting cooperations of private information providers like www.geoswiss.ch/.

The rapidly emerging spatial information management activities resulted to a considerable large number of independent spatial public databases, within each country. To help the various types of "information-users" to find their way in this mass of data, a new, better-organized spatial data collection, management and sharing system within the various organizations, at national level is necessary.

2. SHARING KNOWLEDGE IN SIM

Global monitoring needs small-scale data sets. Regional or national monitoring needs medium scale data, and local issues require large-scale data sets. According to the UN official enquiry, compiled in 1990, about the current status of mapping in the world at medium and small scales, mapping on land area of the globe is nearly complete at 1:200,000; 2/3 of this area is complete by 1:50,000 maps, and 1/3 by 1:25,000 maps. The updating of these maps is far from satisfactory. It is 3.5% (or every 30 years) for 1:2000,000 maps, 2% (or every 50 years) for 1:50,000 maps and 5% (or every 20 years) for 1:25,000 maps. Only Europe with about 7.5% (every 15 years) has a much better update rate. The situation can only be improved by the new data acquisition, management and analysis technology. It is clear that, in recent years, to facilitate global, regional and national / local monitoring the number and variety of applications for the parallel building of small-, medium- and large-scale datasets has been increased rapidly, and indications are that this trend will continue.

A SIM system must serve particular purposes for which it is necessary to select and provide pertinent information, to have the necessary and cost effective accuracy standards, to follow cost-effective updating methods to keep information valid, to analyse the data and utilize them for planning implementations, administrative uses, public information, monitoring the natural and social environment. Currently, 25% of all GIS uses are in the area of facilities management by utility companies, 19% on land information, 13% business applications, 11% environmental applications and 9% basic cartography. (Konecny, 2000).

Much of the existing information cannot be cost-effectively integrated into a SIM structure; therefore the creation of meta-data bases is necessary. So, many countries have already introduced the vision of a NSDI, some of them are quite ahead by having already established a policy and a responsible organization, which operates a data-sharing system.

The achievement of a better communication, cooperation and coordination of the responsible National SDI organizations, at international level, would be of great importance. A step to that direction could be a better-organized *knowledge sharing system*

or more simply: *a knowledge base*. The main categories of partners behind all this movement are: *Customers-Business-Governments (C-B-G)*. What do they expect from each other? How do they cooperate / interact? Countries that are "ahead" seem to be more experienced in issues of implementing such a network of spatial data infrastructure, sharing data between C-B-G. Yet, not all countries can face the challenge and follow closely, but all countries have established some kind of spatial data infrastructure. While dealing with geo-spatial data, collecting, processing, delivering and sharing geo-information among different stakeholders, serious problems arise. Many countries are interested in sharing experience, or need the contribution of some "experts" to overcome all kind of constraints while running their projects.

The success of a project is not depended just on

- *Theory/ education* - there is plenty of academic research literature and experienced academics in the field, in most countries, or of
- M*oney* or *specialised personnel and equipment* - in many countries there is enough access to new technologies and methods and governments have already reached a consensus that initiating a national spatial data infrastructure is an urgent need to avoid, among others, duplication of costs and have updated information available both to the public and private sector to improve the business market.

What is really needed is a *combination* of the above, together with a number of *administrative, legal, political and economic/business knowledge and willingness of interdisciplinary cooperation*, which would lead a country to the Information Society. It is clear that the contribution of "experts" is not enough.

In order to face every day rising problems in such immense efforts towards implementing NSDI projects, what is really valuable is to share experience and knowledge. We should know the state of the art in other countries and *share knowledge*. Spatial Data Infrastructure has to be enlarged to *Spatial Information Infrastructure* and finally to a *Spatial Knowledge Infrastructure* (G. Muggenhuber, 2001).

For the sustainability of SIM, providers have to shift their point of view to the customer's perspective for better understanding their daily challenges. All different services and products would need much more coordination. Increasing the knowledge about "what is needed" and "how does it develop somewhere else" can facilitate a more harmonized development by increased awareness and opportunities for cooperation on multi-national projects.

This paper focuses on a proposal to create focal point for a knowledge base providing information about the essential elements of SIM in different countries. It is of high importance to have easily accessed, simply structured and annually updated, essential information, available to anyone interested.

3. PROPOSAL FOR STANDARDIZATION OF INFORMATION INCLUDED IN THE FIG COM3 COUNTRY REPORTS

Since many years FIG-Commission 3 has developed a considerable activity in the field of Spatial Information Management. The national delegates have presented a great number of country reports during the annual meetings, describing the progress in the field. It is acknowledged that the annual country reports are a valuable source of information about the new trends and activities within various countries. Yet, since there was no further processing of these reports, most of the included information remained "buried" and not easily used by a wider community of interested experts.

