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# Advanced Regional Spatial Data Infrastructures in Europe

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# EXECUTIVE SUMMARY

This report presents the findings of the workshop on Advanced Regional Spatial Data Infrastructures (SDIs) organised by the European Commission Joint Research Centre in May 2008. The objectives of the workshop were to review the state of progress, analyse the different organisational models established with local and national stakeholders, and assess the social and economic impacts of the regional SDIs. Eleven regional/sub-national SDIs in Europe are presented in the report: Lombardy, and Piedmont (Italy), Catalonia and Navarra (Spain), Wallonia and Flanders (Belgium), North-Rhine Westfalia and Bavaria (Germany), Northern Ireland (UK), Brittany (France), and Vysočina (Czech Republic). These experiences are set in the context of the broader European framework provided by the INSPIRE Directive, the national State of Play studies, and international experiences in the USA and Australia. A key finding of the report is that these regions are indeed leading actors in the development of SDIs in Europe, adopting state-of-the art technologies, standards, and models and often setting the pace through example for others to follow. Crucially important is their role in coordinating and organising developments at the local level through a large array of partnerships and organisational models. This organisational work is challenging because it involves a very large number of stakeholders operating at the local level, and requires long-term political, organisational, and personal commitment. However, the evidence available at the present time indicates that it is at the local level that the largest social and economic benefits of an SDI can be found, supporting operational day-to-day applications affecting millions of citizens and local businesses. To achieve these benefits there is no alternative but to engage locally, and invest in building and maintaining relationships and trust. From this perspective, the main lesson of the European experiences, supported by those in the USA and Australia, is that Spatial Data Infrastructures are foremost social networks of people and organisations, in which technology and data play a supportive role. The technology is cheap, data is expensive, but social relations are invaluable.

# SECTION I: INTRODUCTION AND CONTEXT

# 1 Introduction

## 1.1 Background

In January 2006, the Joint Research Centre (JRC) of the European Commission organised a workshop to review best practice in the assessment of Spatial Data Infrastructures (SDIs), compare methodologies and findings, and see also what lessons could be learned from similar large scale infrastructures. Among the key findings of that workshop were that most evidence available is still ex-ante, i.e. when a case has to be made to obtain funding for an SDI, with little evidence at implementation stage to support the assumptions made on both costs and benefits. For this reason, the workshop concluded that there was an urgent need to give priority to longitudinal studies of SDIs in progress, paying particular attention to sub-national/regional SDIs, and to application-driven approaches able to identify more easily stakeholders, user communities, and potential benefits (see Craglia and Nowak 2006[1]).

As a follow-up of that workshop, the Spatial Data Infrastructures Unit of the JRC commissioned a study of the socio-economic impact of the SDI in Catalonia to the Centre of Land Policy and Valuations of the Universitat Politècnica de Catalonia. The one-year study, which was concluded in December 2007, found that if the cost of topographic data production is excluded, the initial investment of €1.5 million over the period 2002-06 was recovered in less than one year with main benefits accruing at the level of local public administration[2]. These benefits took the form of increased internal efficiency (time saved in internal queries by technical staff, time saved in attending queries by the public, time saved in internal processes) and effectiveness benefits (time saved by the public and by companies in dealing with public administration).

The Catalonia study was important because for the first time it provided real evidence of both investment costs and measured benefits. It also allowed testing the methodology proposed by the JRC and learning lessons for further studies. One of such studies is now in progress in the Regione Lombardia of Italy in collaboration with the JRC and will be completed in 2009.

As part of the joint project Regione Lombardia and JRC, the JRC organised a workshop in Ispra in May 2008 to bring together some of the more advanced regional SDI experiences in Europe. The focus of the meeting was on:

1) State of progress.

2) Organizational model(s) to develop the needed partnerships across agencies and sectors and to engage local authorities in the implementation and use of the SDI in the region.

3) Measurement of social and economic impacts.

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1 http://www.ec-gis.org/sdi//ws/costbenefit2006/reports/report_sdi_crossbenefit%20.pdf

2 http://inspire.jrc.ec.europa.eu/reports/Study_reports/catalonia_impact_study_report.pdf

The meeting was also the basis for the development of a network of excellence of regions in Europe to share experiences and best practices in SDI development, also in support to the implementation of the INSPIRE Directive. Although the focus was primarily on Europe, the workshop had also the benefits of presentations addressing the experiences in the USA and Australia, to set the European experience in a wider context. The list of participants is included in Appendix A.

This report presents the finding of the workshop and is organised as follows: Section I sets the context by introducing the report, the INSPIRE Directive which frames the development of SDIs in Europe, and the current state of play of SDIs at the national level, respectively. Section II is the main part of the report and includes the eleven regional experiences in Europe presented at the workshop. Section III provides a first comparison and evaluation, while Section IV introduces examples of cross-border collaborative projects. Section V contextualizes the European experiences with those in the USA and Australia, and Section VI concludes with key lessons learned and recommendations for best practice and future activities.

## 1.2 INSPIRE

Directive 2007/2/EC of the Council and the European Parliament[3] establishes the legal framework for setting up and operating an Infrastructure for Spatial Information in Europe (INSPIRE) based on infrastructures for spatial information established and operated by the member states. The purpose of such infrastructure is, in the first instance, to support the formulation, implementation, monitoring, and evaluation of Community environmental policies, and to overcome major barriers still affecting the availability and accessibility of pertinent data. These barriers include:

1. Inconsistencies in spatial data collection: spatial data are often missing or incomplete or, alternately, the same data are collected twice by different organisations.
2. Lacking documentation: description of available spatial data is often incomplete.
3. Spatial data sets not compatible: spatial data sets often cannot be combined with other spatial data sets.
4. Incompatible geographic information initiatives: the infrastructures to find, access and use spatial data often function in isolation only.
5. Barriers to data sharing: cultural, institutional, financial and legal barriers prevent or delay the sharing of existing spatial data.

The key elements of the INSPIRE directive to overcome these barriers include:

1. Metadata to describe existing information resources so that they can be more easily found and accessed.
2. Harmonisation of key spatial data themes needed to support environmental policies in the Union.
3. Agreements on network services and technologies to allow discovery, viewing, download of information resources, and access to related services.
4. Policy agreements on sharing and access, including licensing and charging.

