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Spatial Data Infrastructures**

**The Infrastructure for Spatial Information in the European
Community vs. regional SDI: the shortest way for reaching
economic and social development***

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Summary

Europe has already established and is operating relevant developments towards the SDI and that many European institutions are playing key roles in contributing to it. Europe is also aware that SDIs generate financial, political, socio-economic, commercial and technical benefits and because of this it is investing at Community and at MS level. It has also to be considered for the sake of clarity that the mentioned activities are part of a common approach to SDIs which is globally pervading our earth. It has already been largely demonstrated that the success and the efficiency of SDI is strictly dependent on how it has been designed, organized, populated by data, how it satisfies the need of end users, how it is locally dependent and centrally related. According to this, the idea of having a unique model for setting up an SDI is far from being truly sustainable. Having the same ingredients each SDI has its own characteristics insuring its absolute interoperability. Therefore each SDI (national, regional, local) should have the status of full partner of major level SDI and not the one of the client of an already established Supra or Global SDI.

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

Nowadays the way in which, Europe acts shows some very interesting peculiarities in the sense that it individuates one Directive for removing inefficiencies and improving value and quality in the provision, sharing and use of GI. To let collaborate together National SDIs developed by the Member States under the aegis of a common agreed Directive and then to proceed through implementing technical rules and common data models it is seems the most effective way for maximizing the results respecting the identities and the peculiarities of each nation and his territory.

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 the local level (nation-regions , nation-provinces, region-provinces, etc.). The issue of relationships between central SDI and local SDI is becoming even more important in the political trend of devolution to local governments in the EU and represents foundations for collaboration with countries from other continents. It should be clear also that the way of achieving social and economic development should be consistently based on academic education, research and training institutions able to produce not only GI specialists and GI users and products but also specialized professionals for designing and developing geo-services. After some profitable 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 mainly of public administrations from the technology driver to the social and economic drivers in order to ensure the development of society by offering finalized and locally-based services based on GI and technological achievements. This may be achieved by a strict analysis of real user needs, an effective design process and investing adequate resources in the framework of capacity building of the users.

The Infrastructure for Spatial Information in the European Community vs. regional SDI: the shortest way for reaching economic and social development

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Acronyms mostly used:

EU European Union - **EC** European Commission - **ESDI** European Spatial Data Infrastructure - **EUROGI** EUROpean umbrella organisation for Geographic Information - **GI** Geographic Information - **GIS** Geographic Information System(s) - **INSPIRE** Infrastructure for Spatial Information in Europe - **MS** Member State – **NGO** Non Governmental Organization - **PA** Public Administration - **SDI** Spatial Data Infrastructure .

The opinions and the ideas expressed in the paper are of the author even if they are based on official documents.

Some historical and theoretical references about infrastructures.

Infrastructures have always represented the most efficient system for achieving effective control over and management of territory and for the development of society. Since infrastructures may be based on different patterns and they develop according to the native characteristics of the places and of the societies to which they belong, history has many examples of infrastructure, among which may be recalled : the roads in the Roman empire that constituted a transportation infrastructure covering most or the whole Europe and more, the churches and the abbeys during the medieval period which were reference points of European territory, the roads of the INCA empire for managing the all territory , “the ways of songs” of Australian natives for their nomadic settling of the territory. These are just some few examples to highlight the relevance of the infrastructure as part of the human being and his development. Today the cloud of internet is only the present phase of the materialization of the need to be connected by the world population. This characteristic of connecting for reciprocal benefit is a global view shared by all nations and hopefully may represent within each nation and globally as well, the way forward for helping to achieve some of the goals of our society.

The basic reason why infrastructures have played globally a relevant role directly connected with the development and the sustainability of the territory is to be found in the main characteristic of the infrastructure of allowing and meeting of the sharing of different cultures and behavior making them understandable to each other and facilitating overall physical and non-physical exchanges.¹ Connecting people, regions, nations through infrastructures has the interoperability on the basis of its functioning. The interoperability itself provides for some specific aspects to be addressed (hardware, software, data and semantic) in order to achieve the effective functioning of the infrastructure.