During the FIG meetings in Prague (WW 2000) and in Athens (Com3 annual meeting, October 2000), it was suggested that it would be very helpful to put some effort and try to make a first processing of the collected information, already presented as national reports in Prague and in Athens, so that in future some real comparisons about trends and activities in SIM over time and also across countries might be possible. The first results of this primary processing were presented in Seoul, Korea in May 2001. It was suggested, that country reports could have some kind of "common structure". A number of issues, which were considered to be of common interest, were selected and presented, and it was suggested that national delegates might use this as a framework, and include such kind of information into their presentations, so that gradually, year by year, this would lead to a more standardized structure, and through that, a better processing of the collected information can be achieved. The framework suggested (C. Potsiou et al, 2001) consists of the following units:

Section 1 focuses on *brief general information* and *basic statistical indicators for easier comparison*, such as:

country area (km2),
population,
education in geo informatics (postgraduate courses, on-going training),
organizations and professions actively involved in SIM
number of surveyors/ GIS specialists (the role of surveyor related with SIM),
internet access and its increasing rate,
main publications on the field (i.e. magazines, conferences)

In *Section 2* a *short description of the state of the art in NSDI* is given, together with a *brief definition of the vision*.
Basic aspects should be mentioned here. As mentioned above, all countries have a kind of spatial data infrastructure. Some of them, due to some serious reasons, are still at the traditional stage, at which they try to pass from analog cartography to GIS applications and to the fully digital phase; some others have already reached the second phase, at which they try to establish the strategy for digital spatial data management; and some others have proceeded to the third phase, and have operating clearinghouses for data sharing, and provide both data and services electronically through Internet. According to the situation, delegates may describe briefly issues like:

- Has the government so far reached a consensus that a national spatial data infrastructure is needed and when was that?
  At what phase of development is the NSDI at your country? For example: What is the concept, what are the values to the society? Does a working system for SI exchange at national level already exist?
  What are the budget / funding sources? Is it sustainable – what are its recoverability perspectives?
- Or, is the system developed experimentally at local level and in various agencies of public and private sector, or just pilot studies and initial efforts are made in implementing a SIM policy/strategy?
  SIM policy primary concerns the actions of governments with respect to the issues such as access, pricing, privacy, liability, and copyright. In much of this debate SIM issues form part of a much broader debate concerning national information policy and open government.
  What administrative measures are taken place? (i.e. like the establishment of the responsible agency/organization).
  What relative preparatory activity is been compiled, for example standardization of spatial data, building the system for information exchange, etc.
- Or, if nothing about all the above mentioned happens and the country still has the traditional cartographic infrastructure and activity, then some short description of the existing barriers and problems should be given, for example the lack of basic infrastructure (technical or legal), of availability and accessibility to new technologies and methods, educational issues, lack of funds perhaps and/or coordination in geo-info activities, etc.

Section 3 focuses on the necessary legal framework for a NSDI.
At this part questions like the following can be addressed:
Is there the necessary political support?
What is, in brief, the existing legislation for the initiation of a NSDI, for example the creation of a responsible organization and where does this organization belong administratively?
What is the legislation that rules its operation, are there any existing strategy documents?
Is there any legislation that rules the access to the data, the rights to the data, the protection of databases, the copyright, and the digital services through Internet?
In the cases that no such legislation exists, then it would be useful to mention relative legislation concerning spatial data, GIS, main cartographic purposes.

Section 4 collects indications about basic characteristics about NSDI organizations,
which operate already, such as: the organizational plan, human resources/personnel, data providers/users.
In the case of no such organization, existing spatial data providers and main public or private organizations for spatial data collection and sharing are to be mentioned.

Section 5 focuses on the technical aspects of either an existing/operating data sharing system, or of a system under development. That is information about the:
- Structure and operation of the network, hardware, system and application software,

- Data modeling (contents, structure),
- Standards and technical specifications,
- Metadata,
- Compilation time,
- Maintaining-updating frequency,
- Data capturing and updating methods (such as: traditional, GPS, digital RS, digital photogrammetry),
- Quality control process,
- Geodetic infrastructure - control networks - reference systems -projection,
- Main map series-scales- and the coverage,
- Existing databases,
- Products, value-added products/ services,
- Clearinghouses, delivery mechanisms of data,
- Accessibility,
- Internet (data, services).