[3] http://inspire.jrc.ec.europa.eu/directive/l_10820070425en00010014.pdf

5. Coordination and monitoring mechanisms.
6. Implementation process and procedures.

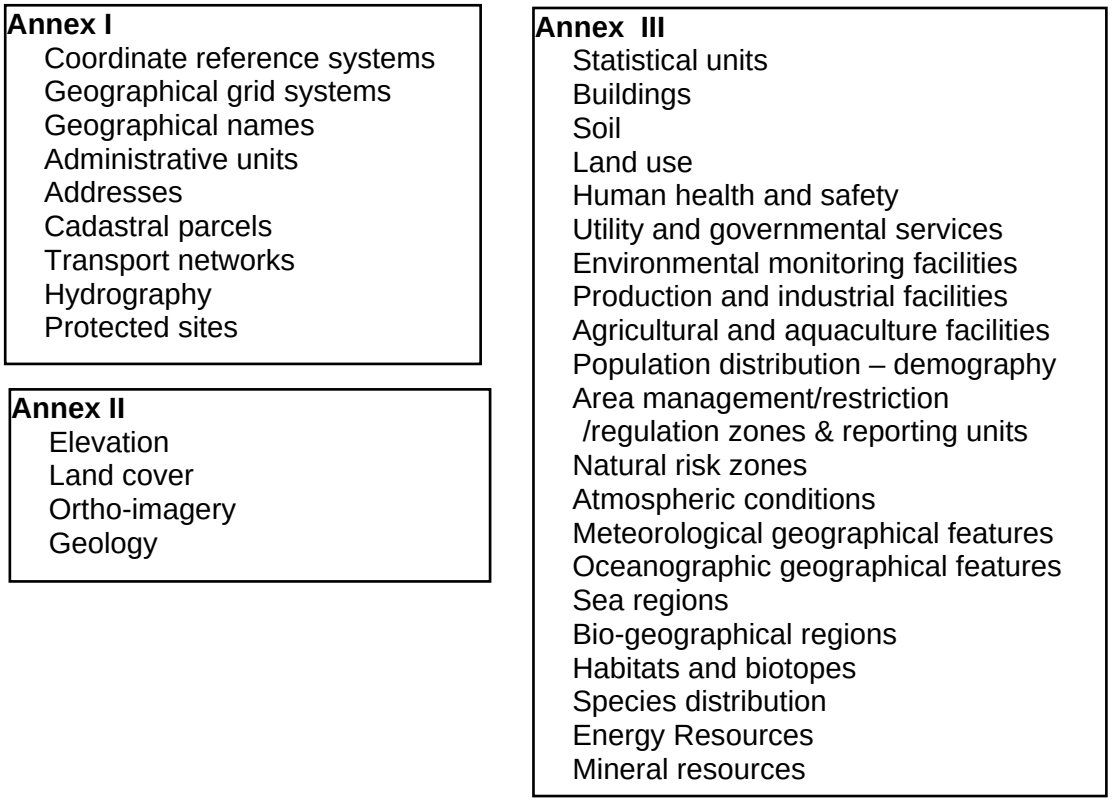
From the outset of this initiative in 2001 it was recognised that to overcome some of the barriers highlighted above, it would be necessary to develop a legislative framework requiring Member States to coordinate their activities and agree on a minimum set of common standards and processes. This in turn requires the wide support of the Member States to the objectives of INSPIRE. Therefore, a very collaborative process was put in place to formulate the INSPIRE proposal. This process in particular involved the establishment of an expert group with official representatives of all the Member States, and working groups with expertise in the fields of environmental policy and geographic information to formulate proposals and forge consensus. From this process, it was agreed that the key principles of INSPIRE should be:

1. That spatial data should be collected once and maintained at the level where this can be done most effectively.
2. That it must be possible to combine seamlessly spatial data from different sources across the EU and share it between many users and applications.
3. That it must be possible for spatial data collected at one level of government to be shared between all the different levels of government.
4. That spatial data needed for good governance should be available with conditions that do not restrict its extensive use.
5. That it should be easy to discover which spatial data is available, to evaluate its fitness for a purpose and to know which conditions apply for its use.

Following three years of intensive consultation among the Member States and their experts, a public consultation, and the assessment of the likely impacts of INSPIRE[4], the European Commission adopted the INSPIRE proposal for a directive in July 2004. An amended proposal was adopted by the Council and European Parliament in March 2007, and came into force on 15th May 2007. Figure 1 details the thematic coverage of INSPIRE, and Tables 1 and 2 provide an overview of the key milestone foreseen for the adoption and implementation of the Directive respectively.

4 http://inspire.jrc.ec.europa.eu/reports/inspire_extended_impact_assessment.pdf

**Figure 1: The INSPIRE Data Themes**




A key milestone is 15th May 2009 at which stage all Member States should have passed national legislation transposing the INSPIRE Directive, and established their spatial data infrastructures. Given the institutional diversity of the Member States, some of the SDIs in the Member States are likely to have a strong regional or sub-national dimension, which adds interest to the finding of this report.

SDI activities in the Member States pre-date in many instances the launch of INSPIRE, and a series of studies conducted by the University of Leuven on behalf of EUROSTAT have charted the progress made in the EU and beyond. The key findings are summarized in the next section.

**Table 1: Roadmap for INSPIRE Adoption**

| Milestone date | Description |
|---|---|
| 2007-05-15 | Entry into force of INSPIRE Directive |
| 2007-08-15 | Establishment of the INSPIRE Committee |
| 2008-05-14 | Submission for opinion of the INSPIRE committee of IR for the creation and updating of metadata |
| 2008-11-15 | Submission for opinion of the INSPIRE committee of IR for monitoring and reporting |
| 2008-11-15* | Submission for opinion of the INSPIRE committee of IR for discovery and view services |
| 2009-05-15* | Submission for opinion of the INSPIRE committee of IR for download services |
| 2009-05-15* | Submission for opinion of the INSPIRE committee of IR for coordinates transformation service |
| 2009-05-15* | Submission for opinion of the INSPIRE committee of IR governing the access rights of use to spatial data sets and services for Community institutions and bodies |
| 2009-05-15 | Submission for opinion of the INSPIRE committee of IRs for the interoperability and harmonisation of spatial data sets and services for Annex I spatial data themes |
| 2009-05-15 | Provisions of Directive are brought into force in MS |
| 2010-11-15* | Submission for opinion of the INSPIRE committee of IR for schema transformation and "invoke spatial data service" services |
| 2012-05-15 | Submission for opinion of the INSPIRE committee of IRs for the interoperability and harmonisation of spatial data sets and services for Annex II and III spatial data themes |

* = Date proposed by the Commission

**Table 2: Roadmap for INSPIRE Implementation**

| Milestone date | Description |
|---|---|
| 2010-05-15 | Implementation of provisions for reporting |
| 2010-05-15 | Metadata available for spatial data corresponding to Annex I and II |
| 2010-11-15* | Discovery and view services operational |
| 2010-11-15 | The EC establishes and runs a geo-portal at Community level |
| 2011-05-15* | Download services operational |
| 2011-05-15* | Coordinates transformation services operational |
| 2011-05-15 | Newly collected and extensively restructured Annex I spatial data sets available |
| 2012-11-15* | Schema transformation and "invoke spatial data service" services operational |
| 2013-05-15 | Metadata available for spatial data corresponding to Annex III |
| 2014-05-15 | Newly collected and extensively restructured Annex II and III spatial data sets available |
| 2016-05-15 | Other Annex I spatial data sets available |
| 2019-05-15 | Other Annex II and III spatial data sets available |

* = Date proposed by the Commission

## 1.3 State of Play of SDIs in Europe

In 2002, the European Commission launched a study, "Status of the National Spatial Data Infrastructures in Europe, a State of Play" covering the period mid 2002- mid 2005 (later extended with new studies for 2006 and 2007), to describe, monitor and analyse the activities related to the national spatial data infrastructures in 32 European countries: 27 EU Member States, 1 Candidate Country and 4 EFTA countries. The contract was awarded to the Spatial Applications Division, K.U.Leuven Research & Development. All the reports by country and year of study are available through the INSPIRE we site[5]. The latest study refers to 2007, and identified 32 indicators structured around seven main components: organisational issues, legal framework and funding, reference data and core thematic data, metadata, access and other services, standards, and thematic environmental data. Table 3 shows the indicators used, while Figure 2 shows the state of play as of 2007.

Figure 2 shows that most countries have now a more coordinated SDI approach, and territorial coverage at the national level, and have also one or more of the SDI components at an operational level (first two columns from the left). Data availability (related to the INSPIRE themes), metadata, network services, and standards are also very well developed particularly in the Europe 15 countries, while Europe 10 countries (entered in the Union in 2004) are rapidly catching up. Against these positive developments, it clear from Figure 2, that the area of Legal issues and Funding presents a much more chequered progress, partly because no clear information is available or the legal basis for the national SDI has yet to be consolidated together with a sustainable funding regime. Looking at the area of services, the picture reflects well the current state of the art in SDIs: discover and view services, and to a certain extent download are relatively well developed, but much progress is still to be made on services (columns 29-30) for transformation, and above all chaining (invoke), which will take us to new generation of SDIs, less data-centric and more information and service-centric.

