Mauro Salvemini* | # Spatially enabling e-government through geo-services

**Abstract** E-government, already well-known, is evolving towards "geo-government" through the use of geospatial data, web-based information services (geo-services) and data infrastructure. This trend is a global one and for some years now several international agencies have focused on the issue, receiving regulatory and methodological indications from the EU INSPIRE Directive in order to create European spatial data infrastructure and furnish operational guidelines to member states. Some European projects have facilitated this evolution – and are continuing to do so - by creating opportunities for national and sub-national entities.

## FOREWORD

The present document refers to the paper already presented at the *9th Ninth United Nations Regional Cartographic Conference for the Americas*[1]*,* New York, 10 - 14 August 2009 and it continues the discussion of how to integrate *e-go*vernment and geographic information for providing the most efficient services to the inhabitants in various spatial and temporal situations.

The paper summarizes some of the actions already developed on the European Union (EU) level considering national and sub-national initiatives. The paper discusses the European project under e-contentplus programme (e-SDInet+) project focusing on some practical aspects and briefly addresses some theoretical issues. Moreover, on the side, some basic information regarding European policies relating to Geographic Information (GI) is summarized in order to build and share a common basis of knowledge.

## E-GOVERNMENT AND GEO-SERVICES

*Geo*-government (*geo-gov*) is the ability of public authorities to use geographic information for managing, controlling and planning human activities and the nature of the territory. *Geo-gov* comes about if the geo-information is bundled within public administration initiatives in a way that the final user (generally the citizen but also the environment and the wildlife) obtains fully recognized advantages which may not be achieved without using geo-information and SDI .

*Geo-gov* practices use and orchestrate web services which use GI, so called geo-web services, and traditional web services and/or software programs for treating and delivering results to final users. Since the beginning, *e*-government services have been developed and widely used mainly in nations where they may be economically and socially sustainable. In countries and/or situations where

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1  http://unstats.un.org/unsd/geoinfo/RCC/docs/rcca9/ip/9th_UNRCCA_econf.99_IP12.pdf

primary needs are not fully satisfied, both the *e-gov* and GI may easily appear as a deep divide. This situation implies the application of the frequently used axiom: no cartography = no development. According to this and in order to create development, many resources are being invested to build cartography and data bases which, contrary to the previous axiom, are difficult to be used by the local population for its benefit. The lack of available technology, the disconnection from real local needs and the not easily understandable differences in representing reality are the principal reasons for not making GI usable and useful in so-called developing communities.

It has been largely demonstrated that GI is in the knowledge and memories of the populations. Because of this, the action of giving benefits through the GI should be reversed insuring how to provide useful services to the population by extracting information from their knowledge and use of the territory.

Some considerations about how to provide services is also necessary. Not only should the www. be considered as the only system for providing information and services but some other (telephone, radio, TV, door to door , etc. ) systems should be considered. Some of them are suitable in emergency management and some others already demonstrate their efficiency by providing real geo-based services to populations in disadvantaged areas.

According to the previous assumptions, the SDI becomes a more complex system efficiently attuned to real information derived previously from the inhabitants, aiming at providing useful and sustainable services.

In my opinion, in order to maximise the effectiveness of the results, our attention has to be turned to Spatial Data Infrastructures as a comprehensive system which satisfies the need of the users (citizens, inhabitants) placed at the centre of the scene. The spatial component of data in the infrastructure has always been present, but sometimes it was hidden and/or bundled within data and information collected and stored in systems and or simply provided to the decision-making process. Therefore the real strength of the DI (Data Infrastructures) has been, and is still, based on the majority of situations, on the infrastructure itself.

This hampers the advantages of using geographic data in the services provided to citizens. Therefore, in the most common situations on a global level, public administrations are focussing more on the development of infrastructure than on the results produced.

This implies that very much effort is used, especially in developing countries, for transferring models and infrastructure already developed in more wealthy situations and societies. This does not contribute to eliminating the divide unless sustainability is insured and the real needs of the population are clearly placed at the centre of the SDI discourse universe.