Section 6 collects information about the pricing policy and financial issues, such as:
- Level of privatization,
- Price of data/ services, commercial involvement/business culture,
- Profit from the products/services,
- Self-recoverability perspective.

Section 7 refers to future plans/strategies and research activities
The future NSDI strategy plan especially of the countries that are "in front" is of great value, for those countries that are trying to establish their own policy. Also, many organizations have developed research activities in cooperation with universities and other educational institutes, such as in KMS, Denmark (Dougberjerg, Brande-Lavridsen, 2000). It would be of great help to mention some of the research issues, new trends and results.

Section 8 refers to international co-operations and participation to international or transnational projects,
For example like those carried out by EUROGI, EuroGeographics, GLOBAL MAPPING, etc, the type, scope and budget of each project, (Greunreich D., 2000)
recent results/ level of development, *or,* support projects *like: PHARE, World Bank.*

Section 9, the *identity data* of the author (name, address, e-mail) are mentioned together with *references*.

4. EXAMPLE OF A STANDARDIZED COUNTRY REPORT

An example of a standardized country report is given below, as it was derived from a first processing of the given presentation. It was selected to be the country report of Burkina Faso, as it was a paper with enough information, representative of the state of the art in countries that are more close to the traditional stage, trying to pass to the fully digital phase and trying to introduce an infrastructure for better coordination of their products and services.

4.1 Country: Burkina Faso

4.1.1 General Information – Statistical Data
Area: 274.000 Km^2
Population: 12 millions, growing rate 2,68%, 20% in urban areas, 30% educated
Education in geo-info: <50 surveyors of bachelor level, approx. 250 technicians
Role of the surveyor: restricted mainly in public sector trying to set up a cadastral system in urban land; 15 private companies.

4.1.2 Description of the state of the art in NSDI
There is a strong need for NSDI, yet there are some barriers: lack of coordination of running projects, lack of standards/ official norms, insufficient training, old fashioned equipment, lack of policy, technical problems i.e. many existing systems of geodetic infrastructure.

4.1.3 Legal framework
Relative legislation:

1904	Law for West Africa French Colonies for "security of Land Tenure"
1932	Land Policy
1960	Law 77/60 recognition of customary ownership
1984	All rights transferred to the government
1991	Possibility for private property
1996	Liberalization of land market, Law 14/96/ADP

4.1.4 Basic characteristics about NSDI organization/ responsible agencies
No main organization- 22 GIS data providers, most of them are projects of World Bank/International Cooperation funds.

4.1.5 Technical Aspects
Geodetic Infrastructure:

1950	Astronomic network of 200 points, compiled by IGN-France. Coverage: all West Africa French colonies. Ellipsoid: Clarke 1880. Precision: approx.50m. Projection: UTM Fuseaux 30&31
1958	Triangulation of Quagadougou area (54 points), compiled by IGN-France. Coverage: 9,500 hectares. Ellipsoid: Clarke 1880. Precision: 9cm. Projection: UTM Fuseaux 30
1960	Points (46) along the 12^{th} parallel by IGN. Coverage: line of the 12^{th} parallel. Ellipsoid: Clarke 1880. Precision: 10-20cm. Projection: UTM Fuseaux 30 & 31. Datum: ADIN DAN
1979	Doppler Network (16 points). Coverage: all country. Ellipsoid: by Doppler on WGS 72, computing final results Clarke 1880. Precision: approx.5m
1997	Official geodetic network- 55 GPS points. Ellipsoid: WGS 84, GRS 80, Clarke 1880. Precision: 7-10cm. Projection: UTM Fuseaux 30 & 31.
2000	More than 217 points

Databases:

1998 Rural Cadastre: transformation of customary rights to legal rights-No spatial data

1980 Urban land management in two main towns

4.1.6 Pricing Policy

Not available

4.1.7 Future Strategies and Research Activities

Continuation of existing projects

4.1.8 International co operations/ support projects

World Bank: "Urban Project III" in two towns

4.1.9 Identity Data-References

Alain S Bagre, Land Surveyor and Urban Planner, Correspondent Member of FIG, e-mail: abagre@fasonet.bf

"Surveyors and Land Information Management in Burkina Faso, Which Role in the 3rd Millennium?", Presentation at the annual meeting of Come of FIG , Athens 2000, Greece.

5. EXPECTED RESULTS – FUTURE PLAN

Based on the described above framework, the so far collected recent country reports, mainly at the meetings in Prague, Athens and Seoul, are being processed so that they get a standardized structure and become more short and easy to be read quickly. An effort will be made so that more information (concerning more countries) will be added, derived from other relative publications, and international meetings, like the "Survey of National and Regional Spatial Data Infrastructure Activities Around the Globe" collected and provided by Onsrud's questionnaire, available in the Internet.