Another way of looking at the current state of play, is to map the typology of the 32 countries surveyed against the generational perspective put forward by Masser (2005) and Rajabifard et al. (2003), who identified two "generations" of SDIs: The first largely driven by data producer and focused on the completion of the national databases (product-driven), while the second is user-led and process driven, emphasizing partnerships, agreements and a broader set of applications. The key features of the two generations of SDIs are summarised in Table 5. In the State of Play studies, the 32 countries are classified into two main groups: where the development is lead by a national data provider (normally the national mapping agency), with or without user involvement, and where it is lead by other governmental or non-governmental organisation (for example the council of ministries, or a GI association), with or without formal legal mandate. Each group is then sub-divided further based on the extent of operationality of the SDI (see Table 4).

5 http://inspire.jrc.ec.europa.eu/state_of_play.cfm

**Table 3: Indicators used in the State of Play studies**

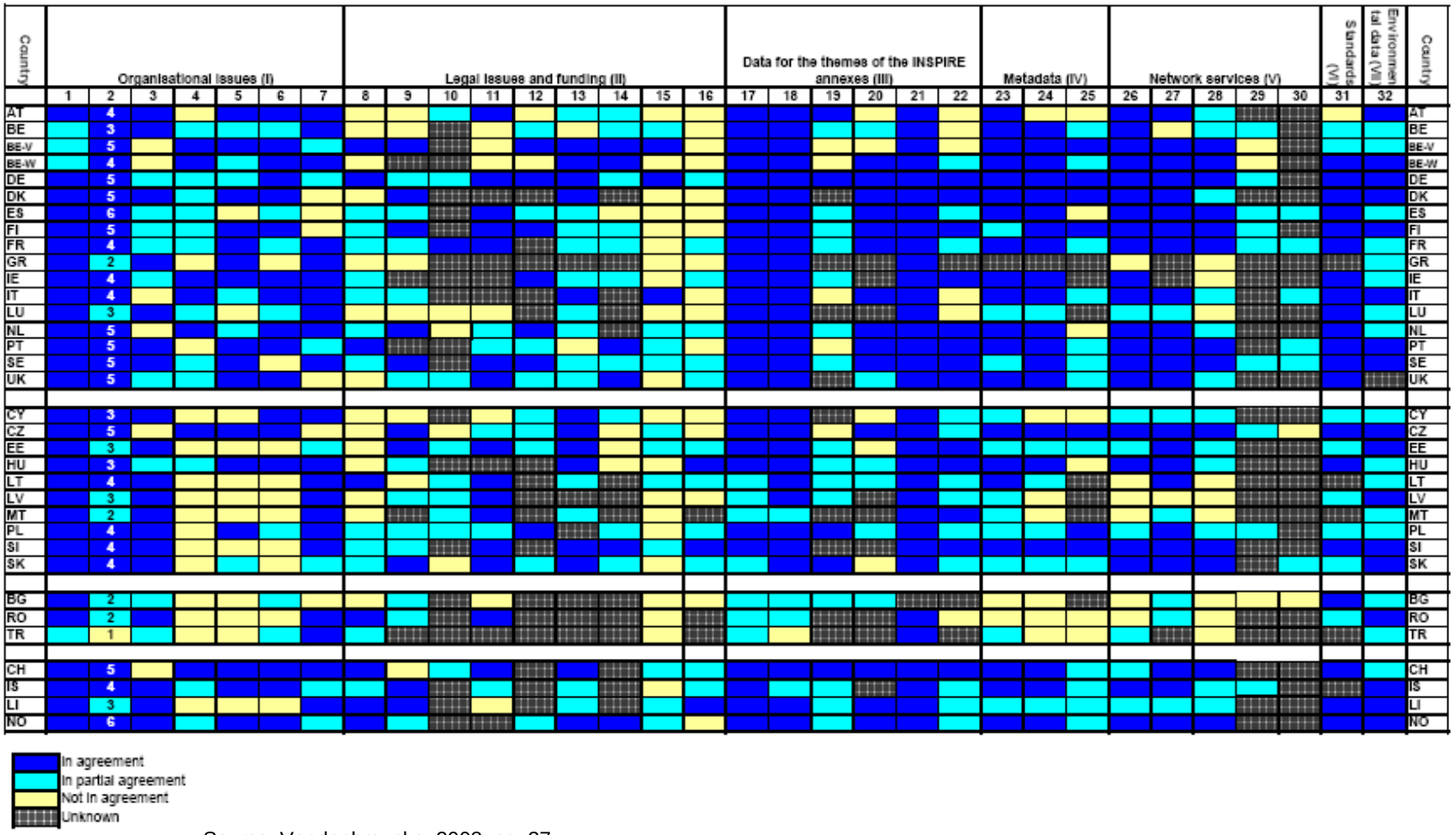
| | | |
|---|---|---|
| **I. Organisational issues** | | |
| Level of SDI | 1 | The approach and territorial coverage of the SDI is truly national |
| Degree of operationality | 2 | One or more components of the SDI have reached a significant level of operationality . **Figure between 1 and 6 added.** |
| Coordination | 3 | The officially recognised or de facto coordinating body of the SDI is a NDP, i.e. a NMA or a comparable organisation (Cadastral or Land Survey Agency, i.e. a major producer of GI) |
| | 4 | The officially recognised or de facto coordinating body for the SDI is an organisation controlled by data users |
| | 5 | An organisation of the type 'national GI-association' is involved in the coordination of the SDI |
| Participants | 6 | Producers and users of spatial data are participating in the SDI |
| | 7 | Only public sector actors are participating in the SDI |
| **II. Legal issues and funding** | | |
| Legal framework | 8 | There is a legal instrument or framework determining the SDI-strategy or -development |
| Public-private partnerships (PPP) | 9 | There are true PPP's or other co-financing mechanisms between public and private sector bodies with respect to the development and operation of the SDI-related projects |
| Policy and legislation on access to public sector information (PSI) | 10 | There is a freedom of information (FOI) act which contains specific FOI legislation for the GI-sector |
| Legal protection of GI by intellectual property rights | 11 | GI can specifically be protected by copyright |
| Restricted access to GI further to the legal protection of privacy | 12 | Privacy laws are actively being taken into account by the holders of GI |
| Data licensing | 13 | There is a framework or policy for sharing GI between public institutions |
| | 14 | There are simplified and standardised licences for personal use |
| Funding model for the SDI and pricing policy | 15 | The long-term financial security of the SDI-initiative is secured |
| | 16 | There is a pricing framework for trading, using and/or commercialising GI |

**Table 3 (cntd): Indicators used in the State of Play studies**

| | | |
|---|---|---|
| **III. Data for the themes of the INSPIRE annexes** | | |
| Scale and resolution | 17 | Geodatasets exist which provide a basis for contributing to the coverage of pan-Europe for the INSPIRE-selected data themes and components |
| Geodetic reference systems and projections | 18 | The geodetic reference system and projection systems are standardised, documented and interconvertable |
| Quality of reference data & core thematic data | 19 | There is a documented data quality control procedure applied at the level of the SDI |
| Interoperability | 20 | Concern for interoperability goes beyond conversion between different data formats |
| Language and culture | 21 | The national language is the operational language of the SDI |
| | 22 | English is used as secondary language |
| **IV. Metadata for the data of the themes of the INSPIRE annexes** | | |
| Availability of metadata | 23 | Metadata are produced for a significant fraction of geodatasets of the themes of the INSPIRE annexes |
| Metadata catalogue availability + standard | 24 | One or more standardised metadata catalogues are available covering more than one data producing agency |
| Metadata implementation | 25 | There is a coordinating authority for metadata implementation at the level of the SDI |
| **V. Access and other services for data and their metadata** | | |
| Discovery Services | 26 | There are one or more discovery services making it possible to search for data and services through metadata |
| View Services | 27 | There are one or more view services available for to visualise data from the themes of the INSPIRE annexes |
| Download Services | 28 | There are one ore more on-line download services enabling (parts of) copies of datasets |
| Transformation Services | 29 | There are one or more transformation services enabling spatial datasets to be transformed to achieve interoperability |
| Middleware Service | 30 | There are one or more middleware services allowing data services to be invoked |
| **VI. Standards** | | |
| Standards | 31 | The SDI-initiative is devoting significant attention to standardisation issues |
| **VII. Thematic environmental data** | | |
| Thematic Environmental data | 32 | Thematic environmental data are covered by the described SDI-initiative or there is an independent thematic environmental SDI |