¹ This has been discussed in the theorem demonstrating the existence of the Data Infrastructures and Spatial Data Infrastructures even in absence of ICT infrastructure which I presented and was then discussed at 2006 IGU Conference in Brisbane.

Spatial Data Infrastructures (SDI) are specifically defined as having metadata, spatial data sets and spatial data services, network services and technologies, agreements on sharing, access and use, coordination and monitoring mechanisms, processes and procedures.²

Spatial data initiatives in Europe.

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 the diversity of historical, political and social aspects, which characterize each MS, generally divided into sub national areas with their own identity and power, make it very difficult to have a single European view of anything. Nevertheless it is possible to record a common attitude of the MS governments in treating specific aspects which have been addressed and agreed upon at EU level such as, in the specific dominion treated by this paper, the *e*-government, environmental issues and Geographic Information (GI) and other related techniques.

It is worth knowing that the EU acts with MS through Directives which after being approved by the EU Parliament must be transposed and implemented into each national legislation through a specific national act. Being in default of implementing EU directives may open infringement procedures on the part of the EU itself against the defaulting MS.

The European Commission (EC) (formally the Commission of the European Communities) is the executive branch of the European Union. The 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 has been passed by the EU Parliament and came into force on 15 May 2007: it is named INSPIRE(Infrastructure for SPatial InfoRmation in EUROPE)³. The Directive sets a general framework for a Spatial Data Infrastructure (SDI) for environmental policies and for policies with clear impact on the environment. INSPIRE aims to improve the interoperability and the access to spatial information across the EU at local, regional, national and international level, to 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

² SDI has an evolving definition as Williamson says : •“*The SDI concept is still evolving. However a key component of SDIs is that they are dynamic in nature due to the intra- an inter-jurisdictional partnerships they are based on.* “ . Some different aspects are highlighted by several entities : GSDI (Global Spatial Data Infrastructure) association privileges the access to data, protocols and standards ; EU INSPIRE directive is mainly aiming to data and interoperability; some authors are euphoric of Web GIS services; some authors address the complexity and public administration / user needs (capacity building) ; some authors address basic theories (semantics, cognition, grid computing, ubiquitous, etc.) .

³ <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.

Information. INSPIRE is based on the premise that the European spatial data infrastructure shall be built upon the national infrastructures that have 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 and they represent the pillars of the initiative which started more than five years ago and is nowadays consolidated into the Directive. 1. Spatial data have to 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 them among several 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 are made available under conditions which do not unduly restrict their extensive use. 5. It should be easy to discover available spatial data, to evaluate their suitability for a given purpose and to know the conditions which apply to their use.

These principles clearly address the ambitiousness of INSPIRE which intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services to the users. These services should allow the 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 at European, national and local level and the 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.

The Directive has a key part in three annexes⁴ which cover the priority data themes to which the Directive is addressed and they are covered by its daughter legislation which take the form of Implementing Rules (IR) for 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

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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

up at EU level as part of the legislation.

The Directive transposition time expired in May 2009 but it has to be said that, in spite of the wide consensus and strong support that has been received since the initial phase from the majority off the scientific and technical communities and the public administrations, after two years from the date of entering into force only a minority of the MS have already ended the transposition phase. 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.

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

Lessons learned: role of Public Administration and of end user.

Along with and in support of the INSPIRE Directive and ever since the early decision of taking this initiative to set up an EU infrastructure for spatial data, the European Commission (EC) has established 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 setting up adequate and sustainable models for maximizing and exploiting the use of GI within the EU. It is worth mentioning some of the most recent and relevant projects in the area just to show the effort which the European community has made and is continuing to make as regards the issue.