What does this infrastructure represent for the public administration concretely? In physical terms, the infrastructure refers to spaces hosting employees, visitors and archives as well as roads and routes, cables and networks allowing the circulation of papers, forms, certificates and information. In immaterial terms, the infrastructure is represented as the set of rules, procedures, specifications, data and information which govern the production, distribution and usage of services and the functioning of the infrastructure itself. When building SDI, public administrations often privilege more tangible and industrial aspects.

The paradigm of paying attention to IT aspects of infrastructure needs to be changed for the benefit of the final users who require results and services on time and where necessary.

This is absolutely demonstrated by the fact that the geo-services offered and/or supported by SDI are used locally by end-users whose own identity is reflected in the services requested and by the fact that the *geo-gov* as a whole policy acts locally as already experienced by *e-gov.* The approach of providing services where they are needed and for the direct users helps reduce the digital divide and *de-facto* facilitates social and economic development.

Today, the way in which Europe acts shows some very interesting peculiarities in the sense that it promulgates a Directive (see paragraph below) for removing inefficiencies and improving value and quality in the provision, sharing and use of GI. To have National SDIs developed by the Member States collaborate under the aegis of a commonly agreed Directive and then to proceed by implementing

technical regulations and common data models seems the most effective way for maximizing results while respecting the identities and the peculiarities of each nation and its territory.

The Directive does not address the realization of infrastructure but with its efficiency and sustainability. The Directive's legal framework seeks to allow the composition of all data and services. The model is an equal opportunity model for all data and providers and is based on the principle of subsidiarity. The strength and applicability of a subsidiarity model for developing SDI is largely demonstrated by the fact that it is applied in the majority of the European nations between the central and local levels (nation-regions, nation-provinces, region-provinces, etc.). The issue of the relationship between central and local SDI is becoming increasingly important within the political trend of the devolution to local governments in the EU and represents foundations for collaboration with countries from other continents.

It should also be clear that the way of achieving social and economic development should be consistently based on education, research and training institutions that can produce not only GI specialists and GI users and products but also specialized professionals for designing and developing geo-services. On the other hand, if these components are not all present, it does not mean that a nation or a community cannot have the chance to join to an SDI.

After some beneficial years of investigation and technical and scientific findings mostly based on the axiom of interoperability, it is now time to overturn the SDI praxis shifting the effort of public administrations from driving technology to driving social and economic progress in order to ensure society's development by offering finalized and local services based on GI and technological achievements. This can be achieved through the rigorous analysis of real user needs, an effective design process and the investment of adequate resources within a framework of user capacity building .

## E-GOV SERVICES, GEO-GOV SERVICES AND EMERGENCY MANAGEMENT

*E-gov* services should be developed according to the conditions of the local community. Geo-services not only represent the natural evolution of *e-gov* services but can also be developed for managing specific emergencies occurring in the absence of adequate *e-gov* services.

The use of geo-services in disaster and emergency management is an effective example of the relevance of GI but other domains such as agriculture, aquaculture and fisheries, forestry, settlements and others can be considered as fields for application in which GI is absolutely mandatory and which can be adequately developed for delivering services to communities which are, are not or are on the way to, using *e-gov* services.

It does mean that the geo-services and SDI should not necessarily be developed on the already existing *e-gov* infrastructure and that the data infrastructure of *geo-gov* services can be autonomously developed respecting the interoperability principles upon which data infrastructure practice is based.

## EUROPEAN SPATIAL DATA INFRASTRUCTURE: THE CHALLENGE

The meaning of Europe needs some explanations. The "European Union" (EU) refers to the current political association of 27 Member States (MS) which form an economic and political union. It should be openly recognized that, in the EU, the peculiarities and diversity of historical, political and social features, which characterize each Member State (MS), generally divided into sub-national areas with their own identity and power, make it extremely difficult to have a single European view of anything. Nevertheless it is possible to record a common approach of the MS governments in treating specific aspects which have been addressed and agreed upon at EU level such as, in the specific domain treated by this paper, the *e-gov*ernment, environmental issues, Geographic Information (GI) and other related techniques.

It is worth knowing that the EU acts with MS through Directives which, after their approval by the EU Parliament, must be transposed and implemented within each national legislation through specific national legislation. Default in implementing EU directives can open infringement procedures by the EU against the defaulting MS.