Source: Vandenbroucke, 2008, pg. 18-19

**Figure 2: SDIs in Europe: State of Play 2007**




Source: Vandenbroucke, 2008, pg. 37

**Table 4: Classification of countries based on SDI type 2007**

| Level I | Level II | Level III | EU-27 | CC(-1) | EFTA-4 |
|---|---|---|---|---|---|
| | | | | | |
| NDP-led | users involved | operational | DK, FI, SE, PT, HU | | IS, NO |
| | | partially operational | AT, GR, LU, PL | | |
| | | not operational | BE, **RO** | | |
| | users not involved | operational | SI, SK, LT | | |
| | | partially operational | EE, LV, CY | | LI |
| | | not operational | MT, BG | TR | |
| | | | | | |
| not NDP-led | formal mandate | operational | BE-VL, DE, **ES, NL**, CZ | | CH |
| | | partially operational | IT, IE | | |
| | | not operational | | | |
| | no formal mandate | operational | UK, BE-WA | | |
| | | partially operational | FR | | |
| | | not operational | | | |

Source**:** Vandenbroucke, 2008, pg. 40

**Table 5: Key features of the two generations of SDIs**

| **Similarities and Differences** | **1st Generation** | **2nd Generation** |
|---|---|---|
| Nature | Explicitly National | Explicitly National within the hierarchical context and therefore more flexible for cross jurisdictional collaboration |
| Development Motivation | Integration of Existing Data | Establishing the Linkage between People and Data |
| Expected Outcomes | Linkage into a Seamless database | Knowledge Infrastructures, Interoperable Data and resources |
| Development Participants | Mainly Data providers | Cross-Sectoral (provider, integrators, users) |
| Funding/Resources | Mainly no specific or separate budget | Mostly include in National Mapping program, or having separate budget |
| Driving/coordinating Agency | Mainly National Mapping Organisations | More independent organisational committees/ Partnership groups |
| Awareness | Low awareness at the beginning, gradually learning more | More aware, knowing more about SDI and its requirements |
| Capacity Building | Very low | Communities are more prepared to engage in on-going activities |
| Number of SDI Initiatives | Very limited | Many more |
| SDI Development Model | Predominantly Product-based | Increasingly Process-based, |

| | | |
|---|---|---|
| | | or hybrid Product-Process approach depending on the jurisdiction |
| Relationship with the other SDI levels and International Initiatives | Low | Much more |
| Measuring the Value of SDIs | Productivity, savings.. | Holistic socio-cultural value as well as measuring the expense of not having an NSDI |

Source Rajabifard et al. 2003, pg. 106

On the basis of Tables 4 and 5, we can re-classify the 32 European countries in the State of Play study into three categories of similar size relating to the first generation (data-producer led, users not involved), second generation (user led) and transition between the two in which users are involved but do not lead the process. As INSPIRE gets implemented, all countries are likely to get a formal mandate to coordinate the development of their SDI, so that categorization will no longer be relevant. The extent of user involvement and lead will however continue to be an important distinction in the transition between first and second generation infrastructures.

The State of Play studies provide a useful overview of developments at the national level, but some of the examples of best practice are to be found at the sub-national level. The case-studies presented in this report were selected on the basis of expert knowledge and availability to participate in the workshop. Therefore, it is certainly not an exhaustive collection of all the cases of best practice, but an important sub-group nevertheless. An indication in this respect is that all the regional experiences summarized in the following sections of this report belong to the countries in the Second Generation SDI category, namely Italy, Spain, France, Germany, Belgium, the Czech Republic, and the United Kingdom.

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Masser I. 2005. *GIS Worlds: creating spatial data infrastructures*. Redlands: ESRI Press.

Rajabifard A, M.E F. Feeney, I. Williamson and I.Masser. 2003. National SDI Initiatives. In Williamson I., A. Rajabifard A. and M.E F. Feeney (Eds.). 2003. *Developing spatial data infrastructures: from concept to reality*. Boca Raton, FL.: CRC Press. pp. 95-109.

Vandenbroucke D. 2008, *Spatial Data Infrastructures in Europe: State of Play 2007*. http://inspire.jrc.ec.europa.eu/reports/stateofplay2007/INSPIRE-SoP-2007v4.pdf

# SECTION II: REGIONAL PROFILES

# 2 Lombardy

## 2.1 Regional Setting

Lombardy in one of the wealthiest among the 20 Italian Regions, hosting one-sixth of the national population (9.5 millions), and contributing to ~20-25% of the total national GDP, €305,550.4 million in 2006 (equivalent to ~3,2 % of the total EU GDP). Located in the North of Italy, it covers an area of approximately 23 thousand square kilometres. About half of the regional territory is characterized by mountains and hills, while the 47% of it extends on the Po River plain. It shares its border with other Italian regions (Piedmont on West, Emilia-Romagna on the South, and Veneto on the East) and with Switzerland on the northern edge (see Figure 3). The administrative system is hierarchically structured within 3 main tiers ('Regione', 'Province' and 'Comuni'). Moreover, the 'Comunità Montana' represents an intermediate inter-municipal level of government grouping small comuni in mountainous areas. Accordingly, the overall territory of the 'Regione Lombardia' is divided into a complex setting of 11 Provinces, 30 'Comunità Montane' (CMs) (involving 558 municipalities), and 1,546 'Comuni'.

**Figure 3: Location of Lombardy**


Source: Assembly of European Regions www.aer.eu

The Province of Milan hosts about the half of the total population and a workforce about 1.7 million, followed by the Province of Brescia and the Province of Bergamo each of

which host about 1 million inhabitants and half a million workers. The municipal pattern is characterized by a large number of small municipalities (1,151 of which have a population < 5,000 inhabitants). Only 4 municipalities - namely Milan, Brescia, Monza and Bergamo - have a population > 100,000 inhabitants. Administrative fragmentation is higher in the most densely populated areas, while municipal territorial extent widen in less populated areas such as in the mountain part of the Sondrio Province.

## 2.2 Policy Framework

### *2.2.1 National Level*

In Italy, GI policies at the regional level are influenced by the national regulatory frameworks on digital Public Administration, by the transformation of the cadastral system, and by the agreement central-regional-local administrations for the development of a national topographic database.

The National Act n°82/2005 -which constitutes the Code for Digital Administration delegates to the National Centre for Informatics in Public Administration (CNIPA) coordination and support to Public Administrations in their modernisation processes to improve efficiency and reducing costs. Given the relevance of GI to spatial government and taxation, the CAD established a Committee for technical rules on GI in Public Administration and delegated to CNIPA the implementation of a national GI catalogue and the specifications of its data contents, maintenance, documentation, access, and exchange rules. The CNIPA moreover participates to the Framework Program Agreements (APQ) through which the Regions negotiate strategies and infrastructural programs with the Ministry of Economy and Finance responsible for funding.

The national Act D.L gs. n°112/1998 moves the cadastral functions from the Ministry of Economy and Finance to local administrations. Nowadays the transfer can be considered at an advanced stage of development and funding is provided to support Municipalities in the process.