The EU Project HUMBOLDT⁵ (Towards the Harmonisation of Spatial Information in Europe) intends to contribute to the implementation of a European Spatial Data Infrastructure (ESDI). The main goal of the project is to enable organizations to document, publish and harmonize their spatial information, by facilitating and automating the necessary processes as far as possible. An essential element of the project is the development of thematic scenarios in which the different components are applied and tested under realistic conditions.

The ORCHESTRA⁶ project, recently ended, has produced the specifications for a service oriented spatial data infrastructure for improved interoperability among risk management authorities in Europe, which will enable the handling of more effective disaster risk reduction strategies and emergency management operations. The main result of the project is the Reference Model-ORCHESTRA Architecture (RM-OA), open and based on standards, which is now an OGC Best Practice.

eSDI-NET+⁷ is a thematic network project aiming to the promotion of cross border dialogue and exchange of best practices on SDIs throughout Europe, bringing together key stakeholders of European SDIs and to realizing a platform for communication and exchange of knowledge at all levels, from local to global. Currently the network involves 21 participants all over Europe and includes Associations, Institutes, Universities, Private Companies whose work is related with

⁵ <http://www.esdi-humboldt.eu>

⁶ <http://www.eu-orchestra.org>

⁷ <http://www.esdinetplus.eu>

Geographic Information, and promotes dialogue between them.

EURADIN 8 (EUROPEAN ADDRESS INFRASTRUCTURE) aims at constituting a Best Practice Network in order to promote the European Address harmonization regarding the definition, registration and access to the European Address Data. The project main result will be the proposal for the European addresses Infrastructure and the implementation, testing, and validation of a pilot solution.

Projects receive financial support through the European Union Framework Programs for Research, which bundle all research-related EU initiatives together under a common roof playing a crucial role in reaching the goals of growth, competitiveness and employment, and specific programs such as *e-Contentplus*⁹ which provides measures to make digital content in EUROPE more accessible, usable and exploitable. These projects are defining specifications, common data models, guidelines, best practices as well as services to access and download relevant data models in a number of vertical domains corresponding to several themes of the Annex I to III of the Directive, ranging from geology to natural areas from planning to addresses, from place names to marine and coastal areas, etc.

INSPIRE Directive is technically based and geared by five motors represented by the previously mentioned IR. But in the framework of the IR some other rules and models to be applied to data listed in the three annexes of the Directive are expected. These finalized and thematic models represent the real challenge of putting the interoperability to work at EU level and even at national level. The large number of the data types considered by the Annexes together with the user definitions which span from semantic to technical native interpretation is absolutely making hard to assume that a world of interoperable SDIs might support the European decision making process in few years. Nevertheless the impact of INSPIRE, his Annexes, the best practices of SDI, the pervasion of GI in *e-government* already had an impressive and in some sense unforeseen impact to the information society and to the services delivered to the citizens.

The INSPIRE Directive has been perfectly on time to systemize the tremendous impact of GI in the public administration. 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 make sustainable the usage of GI within the Public Administration processes. Sustainability for using GI means that concrete results should be achieved and integrated into real services offered to the inhabitants and then be used efficiently by them.

Interoperability standards offer effective solutions which need some refinements, technical community acceptance and integration in the software engineering process. But what is really needed is to insure that Public Administration employees have the attitude and the skills for using the solutions mentioned above. If not : it is possible to foresee catastrophic situations due to wasted resources (money, skills , data , services , etc.) , the frustration of the achievements of expected and required services and unreadiness to manage severe situations. It has to be said that the issue of setting

⁸ <https://www.euradin.eu>

⁹ http://ec.europa.eu/information_society/activities/econtentplus/index_en.htm

adequate skills in the field of advanced GI and mainly the SDIs has been recognized as relevant in several ongoing research and best practice projects of the 6th and 7th European Union Framework Program. Moreover some other projects focus on the criteria evaluation of SDIs in order to check the real effectiveness of the GI services offered by the Public Administrations and to grade them. The findings of several projects and researches 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. Therefore it is highly advisable to set up a platform containing a training package assisted by a training framework to support the enhancement of the skills necessary to use services and GI in an interoperable way. To this regard it is worth recalling the European Computer Driving License – GIS¹⁰. The program, developed by LABSITA and AICA which is Italian branch of ECDL Foundation, has been developed to satisfy the demand for basic GIS knowledge and technical GIS skills, the ECDL Foundation launched and endorsed this Certification in 2008.