The European Commission (EC) (formally the Commission of the European Communities) is the executive branch of the EU. This body is responsible for proposing legislation, implementing decisions, upholding the Union's treaties and the general day-to-day running of the Union.

The most relevant and recent directive regarding GI was passed by the EU Parliament and came into force on 15 May 2007; it is named INSPIRE( Infrastructure for SPatial InfoRmation in EUROPE)[2]. The Directive sets a general framework for a Spatial Data Infrastructure (SDI) for environmental policies and for policies with clear impacts on the environment. INSPIRE seeks to improve interoperability and access to spatial information across the EU on local, regional, national and international levels, facilitate the sharing of GI between public authorities and the improvement of public access to spatial information.

INSPIRE is also complementary to related policy initiatives, such as the Directive on the re-use and commercial exploitation of Public Sector Information. INSPIRE is based on the premise that European spatial data infrastructure will be built upon national infrastructures that have already been established and operated by the MS. Five key principles have been highlighted since the signature of agreement among three Commissioners of the EU Government. They represent the pillars of the initiative which began more than five years ago and is today consolidated within the Directive.

1.  Spatial data must be stored, made available and maintained at the most appropriate level.
2.  It should be possible to combine spatial data from different sources across the community in a consistent way and share it among diverse users and applications.
3.  It should be possible for spatial data collected at one level of public authority to be shared among other public authorities.
4.  Spatial data should be made available under conditions which do not unduly restrict its extensive use.
5.  It should be easy to discover available spatial data, to evaluate its suitability for a given purpose and to know the conditions which apply to its use.

These principles clearly address the ambition of INSPIRE which intends to trigger the creation of a European spatial information infrastructure that delivers integrated spatial information services to the users. These services should allow users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an inter-operable way and for a variety of uses. The target users of INSPIRE include policy-makers, planners and managers on European, national and local levels as well as citizens and their organizations. Some examples of possible services are: the visualization of information layers, the overlay of information from different sources, spatial and temporal analysis, etc.

A key part of the Directive is in three annexes[3] which cover the priority data themes addressed by the Directive and they are covered by its daughter legislation which takes the form of Implementing Rules (IR) regarding specific aspects.

At the moment these IR cover five major issues: Metadata, Interoperability of spatial data sets, Network services, Data and service sharing, Monitoring and reporting. They will become legally binding as a EU decision through a comitology process set up on the EU level as part of the legislation.

The deadline for Directive transposition was in May 2009 but it has to be said that, despite the broad

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**2**  http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2007:108:SOM:EN:HTML translation in all EU languages may be found at this reference.
**3**  ANNEX I - SPATIAL DATA THEMES REFERRED TO IN ARTICLES 6(A), 8(1) AND 9(A): 1. Coordinate reference systems; 2. Geographical grid systems; 3. Geographical names; 4. Administrative units; 5. Addresses; 6. Cadastral parcels;7. Transport networks; 8. Hydrography; 9. Protected sites.
ANNEX II - SPATIAL DATA THEMES REFERRED TO IN ARTICLES 6(A), 8(1) AND 9(B):
1. Elevation; 2. Land cover; 3. Orthoimagery; 4. Geology
ANNEX III - SPATIAL DATA THEMES REFERRED TO IN ARTICLES 6(B) AND 9(B):
1. Statistical units; 2. Buildings; 3. Soil;4. Land use;5. Human health and safety; 6. Utility and governmental services; 7. Environmental monitoring facilities; 8. Production and industrial facilities; 9. Agricultural and aquaculture facilities; 10. Population distribution — demography; 11. Area management/restriction/regulation zones and reporting units;12. Natural risk zones;13. Atmospheric conditions; 14. Meteorological geographical features; 15. Oceanographic geographical features;16. Sea regions;17. Bio-geographical regions; 18. Habitats and biotopes;19. Species distribution; 20. Energy resources;21. Mineral resources

consensus and strong support that has been received since its inception from the majority of the scientific and technical communities and public administrations, after two years of becoming legally binding, only a minority of the MS have already completed transposition. Nevertheless the adoption phase of the IR, which runs parallel to the transposition process, will last until 2012 with phased compliance between 2010 and 2012.