Since 1996, the Conference State-Regions-Provinces established the so-called 'Intesa Stato-Regioni-Enti Locali per i Sistemi Informativi Territoriali (Intesa-GIS) as a protocol agreement involving central, regional and local administrations, as well as the CNIPA, the Comunità Montane, and national agencies such as the Military Geographic Institute (IGM), the Navy Hydrographic Institute (IIM), the Air Force Geo-Topo-Cartographic Information Center (CIGA). The purpose of this protocol is to coordinate the implementation of the national topographic geo-database and ortho-imagery coverage. According to the agreement the local level is responsible for the large scale geo-database development while for the small-medium scale the Regions collaborate with provinces and other national bodies. As a result of the work of the Intesa-GIS standards and implementation rules for the geographic database have been issued, which will be revised in future to take into account of the INSPIRE Implementing Rules. More information on the policy framework in Italy is available at http://inspire.jrc.ec.europa.eu/reports/stateofplay2007/rcr07ITv92.pdf

### *2.2.2 Regional Level*

In Lombardia, the first regulatory framework for geographic information dates back to 1979 when the regional government (Regione Lombardia) adopted the Act number 29

which defined the responsibilities of the Region for the production and maintenance of the topographic map (1:10,000 scale) and of thematic cartography. Aim of this first act was to support spatial planning and management at the regional and sub-regional spatial and sector policies and planning. Two years later the Act n°15/1981 established the regional GIS. That same year Lombardia Informatica S.p.a. (LISPA) was established by Regione Lombardia as a publicly-owned company to support the ICT requirements of the regional public administration. Today, LISPA has over 600 employees with a gross annual turnover of over 200 Mio Euros, and is the key technology partner supporting the Regione in the development of its SDI. This SDI obtained legal backing through the Regional Planning Act of 2005 (RL 12/2005) which introduced a new vision moving from different GI Systems towards an integrated regional infrastructure in which the Regione and the local administrations collaborate for the dynamic GI production and maintenance of spatial information, initially to support planning. Following the 12/2005 Act, several normative documents have been issued by the Regione to support its operative implementation with regards to objectives, coordination processes, communication and exchange protocols, data specifications.

## 2.3 Organization

The development of the Regional SDI is lead by the SDI Unit within the Directorate General Territory and Planning of Regione Lombardia. This Unit is supported from the technological side by LISPA, and from the strategic side by a Steering Committee formed by representatives of Regione Lombardia, LISPA, an ICT research and training consortium (CEFRIEL), and the JRC of the European Commission, which ensures the linkage between the regional SDI and the emerging INSPIRE specifications.

Among the SDI Unit responsibilities are:

- Definition of data specifications for topographic database and spatial planning information;
- Publishing spatial data and giving access to shared services;
- Promoting the use of spatial information among public administrations;
- Financing specific GIS projects and promoting research activities;
- Participating in collaboration and projects with other committees and organisations at European, national and inter-regional level.

Formal agreements have been established among all the partners who participate in the SDI. In the coordination of the SDI development a number of critical issues have been faced initially, including:

- The high number of participants (11 provinces and 1546 municipalities),
- An average low awareness at the local level of GI potential benefits if not supported by real cases (taxation, cadastre, health safety and security);
- Different technologies used by the participants;
- Different semantic and data models;
- Geometric inconsistency among data produced by different actors;
- Integration issues due to conflicts about GI ownership among different organisations;
- Complexity of distributed database maintenance.

To address these issues, pilot projects have been set up in selected areas, helping in the adoption of standards, technical specifications and harmonization tools, and

integration with administrative procedures. Decentralized service centers have also been set up to support smaller municipalities in the SDI implementation, and help overcome their small size and fragmentation though collaborative agreements among adjoining authorities.

## 2.4 State of Development

The regional SDI being developed is a good case-study of an effort to move from a collection of loosely coupled GI Systems developed within the departments of the Regione Lombardia towards an infrastructure that serves not only the Regione Lombardia itself, i.e. the regional authority, but also the entire regional territory including public administrations, the private and voluntary sectors, education and the public. Having devised the strategy, the Regione Lombardia has been successful in applying to national government funds related to the implementation of e-government. The funds obtained are supporting three main projects:

- RELIT: the project, run by the SDI Unit with the support of LISPA, and in collaboration with the Milano and Bergamo Provinces, the Milano Municipality, and the DG JRC of the European Commission, consists on the applied research study of the technical and organizational factors for the Regional SDI development;
- SITI: the project, run by the Comunità Montana Valtellina di Sondrio and Valtellina di Tirano, deals with data collection and GIS development for administrative and technical PA procedures support;
- ISAC: the project, run by the Comunità Montana di Valle di Sabbia with the operational support of Secoval srl, develops an inter-municipal Service Centre for large scale topographic database implementation as well as thematic and cadastral GI management.

These three projects, and RELIT in particular, have made an important contribution in implementing the SDI strategy.

### *2.4.1 Data*

Further funding from central and regional government has enabled to put in place a programme to update the regional topographic database through a partnership approach with local authorities which are co-funded (50%) to produce detailed topographic databases (DBtopo) according to agreed common specifications, that are then generalised for regional use. Municipalities are required to form local partnerships to access the regional funding for DBtopo production at the scale 1:1,000/1:2,000 for settled areas and 1:5,000/1:10,000 for rural areas. The programme has been successful since its beginning and in the first two tenders 2006-2007 about 800 municipalities grouped within 13 partnerships and received some €17 million of co-funding. More tenders have been issued in 2008 contributing to increase the regional coverage. The process of data acquisition, structuring, validating, and processing is a major financial, technical, and organizational commitment but will allow to have in place a shared multi-scale database useful for both local and regional processes, and maintained locally through regular administrative processes such as building permits, commercial licences, and links to population and other key registers. It is therefore a major strategic investment in the modernization of the entire system of public administration in the

region. In addition to the updated DBtopo, several information layers are already available though the services offered by the regional SDI.

### *2.4.2 Services*

The regional SDI offers several services to the user, such as:

- Discovery;
- View;
- Download (data are available for free to the final user by selection of format, themes, and location);
- Gazetteer;
- Transformation (available both as a stand-alone application and as webservice for relevant Italian reference systems);
- Geoprocessing (DBtopo quality control);
- GPS ground stations data access.

These services are available from the geo-portal of Regione Lombardia (http://www.cartografia.regione.lombardia.it/geoportale). The architecture allows different regional departments to edit the datasets for which they are responsible. Moreover, other regional administrations such as the Provinces and the Communes can use the geo-portal to publish their topographic and thematic datasets and relevant metadata. In the geo-portal more than 50 regional map services are available (ArcIMS) and WMS regional reference maps (scale 1:50,000 and 1:10,000) are currently under implementation.

**Figure 4: Geoportal of Regione Lombardia**


A map viewer is embedded in the geo-portal metadata catalogue by which users can access all ArcIMS and WMS map services published in the catalogue by the participants. The geoprocessing services supply procedures for the DBtopo quality

control. The download services have obtained a relevant user success with up to 900 unique hits per week. The geo-coding services are also very popular.

The geo-portal and the regional SDI services are built on top of the Regional Enterprise platform for Geographic Services (REGIS). The system Service Oriented Architecture is compliant with international standards such as ISO, W3C, and OGC, and part of the RELIT project's objectives is also to ensure that the portal, metadata catalogue, and services are compliant with the emerging INSPIRE Implementing Rules. In this respect, tests have already been made to ensure that the metadata is compliant both with INSPIRE and EN ISO 19115, as well as the national catalogues being developed by CNIPA.

On top of the SDI data and services available, a number of applications have been developed to support spatial planning and decision making processes such the local land use planning, Environmental Impact Assessment (EIA), and Soil Protection.

### *2.4.3 Impacts*

A cost-benefit study is currently under development in collaboration with the JRC of the European Commission to evaluate the impacts achieved by the implementation of the regional SDI. The study deals with both internal (within the Regional Administration) and external (other public and private organization and citizens) impacts in terms of cost savings, efficiency and quality of service improvement, and user satisfaction. Work in progress includes direct interviews and a questionnaire to private sector professionals (engineers, architects) dealing with planning, environmental impact assessment, and other processes for which the SDI is relevant.

# 3 Piedmont

## 3.1 Regional Setting

The Region of Piedmont is located in the North-West of Italy. With an area of 25,399 km$^2$, it shares its borders with France to the West, with Valle d'Aosta Region to the North-West, with Switzerland to the North, with Lombardia and Emilia-Romagna Region to the South-East, and with Liguria Region on the South (see Figure 5). Piedmont has a population of more than 4.4 million inhabitants, 901 thousands of which live in Turin, the regional capital city.