The local dimension of SDI and the role of non-governmental organizations.

As already mentioned since each MS of the EU is characterized by a very high number of local PA the robustness of National SDI is based on how and how much the local communities are involved in the process of participation in SDI. This takes place under the subsidiarity principle which is intended to ensure that decisions are taken as closely as possible to the citizen and that constant checks are made as to whether action at European and/or central or upper level is justified in the light of the options available at national, regional or local level.

According to the attention locally given to the opportunity to have and to store data for several communities INSPIRE represents not only a European directive but also a way to further the development of knowledge and capability, to achieve results and put into reality their own policies. It has been monitored in Europe that since INSPIRE has come into force the SDI practice has demonstrated its utility by bringing local authorities and citizens closer together and by clarifying and systemising the dependencies and links of local authorities from the central or major order institutions (region, nation, etc.). The SDI itself, being a contemporary infrastructure, boosts the interconnections among different players, supports democratisation and public participation, offers opportunities to the economy driven by the private sector, facilitates the opportunity for exploring innovative ways of participation between

¹⁰ www.ecdlgis.com --The ECDL GIS Certification process includes three modules that certify a professional has demonstrated his/her skills in basic concepts of IT used in GIS; the components of GIS; geodesy and topography applied to GIS; concepts and techniques of digital cartography; and the techniques of analysis and viewing in GIS. These skills are tested using multiple choice questions and practical tests applied to the most common GIS software (ESRI and Intergraph and some open source software). The three modules are: Cartography (Module 1); GIS Systems (Module 2); and the Use of the GIS Software (Module 3). The real strength of the certification is the vendor neutrality which is a requirement that was set by the ECDL Foundation. While it is designed to be vendor neutral and covers many common tasks used in different types of GIS software, the third module verifies the candidate's knowledge and ability to use GIS software packages.

public and private. The SDI, due to this complexity, opens a large perspective to be complemented by side actions performed by non governmental organisations.

The concept and praxis of complementarity is very much present specially in complex actions where many stakeholders, subjects, functions and models co-exist. Some of the main tasks of the complementing process aim to complete the main object, to provide what the official partners lack and to maximise what they provide. In this respect it may be taken as example the action performed by the EUROpean umbrella organisation for Geographic Information (EUROGI) as non governmental organisation to complement the realisation, the transposition and the evolution of INSPIRE undertaken by the institutional activities of the EC and the EU Member States. Acting as a complement of public institutions is a relevant issue of the mission of any non-governmental organisation and this is largely recognised nowadays in several domains of present culture and society.

The complementing effort concretizes through the principles which drive the methods and the activities which are put in place for pursuing the desired effects.

INSPIRE principles have a long history and may be considered in the framework of the European policies which have been finalised to manage national sovereignty and multiculturalism while recalling some universal concepts and values. Geographic data have been and are the focus of the knowledge, the management and the sovereignty of the Member States and therefore, one of the main principles of Inspire, even if treated through the technical approach of standardisation, is the sharing of geographic data. Sharing is a relevant principle as it represents the will that applies universal values to the communities. This may provoke some conflicts and at of course this is not trivial to achieve due to the complexity of the societies and their own organisation. In terms of principles an NGO firstly supports the ideas and concepts underlying the institutional decisions and subsequent acts (e.g. INSPIRE directive) if they match its mission and subsequently operates in the definition phase supporting the process directly and through its members (e.g. in the case of EUROGI the National Member Associations).