Despite of the delay in transposing the Directive into the different national legislations, the Directive itself has influenced, and is continuously influencing, public authorities on the sub-national level. This is a multiplier factor for spatial information in many final user-oriented services provided by central and local public authorities.

## THE MODEL OF ESDINET+ PROJECT FOR CAPACITY BUILDING AND AWARENESS RAISING

Along with and in support of the INSPIRE Directive and since the early decision to take the initiative to set up an EU infrastructure for spatial data, the European Commission (EC) has undertaken a number of activities. Research projects, thematic networks and pilot industrial projects have been financed in order to set up scientific, technical, operational solutions and practices together with exploring and establishing adequate and sustainable models for maximizing and enhancing the use of GI within the EU.

It is worth focusing on capacity-building and awareness-raising at the end of the services chain. According to the previously discussed features of subsidiarity and applying the practice of web services and their architecture together with the principles of SDI regarding data and GI, local authorities can easily be identified as the focus of the entire system.

eSDI-NET+[4] is a thematic network project aiming at the promotion of cross-border dialogue and the exchange of best practices on SDIs throughout Europe, bringing together and bridging key stakeholders of European SDIs and the realization of a platform for communication and exchange of knowledge on all levels, from the local to the global. It runs under the specific program, *e*-Contentplus[5], which provides measures to make digital content in EUROPE more accessible, usable and exploitable. The network involves 21 participants all over Europe and includes associations, institutes, universities, private companies whose work is related to Geographic Information, and promotes dialogue between them.

Since it has been demonstrated and deeply discussed that the local dimension plays a key role in the sustainability of SDI and in providing services to citizens and interfacing the higher level of the public administration mainly providing data and resources to it. The study of the model used in the aforementioned project eSDI-NET+ is useful for the possible adaptation to different contexts and for understanding the real impact of legal frameworks relating to the impact of SDI on local public authorities.

The main goal of the eSDI-Net+ project was the establishment of a "European Network on Geographic Information Enrichment and Reuse." Its intention is to bring together existing key players in Spatial Data Infrastructures (SDIs) and target users in a European Thematic Network to be established as a platform for cross-border dialogue, for information exchange, low-level technical discussions and high-level decision-making.

It is worth noting that some local public authorities often play the role of key player and target user of advanced technologies and innovative solutions for providing services to citizens based on the direct links and interface with the territory and the population.

If local public authorities, even of different nations, can share experiences, knowledge and even data within a network, this builds an absolute capacity for rendering national and international SDI sustainable.

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4 **http://www.esdinetplus.eu** - the project was completed in the second half of 2010. The web site records all the essential documents. It is worth it to highlight that EUROGI, with its experience as an umbrella and networking organization, decided to support the sustainability of the network. The initiative and the efforts of the project will be continued and the long-term perspective for the investment of the European Commission towards a European Spatial Data Infrastructure will be ensured.

5 http://ec.europa.eu/information_society/activities/econtentplus/index_en.htm

It has also been demonstrated that the commonalities increase when descending the scale of the services, therefore the closer the final local service is to the citizens the more it is similar to another service differently located.

The network aims at increasing awareness of the important role that SDIs play in the efficient and effective acquisition, access, enrichment and reuse of Geo Information (GI), permitting the creation of integrated guidelines, standards, and implementation of best practices. It meets the necessity to build a forum for the many initiatives and SDI stakeholders across Europe, especially those acting on a local level.

Therefore, the communication mechanisms between the European and the sub-national levels are addressed in order to maximize the benefits of all initiatives (e.g. in Europe at the moment INSPIRE, GMES, Public Sector Information directive, etc.) regarding digital GI content. All potential barriers to this process, such as cultural und linguistic barriers, technological and organizational barriers as well as legal barriers, are, and will be, addressed during the project.

One of the most important communication mechanisms between the European and the local levels used in this project are the workshops organized by the eSDI-Net+ project partners and coordinated by EUROpean umbrella organisation for Geographic Information (EUROGI). The first step towards these workshops is the identification and analysis of existing SDI best practice solutions on the sub-national level. The next step following the workshops where the best practices are mapped against user needs and the results of the analysis are outlined, is the Best Practice Award ( which specifically was taking place in November 2009) in which all the SDI best practices identified by the project partners participated. The Award was assigned according to a grading process based on several indicators that were amply discussed and agreed upon among the project partners. They were based on the results of the previous national workshops so that the connection to the real world of national and sub-national practices using GI was fully insured.