The Region is divided in 8 Provinces and 1,206 municipalities, 950 of which have a population smaller than 3,000. Together with Turin, only Novara has a population bigger than 100,000. The territory is characterized by mountains (over 43%) and by a number of rivers, among which the Po cross it from the West to the East.

Agriculture features a share of 18% of production while industry the 28% and services the remaining 54%. The regional GDP was € 118,753.5 million in 2006.

**Figure 5: Location of Piedmont**


Source: Assembly of European Regions www.aer.eu

## 3.2 Policy Framework

### *3.2.1 National Level*

See Section 2.2.1

### *3.2.2 Regional Level*

The regional authority (Regione Piemonte) is responsible for the implementation and maintenance of the regional GIS within its broader responsibilities in the field of spatial planning and governance. Currently a new spatial planning regional law is under development. Once adopted it will provide the legal status of the regional SDI as well as the coordination measures between local authorities with regards to spatial data integration.

## 3.3 Organization

The Regione Piemonte is responsible for the development of the regional SDI (SITAD) with the technical support being provided by CSI Piemonte, a regional public consortium for regional and local technical support to public administration, and for delivering services to citizens and the business sector. Common data specifications derived on the base of the national ones are adopted to provide a common geographic knowledge framework. Economic support is provided to local administrations for the creation of topographic database based on the common specifications as a mean to achieve regular regional reference database maintenance.
So far, agreements on sharing have been proposed to the regional internal sector, to the Provinces, and to the municipalities in single or aggregated form, in order to foster:

- The resource metadata documentation;
- The available resource publication in the catalogue;
- Data access and sharing enablement;
- The use of common standards.

Expected results include:

- Data-sharing among stakeholders;
- Increase human resources skills with training and education programme
- Increase the frequency of data update;
- Data model harmonization;
- The integrate the missing data into the regional SDI;
- Promotion of GI technology project among different levels of public administrations

On the end-user side, specific ‘geo-licenses’ have been set up: the so-called matrix “data/use categories/access”, is a simple framework to show all possible kinds of access available for different types of users.

Since 2004, Regione Piedmont also carry on research projects to develop the topographic database from available digital data in CAD format, and its maintenance process according to a collaborative model where different actors supply the relevant update obtained by administrative routines they are responsible for. Moreover, protocols for subsidiary collaboration among administration at the different level have been experimented within a project (2006/2007) for the regional cadastral information systems

based on the experiences of other regions within the national project e-government SIGMATER (http://www.sigmater.it/). The project has been developed with the support of territorial service centers (ALI) delivering technology services to small-municipalities partnerships, similarly to the approach adopted in Lombardy.

## 3.4 State of Development

The development of the Region Piedmont SDI (SITAD) project started with a feasibility study in 2006. SITAD represents the latest evolution of integration efforts for existing sector GIS formerly developed with scattered initiatives over time and in different Regional Departments. The project of the new regional SDI fall within a broader policy of the Region for the public administration Information System integration at the regional and local level and its technology platform. The existing 'RUPAR Piemonte' regional unified network provides interconnection and value-added services to the local administrations. Moreover, the RUPAR2 programme, currently under development, involves the extension of the RUPAR to provide the whole region with broadband connections and new value-added services for administrations and private companies.

At the current state of development the SITAD constitutes a framework for collecting and sharing geographic information and environmental data as well as product and services in different formats within the region. Moreover SITAD implements technology solutions and carries out initiatives to exchange data with other SDIs at the national and international levels. To this end the SITAD development follows national e-government guidelines from CNIPA, and the Intesa GIS and national environmental geo portal guidelines. In the development of SITAD particular attention has been paid to the study and application of interoperability standard (ISO/CEN, OGC) with the aim now to ensure compliance with INSPIRE implementing rules.

### *3.4.1 Data*

A large umber of datasets re already available through the regional SDI for view, and download. The emphasis is moving towards the creation of local topographic databases, based on the common data model, that update the regional basic topographic database. The approval of the new legal framework will boost this process.

### *3.4.2 Services*

The SITAD offers discovery, view, download and invoke services. The online metadata editor (Dublin core and ISO 19115 compliant) is accessible to registered officers and supports XML files upload and export. Un-registered user can access the online metadata catalogue by keyword, classification, relevant public authority, time reference, and geographic location (see http://www.sistemapiemonte.it/serviziositad/). The catalogue currently features over 1500 data records in Italian. View services are currently available in WMS, and the WFS protocol is under implementation. Download service is available to authorized users according to their profile permissions, and in the future will be also available via the WFS service. Invoke services for metadata search and retrieval are also available. The portals has 2000-3000 hits per month (2007).

**Figure 6: Portal of Regione Piemonte**


The SITAD interface is developed according to a multi-layout format in order to allow the application customization according to specific needs of each public administration. Further SITAD developments include a common viewer, further publication tools, WFS transactions, an ontology-based semantic search engine, and the single connection for different WMS within the geo-portal.

### *3.4.3 Impacts*

Moving from lesson learned from similar studies, the assessment of impacts of the Piedmont SDI is currently in progress applying the methodology proposed by the ESDI-NET+ project. After the identification of stakeholders, user communities and potential benefits, the user and business model and the relationship will be defined. Then the analysis of the cost and benefits related with the setup and maintenance of the SDI will help to define indicators for evaluation of the socio-economic benefits. Work in progress includes direct interviews addressed to the Provinces and the most important municipalities (or aggregations of them in case of small or medium-sized municipalities) to test the questionnaire proposed by ESDInet+ project, and on-line interviews to other local administrations to obtain a broad perspective of the actual scenario and to provide inputs for the future development of the regional SDI.

# 4 CATALONIA

## 4.1 Regional Setting

Catalonia is one of the 21 Autonomous Communities of Spain. It comprises four provinces, 41 historical counties (known in Catalan as *comarques*), and 946 municipalities, spanning an area of 32,000 km$^2$. The population in 2006 was of 7,134,700 inhabitants, 15.9% of the national total. Catalonia shares its borders with the Valencia Community on the South, with the Aragon Community on the west, and with France and Andorra on the North, being limited by the Mediterranean on the East (see Figure 7). The Barcelona metropolitan area covers 633 km² with a population of 3.1 while the whole urban region of Barcelona extends to 4.268 km² hosting more than 5.3 million people. The region faced a demographic boom in the 60s and 70s due to a large internal migration form rural areas to more industrialized areas. The autonomous government of Catalonia (the *Generalitat*), and its parliament, have exclusive authority over the following areas: culture; health and social services; education; research; enterprise; territorial policies and public works; the environment; housing; economy and public finance; and justice and security. Other responsibilities are shared with the government of Spain. In 2007 the regional GDP was € 202,509. In terms of GDP/capita, Catalonia is the 4$^{th}$ wealthiest region in Spain. The Catalan economy is distinguished by its industrial profile: while primary sector features a 2.8% share, secondary sector features 37.2% and tertiary 60%.