INSPIRE technical methods are clear and effective. They mainly refer to standards used as the main leverage for creating consensus, for managing and homogenising national and multicultural differences. Methods are often seen as pure technical tools dedicated to smooth, integrate and eliminate differences through the application of technicalities finalised to adapt diversities. In reality the application of methods is always filtered through cultural approaches. In the case of geographic data, more than technical aspects related to data format and information technologies, the semantic, cultural, governmental and organisational aspects play a fundamental role and unfortunately sometimes represent uneasy frictions or obstacles. Regarding methods, there is worldwide, a dramatic need for capacity building within public administrations and society. This can only be achieved by institutional measures together with NGO efforts. With respect to this an NGO as e.g. EUROGI should experience its attitude and try to realise a number of initiatives for capacity building in the widest sense. This has to be further developed using the opportunities and the tools that are offered by international and national policies. In this area falls also the educational and professional training initiatives which have been briefly mentioned before (see ECDL in footnote 10).

The process of acting as complement of institutional initiatives from on the part of an NGO has been named the evangelisation process in order to emphasize the fact that human resources of adequate quality are invested for disseminating knowledge among different communities and directly to the citizens. Awareness raising and capacity

building are the most relevant evangelization results. They are widely recognised as representing the foundation of every action aiming to develop a society. The practical instruments of evangelization are the activities based on principles and methods and they represent the terminals of the process. Unless they take the form of workshops, conventions, forums, websites, white papers and reports, face to face meetings or participation in events and publications, for complementing SDI some specific tools should be set up and used. Among them it is worth recalling the user needs analysis and monitoring, data model verifying against multiculturalism, specific tools for traditional and automated training and education.

The way for achieving economic and social development: *geo-government*.

It has been largely demonstrated¹¹ that the value of geo-information as perceived by the buyer, the user and the citizen (as final free-of charge user) depends on a variety of factors. Some of them are strictly related to the functioning and internal structure of the public and/or private organization in which the spatial data are going to be used. Others depend on the specific application areas and finally some relevant factors are related to how they are perceived and used by the final user that may be easily identified as the final user of the service chain using GI. It has also to be taken into account that the value and the quality of geo-information are codependent as also it has to be taken into account the fact that the availability, specially on the world wide web, of a large amount of free remote sensed and satellite images together with some cartography strongly influence the way how the GI is perceived and used.¹²

Even though the GI is pervading directly and indirectly our everyday life social and economic development may be achieved only if there are clear plans for the usage of spatial information in achieving services for the direct benefit of society.

Just to mention some of the dominions where digital GI has already played a role with the direct participation of the citizens we have to consider: Tourism and traveling, Agriculture, Environment, Natural hazards and security, Land ownership , Housing and planning. But it should also be honestly pointed out that all these application areas and several more technical and specific ones have already benefited for a long time from traditional cartography.

Therefore what more may be offered by the infrastructure of spatial data and how much better?

Since we are mainly a digital oriented society it has to be considered that geo-information is becoming a major constituent of many activities and of human life generally speaking. It has also to be considered that in the process of public

¹¹ EUROGI recently organized the workshop PPP4SDI Public Private Partnerships for building Spatial Data Infrastructures: Summary and recommendations Report -- http://www.epsplus.net/media/files/ppp4sdi_report_part1_v1_1_final

¹² Report of International Workshop on Spatial Data Infrastructures' Cost-Benefit Return on Investment ;Ispra, Italy 12-13 January 2006 http://www.ec-gis.org/sdi/ws/costbenefit2006/reports/report_sdi_crossbenefit%20.pdf
The Socio-Economic Impact of the Spatial Data Infrastructure of Catalonia P. G.Almirall, M. M.Bergadà, P. Q. Ros - Universitat Politècnica de Catalunya Centre of Land Policy and Valuations - M. Craglia (Editor) - European Commission - Joint Research Centre Institute for Environment and Sustainability http://inspire.jrc.ec.europa.eu/reports/Study_reports/catalonia_impact_study_report.pdf