The macro-criteria for the evaluation and grading process are: quantity, quality, cooperation and subsidiarity, sustainability, users and usability. They generate specific indices which were used to assign scores to each of the SDIs analyzed.

In terms of composition of the group of project partners, different stakeholder types and groups were represented within the consortium and are active today within the network. Such **Providers of geographical data** as local, national and regional public authorities are represented directly by several partners as well as indirectly by the GI umbrella association EUROGI that covers the majority of European countries with its members. Intergraph and the GI umbrella associations speak for the private organizations and institutions that create, collect or own digital geographical data. Their expertise is needed for the identification of local, national and regional SDI best practices, for dissemination and raising awareness and, of course, for monitoring the implementation of standard solutions. **Users of digital geographical data** are represented by research institutes, universities, software manufacturers and public authorities. Their role within the project is to evaluate the best practice solutions since their expertise lies in the knowledge of state-of-the-art reference applications and technology development. Since software manufacturers and public authorities are often users and providers of geographical data at the same time, they are also represented within the project as partners.

**National and international GI umbrella associations**, through their partnership in the project, merge GI providers and users, interested organizations and entities from all over Europe. This coverage helps disseminate the eSDI-Net+ Project and to raise local, regional, national and international awareness regarding project goals and the involved SDIs. Moreover, the GI umbrella associations are an important factor for the transfer of expertise.

The main idea of networking users, producers, researchers and managers of GI may be easily summarized. The use of GI has been in place for quite some time but has not been characterized by any interoperability. In order to achieve the SDI task, it is necessary to render the usage of GI within public administration processes sustainable. GI sustainability means that concrete results should be

achieved and integrated into real services offered to the inhabitants and to then be used efficiently by them. To evaluate SDIs in order to verify the real effectiveness of the GI services offered by the public administrations represents an efficient tool for creating synergies and mutual understanding as well as for fostering interoperability. In fact, the findings of several projects and research state that no user community may be built and/or convinced to use a specific technical solution without motivating and training the users to join on the basis of a robust exchange of ideas and experiences.

## CONCLUSIONS AND RECOMMENDATIONS.

This paper has focused on the specific model of a project developed in support of what Europe has already established and undertaken in terms of SDI and which many European local public administrations are putting into reality and supporting .

Europe is also aware that SDIs generate financial, political, socio-economic, commercial and technical benefits and, because of this, it is investing on the EU andat MS levels.

Since the SDIs are globally pervading our earth, it may seem reasonable to consider for evaluation the previously discussed and experimented model of a thematic network for creating a network of SDIs in other areas of the globe.

The model of thematically networking SDIs should not be confused with the model of an ideal SDI.

It has already been amply demonstrated that the success and efficiency of SDI is strictly dependent on how it has been designed, organized and populated by data; how it satisfies the needs of end users; how it is locally dependent and centrally related. According to this, the idea of a single model for setting up an SDI is far from being truly sustainable. With the same ingredients, each SDI has its own characteristics insuring its absolute interoperability. Therefore the networking and the constructive dialogue among stakeholders, users, potential users, developers and institutions is greatly needed. Some points might be considered suitable for creating initiatives and recommendations[6]:

- GI is based on locally-based knowledge of communities;
- SDI should insure the exchange of most of the locally and centrally originated data;
- GI based knowledge and activities should be fostered for the benefit of local communities;
- GI should be used for mitigating the divide among geographical areas and communities;
- Services built on GI, can be delivered directly and remotely.

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6       The recomendations were discussed at the 18th United Nations Regional Cartographic Conference for Asia and the Pacific, to which the author was invited in his role as president of EUROGI and as an expert in the field . Because they came from a an observer, they were taken into consideration by the assembly and became the reference for the adopted resolutions. http://unstats.un.org/unsd/geoinfo/RCC/docs/rccap18/IP/18th_UNRCCAP_econf.100_IP8.pdf