**Figure 7: Location of Catalonia**


Source: Assembly of European Regions www.aer.eu

## 4.2 Policy Framework

### *4.2.1 National Level*

In accordance with the INSPIRE initiative to develop a Spatial Data Infrastructure in Europe, the Permanent Commission of the High Council for Geography (the State's superior, consultative and planning body within the realms of cartography) has established a working group for the development of Spatial Data Infrastructures in Spain (IDEE) in 2002. The IDEE is an initiative to incorporate through a decentralized structure all the national, regional and local SDIs. The Geomatic Commission of the High Council for Geography, which defines and develops the IDEE, has set up a technical open working group, integrated by representatives and experts on geographic information from state, regional and local public organizations as well as from the University and the private sector. This Working Group has carried out periodic meetings three times a year, to present technical guidelines, to agree and approve Recommendations for the SDI in Spain, and also to exchange experiences and to show the IDEE development at the national and regional level. Moreover, nine sub-groups have been established to deal with specific technical and thematic issues to support the IDEE implementation. Specific recommendations have been issued with regard to metadata, web map services, and gazetteers implementation. The national SDI (www.idee.es) is one of the leading examples in Europe at the present time with advanced services available for general use. Its strength is also the result of the lead taken by regional SDIs such as that of Catalonia discussed here and Navarra discussed in Section 5. In November 2008, an open access policy for the non-commercial use of topographic data has been defined at the national level.[6]

### *4.2.2 Regional Level*

The Catalan Spatial Data Infrastructure initiative, known as IDEC, started in 2002 as collaboration between the Cartographic Institute of Catalonia (ICC), the two departments of the regional government, the Department of Land Policy and Public Works, and the Secretary of the Information and Telecommunications Society (STSI) of the Department of Universities, Research and the Information Society. The objective of IDEC is to promote the use of geographic information (GI) by making data more easily available to public and private sector users, and to the general public. Its main function is to develop an enabling platform to promote the dissemination of information and encourage contacts between data providers and data users. The project was also seen as a means of stimulating GI-based projects at regional universities and research centres.

The legal framework was adopted in 2005 (Law n°16/2005) according to which (art. 6) the ICC has the technical responsibility for creating and maintaining the SDI, and, to this end, collaborates with other public organizations and local administrations as coordinating body. Moreover the Cartographic Coordination Commission of Catalonia (CCCC) is created to coordinate collaborations among regional and local administrations, and give advice to the Government. The same law (art. 44) establishes the Catalan SDI based on the principles of no duplication, accessibility and sharing of geo-information (reference data, core thematic data and other data of importance for territorial management) according to interoperability standard.

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6 http://www.idee.es/resources/leyes/A19138-19140.pdf

## 4.3 Organization

The development of the IDEC is coordinated by a Center of Support which is a Unit of the Cartographic Institute of Catalunya (ICC). The Center of Support reports to the ICC Director and to the Cartographic Coordination Commission. A part of the functions established by the law, the Center of Support (ICC) maintains and promotes formal agreements with other Departments and public bodies, as the electronic government organization, the Information Society Secretary, and others. The staff of the Support Center includes 1 Director, 2 programmers, 1 project manager, while technical resources including office space, hardware, software, and servicers are provided by ICC.

## 4.4 State of Development

The IDEC development process started in 2002 with a program plan until 2006. After the preparation of the business model, relationships, institutional arrangements, and the study and implementation of metadata standards, first software were developed and tested. In 2003 the first Geoportal was launched, offering the first services (e.g. first WMS services from the ICC and from the Department of Environment). By the end of the year 123 layers were available including topographic maps, ortho-photos, and other thematic data supplied by many regional organizations. A catalogue was published in three languages containing over 15,000 metadata records supplied by 30 organisations (27 public and 3 private). The tools available allowed creating the first thematic SDI to support coastal management under the EUROSION EU project. In 2003 the first metadata editor MetaD was distributed for free download on the Geoportal.

In 2004 the MetaD tools was updated introducing the ISO 19139 metadata standard, a more useable interface and new tools for metadata management. The catalogue was also updated with new search interface and functions, and the number of records continued to grow as well as the number of user visits with more than 12,000. The WMS client-viewer was also up-dated and new WFS ad WCS were added allowing data download in GML. Also in 2004, the first geo-processing layers were created using WSDL and SOAP standards.

In 2005 and 2006 the number of metadata records as well as the number of thematic layers and services (WMS, WFS, WCS, geo-processing) continued to grow also thanks the establishment of new collaboration and partnerships from both public and private providers. On top of the infrastructure new sector project started with the aim of exploiting the IDEC potential in different domains such us coastal management, and research (IDE.Univers). Among them IDE.Local can be considered a major project involving local authorities in data and metadata sharing. With regional e-government funds and the technical support of the IDEC Support Center incentives were given for the creation of metadata (€ 30 per record), the publication of data in OGC compliant services (€ 2,000 to each participating authority), and for GIS project related to the IDEC development. In less than one year of activity, the IDE.Local project achieved the following results:

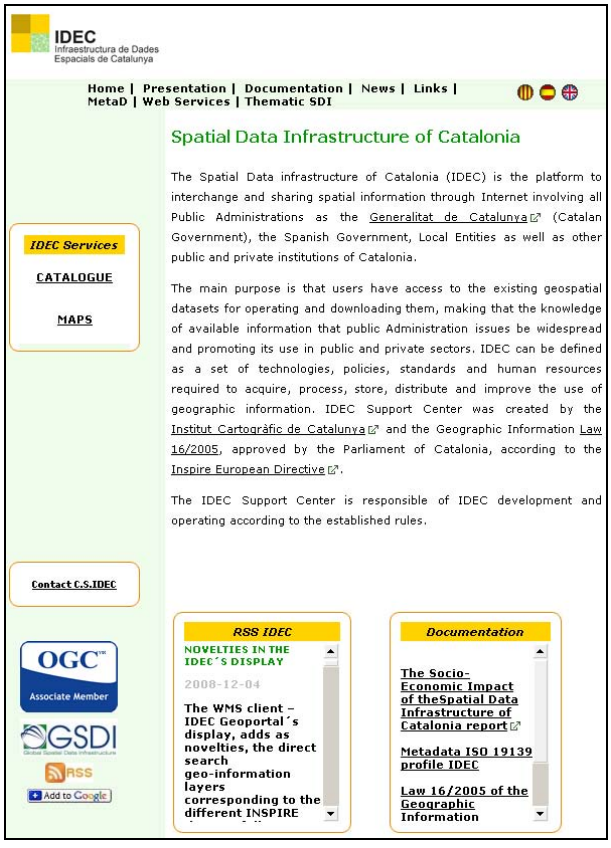
- 80 local authorities were using the map viewer in their web-pages,
- Online Municipal Street Maps were registering 15, 000 monthly visitors;
- 20 local authorities were using publication tools for their new layers;

- 25 municipalities had their WMS (4 to 6 layers) connected to the IDE.Local network;
- 60 municipalities published their geo-data metadata adding 3,000 new records to the Catalogue.

### *4.4.1 Data*

The major providers of data (reference and thematic data) are the Cartographic Institute, the Environment Department, Local authorities and Universities. Minor providers include private companies, NGO and others. Reference data includes topographic data (which contains several INSPIRE themes), orthophotos, at different scales (from 1:1000 to 1:50.000) and street map of Catalonia. Also geographical names are available. These geodata are accessible by the end users using the IDEC viewer or directly accessing to the map servers, thanks to the OGC services (WMS, WFS). Some providers allow to download data by means of the WFS services. All these services are free of charge and publicly available. Every provider is responsible for its data (custodianship, updating, quality, etc.). Currently there are more than 1,500 layers available.

**Figure 8: The Geoportal of the IDEC**




### *4.4.2 Services*

The entry point to the IDEC's services is the geoportal (http://www.geoportal-idec.net/geoportal/eng/inici.jsp) which gives access in three languages (Catalan,Spanish, and English) to the Catalogue, and maps. The Catalogue contains

some 15,000 metadata records for datasets, and some 200 records for services provided by 17 organisations. The geoservices provided include view, download, geocoding, and coordinate transformations. There are also thematic applications addressed towards local authorities and universities. Including customizable viewers and editors for Local authorities which are used as mashups in many public and private sector web pages. (e.g. tourist routes web, industrial companies registers and so on). Currently, 250 municipalities have published in their web pages their customized viewers, based in the IDEC resources, which receives more than 30.000 visits monthly. The geoportal is accessed by other 20.000 visitors monthly, to consult the Catalogue and the Viewer. Mostly they came from the public sector, but also the private users represents a significant percentage. Many other public and private end user applications uses the WMS available in the IDEC network to access to reference and thematic data.