So far it has been collected information about: Great Britain, Norway, Finland, Denmark, Germany, Czech Republic, Austria, Hungary, Greece, Israel, Ecuador, Korea, Japan, Portugal, etc.

The vision of the present task is not simply to create a database, but to publish these data in an open format, through a geographic network over the Internet, easily able for access and analysis by everyone. The basic idea is that data are collected from country reports, which have a free text format -a questionnaire is considered to be quite restrictive- but delegates should try to include information as described at the proposed framework, so that all country reports will have a similar structure. Through that, a more complete description of the infrastructure of each country may be achieved, which will be for the benefit of both the country itself, since a systematic survey of the state of the art of the on-going activities is always a helpful tool, and for the broader community of FIG Com3, since a knowledge infrastructure will be provided to all members of the broader community.

The construction of a prototype is already under development, and a first version of it will be presented in the next FIG WW in Washington, together with some statistical data derived from the system. These statistics will refer to the existence of clearinghouses for spatial data sharing, the digital spatial coverage %, the availability of data and services through Internet and the consumer's perspective.

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BIOGRAPHICAL NOTES

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Dr. Rural and Surveying Engineer, Researcher, Lab. of Photogrammetry, Department of Rural and Surveying Engineering, National Technical University of Athens (NTUA), Greece.

Borne in 1959, graduated from NTUA in 1982, Phd in the field of Spatial Cadastral Information capture and management: 'Digital Spatial Data for the Hellenic Cadastre', from NTUA, in 1995.

Since 1982, she has worked as a professional Surveyor Engineer in Greece, mainly in Photogrammetry and Urban Planning studies. Since 1993, she works at the *Lab. of*

Photogrammetry of NTUA, teaching Photogrammetry, Cadastre and Cartography and participating in research programs. Her research activity focuses on the fields of Cadastre, GIS, terrestrial and digital Photogrammetry. For the periods 1992-96 and 1996-2000, she is elected member of the Council and Treasurer of the Hellenic Society for Photogrammetry and Remote Sensing. She speaks: Greek, English, German. For the period 1994-97, she worked for CIPA, as secretary of the President (International Society for Architectural Photogrammetry). She has organized national and international meetings and seminars in Greece. Since 1982 she has participated in many FIG (com7 and com3) and ISPRS meetings presenting her work. Since 1998, she works as *Technical consultant at Ktimatilogio SA* (Hellenic Cadastre) and participates in WPLA and UN-ECE and CERCO meetings. She is delegate of the Technical Chamber of Greece in FIG general assembly and she is also active in Com3, as chair of WG3.1.

Gerhard Muggenhuber
Has obtained a diploma in Civil Engineering (Surveying) from the Technical University of Vienna and in addition completed postgraduate studies on Geo-Information. 1993-97 he was head of the cadastre-planning department and since 1997 he is head of ”international affair” – both at the *Federal Office for Metrology and Surveying (BEV)* in Vienna, Austria.
Gerhard Muggenhuber has some 20 years of professional experience in management of cadastre and Geo-Information in Austria as well as abroad.
In his present function as head of international affairs at BEV he took part on several international initiatives on various cadastre issues to be initiated in Eastern- and Central European countries. As an active member of bureau of the Working Party on Land Administration (WPLA), an advisory body on land registration matters to the UN-ECE in Geneva. He is also active within *FIG* and was recently elected as Vice-chairman of *Commission 3 (Spatial Information Management).*

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Borne in 1959, graduated in 1982 from Dep. of Rural and Surveying Engineering, NTUA, Phd in Photogrammetry and Cadastre in 1992.
Until 1996 he worked both at Private Sector and the NTUA in the teaching of Photogrammetry and Cadastre. 1996-2000 Lecturer at the Lab. of Photogrammetry of NTUA. Since 1996 he is teaching Photogrammetry and Cadastre.
His research interests focus on terrestrial Photogrammetry, aerial rtriangulations, digital orthophotos, applications of digital Photogrammetry on the Cadastre and GIS. He has authored 30 papers, in the above fields, and he gave lectures in related seminars both in Greece and abroad. For the period 1992-96 he was co-chairman of the WG2-‘Computer Assisted Teaching’ in Commission VI of ISPRS. Since 1997 he is member of the Directing Council of Hellenic Mapping and Cadastral Organization.
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