authorities devolving missions, competencies and responsibilities to other authorities most of them at local level GI is playing the role of homogenizer of information precisely because of univocity of the geographic address for a large quantity of information. As the tendency of many nations and public administrations is to go from central to local for services offered to the population and vice versa to go from local managed monitoring systems to centralized archive, the trend within the user community is to share the personal micro-knowledge of the territory on the internet. The so called micro-geography is the most appreciated by the end user even if macro-geography (so easy to access nowadays through satellite images and the web) has some new appeal as a living atlas. But the easiness of micro-knowledge generates the paradox that, even though the systems facilitate the access and the view of geographic information, real and deep knowledge is not fully transferred. It remains a fact that the citizen is the only one who knows very well the vicinities to which he is customer.

The added value of the SDI resides in ensuring the circulation, the access, the availability of data stored by different users in different locations, the seamless integration of data and in the possibility of sharing the micro geographic information through a macro system providing services to the users.

The SDI may be effective for economic and social development through the government of the territory and the *e-government*. This is the natural trend of using GI but it may be achieved only if public administrations are able to achieve and guarantee *geo-government* services.

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

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) to be placed at the centre of the scene. The spatial component of data in the infrastructures has always been present but sometimes it was hidden and/or bundled in the data and information collected and stored in systems and or simply provided to decision making process. Therefore the real strength of the DI (Data Infrastructures) has been and is based still on the infrastructure itself.

What does an infrastructure represent for the public administration in the concrete dominion? In physical terms the infrastructure goes from the premises hosting employees , visitors and archives to the roads and paths, cables and networks allowing the circulation of papers , forms, certificates and information .In the intangible dominion the infrastructure is represented as the set of rules , procedures , specifications , data and information which govern the production, the distribution and the usage of the services and the functioning of the infrastructure itself.

Conclusion and recommendations.

This paper has demonstrated that Europe has already established and is operating

relevant developments towards the SDI and that many European institutions ¹³ are playing key roles in contributing to it. Europe is also aware that SDIs generate financial, political, socio-economic, commercial and technical benefits and because of this it is investing at Community and at MS level.

It has also to be considered for the sake of clarity that the mentioned activities are part of a common approach to SDIs which is globally pervading our earth. It has already been largely demonstrated that the success and the efficiency of SDI is strictly dependent on how it has been designed, organized, populated by data, how it satisfies the need of end users, how it is locally dependent and centrally related. According to this, the idea of having a unique model for setting up an SDI is far from being truly sustainable. Having the same ingredients each SDI has its own characteristics insuring its absolute interoperability. Therefore each SDI (national, regional, local) should have the status of full partner of major level SDI and not the one of the client of an already established Supra or Global SDI.

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

Nowadays the way in which, Europe acts shows some very interesting peculiarities in the sense that it individuates one Directive for removing inefficiencies and improving value and quality in the provision, sharing and use of GI. To let collaborate together National SDIs developed by the Member States under the aegis of a common agreed Directive and then to proceed through implementing technical rules and common data models it seems the most effective way for maximizing the results respecting the identities and the peculiarities of each nation and his territory.

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 the local level (nation-regions , nation-provinces, region-provinces, etc.). The issue of relationships between central SDI and local SDI is becoming even more important in the political trend of devolution to local governments in the EU and represents foundations for collaboration with countries from other continents.

It should be clear also that the way of achieving social and economic development should be consistently based on academic education, research and training institutions able to produce not only GI specialists and GI users and products but also specialized professionals for designing and developing geo-services.

After some profitable 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 mainly of public administrations from the technology driver to the social and economic drivers in order to ensure the development of society by offering finalized and locally-based services based on GI and technological achievements. This may be achieved by a strict analysis of real user needs, an effective design process and investing adequate resources in the framework of capacity building of the users.

¹³ The institutions already mentioned in the paper are only part of the number of stakeholders involved in the process. In order to find more references the INSPIRE web site and related ones should be visited.