### *4.4.3 Impacts*

A major study was undertaken in 2007 by the Centre of Land Policy and Valuations of the Universitat Politècnica de Catalunya on the socio-economic impact of the spatial data infrastructure (SDI) of Catalonia. The Joint Research Centre of the European Commission commissioned the study and recommended the methodology. The study was based on a sample of 20 local authorities participating in the Catalan SDI (IDEC) together with 3 control local authorities not participating in the SDI, and 15 end-user organisations, of which 12 are private companies operating in the Geographic Information (GI) sector, and 3 are large institutional users of GI. The findings of the interviews were presented in two separate workshops to the participating local authorities and end-user organisations, to validate the findings and discuss the outcomes. The key findings are reported below.

*Costs:*

The total direct cost of establishing and operating the IDEC over a five year period (2002-06) was of €1.5 million, of which €325,000 for each of the first two years (2002-03) necessary to launch the SDI, and €283,000 per annum to operate and develop the infrastructure in the three subsequent years (2004-06). Human resources represented 76% of the costs during the launch period (the rest being capital investment), and 91% during operation. These costs do not include the creation and updating of topographic data, which is under the responsibility of the Cartographic Institute of Catalonia (ICC), and would happen regardless of the development of the SDI, nor the indirect costs associated with the physical and technological infrastructure (e.g. office space) provided by the ICC. They do include the following: metadata creation and maintenance, development of geo-services (including geoportal, catalogue, Web Map Service client), preparation of data for publication, applications, hardware and software, and management.

*Benefits:*

The evidence collected for 2006 clearly shows that the main benefits of the IDEC accrue at the level of local public administration through internal efficiency benefits (time saved in internal queries by technical staff, time saved in attending queries by the public, time saved in internal processes) and effectiveness benefits (time saved by the public and by companies in dealing with public administration). Extrapolating the detailed findings from 20 local authorities to the 100 that participate in the IDEC, the study estimated that the internal efficiency benefits account for over 500 hours per month. Using an hourly rate of €30 for technical staff in local government, these savings exceed €2.6 million per year.

Effectiveness savings are just as large at another 500 hours per month. Even considering only the efficiency benefits for 2006 (i.e. ignoring those that may have accrued in 2004-05, as well as the effectiveness benefits), the study indicates that the total investment to set up the IDEC and develop it over a four year period (2002-05) is recovered in just over 6 months. Wider socio-economic benefits have also been identified but not quantified. In particular, the study indicates that web-based spatial services allow smaller local authorities to narrow the digital divide with larger ones in the provision of services to citizens and companies.

**Links**

The Socio-Economic Impact of the Spatial Data Infrastructure of Catalonia
http://www.geoportal-idec.net/geoportal/eng/docs/impact_study_report.MAX.pdf
Documents about the legal framework:
http://www.geoportal-idec.net/geoportal/eng/inici.jsp?pag=documentacio&home=s
IDE.LOCAL Geoportal: http://www.geoportal-idec.cat/idelocal
IDE.Univers Geoportal: http://www.geoportal-idec.cat/ideunivers/local.jsp

# 5 NAVARRA

## 5.1 Regional Setting

The Autonomous Community of Navarre is located in the North of Spain covering an area of 10.391 km². Navarre is bordered by France to the North, Aragón to the East, La Rioja to the South-West, and the Basque Country to the West (see Figure 9). The total population of Navarre is 605,022 inhabitants (2007) approximately one-third of which live in the regional capital city Pamplona and one-half in the capital's metropolitan area. Among all the 272 municipalities only eight of them are bigger than 10,000 inhabitants. The total GDP for Navarre is €16,400 million (2006)[7] with a contribution of agriculture of 3.1%, industry 28.3%, construction 11.4%, and services 57.4%. In terms of GDP per capita, Navarra was the third wealthiest region in Spain in 2007.

**Figure 9: Location of Navarra**


Source: Assembly of European Regions www.aer.eu

7 http://www.navarra.es/NR/rdonlyres/91D8AEA7-182F-40D9-B7B3-9E4B06434D2F/95502/RESUMENINDICADORES3.xls

## 5.2 Policy Framework

### *5.2.1 National Level*

See Section 4.2.1

### *5.2.2 Regional Level*

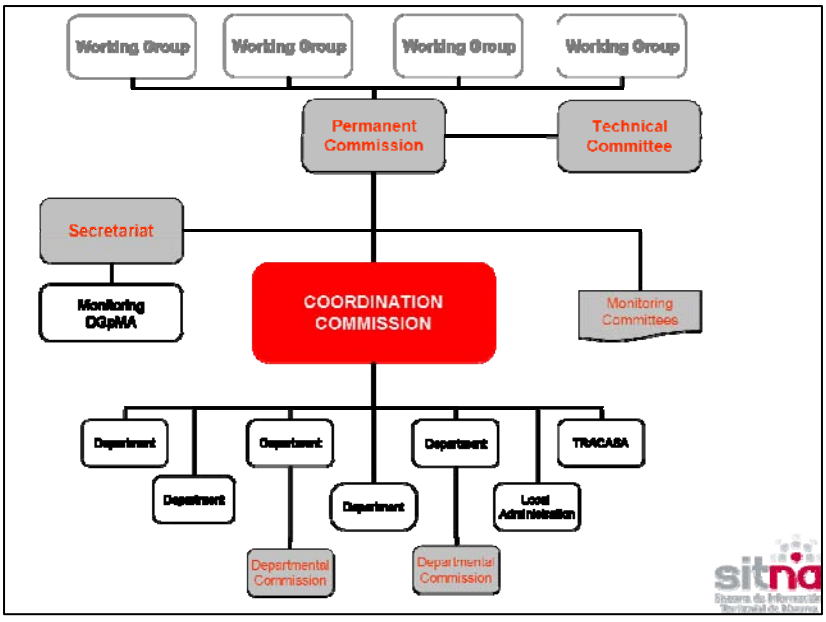
In the last decade the Government of Navarra has gone through several Technology Plans (2000-036/2004-07/2008-11) towards innovation. The strategy of the plans was to improve regional competitiveness, quality of life, and sustainability of development through improved sectoral, regional and European integration. Navarra enjoys a high level of autonomy within the framework of the Spanish Constitution, and levies its own taxes with a contribution then transferred to central government. Of particular relevance to the development of the regional SDI, is that the Government of Navarra also has responsibility for land and property registration (cadastre).

In line with a process of modernization of the public administration in Navarra, the regional SDI has been created through the evolution from restricted corporate systems to an open development infrastructure. The Territorial Information System of Navarra (SITNA) has evolved in the last decade into the regional SDI of Navarra (IDENA) improving integration and giving operative support to a wider number of users.

## 5.3 Organization

The SITNA have been implemented with the technologic support of the company Trabajo Catastrales S.A. (TRACASA). TRACASA, with its 240 employees, is a company supplying cartographic and cadastral services, as well as developing GIS, both in the public and the private sectors. The system organization is corporative and horizontal to ensure broad participation of all key actors. The main Board, the Coordination Commission, is chaired by the Vice President of the Government of Navarra.

**Figure 10: Organisational Structure of the SITNA**



## 5.4 State of Development

The SITNA has been designed to coordinate and update integrated GI resources from multiple units (all the Government Departments are involved in data supply) so that they can be used to support the activities of every unit, allowing every user's category to fulfill specific needs for information. The system integrates incoming informative flows of the different suppliers, and supplies back territorial integrated information. The incoming information flows are subject to quality assurance procedures, and a precise homogeneous reference system is used for spatial data integration. The system also allows for time series data management.

Whilst SITNA developed over a long period and was successfully used within the public administration, the emergence of the INSPIRE initiative highlighted the need to develop further a catalogue of resources, view and download services, and interoperability with other SDIs at national and international level[8]. This is the context within which IDENA has been developed to promote integrated and open internet access to geographic information of the corporate Information System of Navarre (i.e. SITNA). So while IDENA is SITNA' answer to INSPIRE and the National Spanish SDI, SITNA also supports other public applications regarding postal addresses, crops and the agricultural parcels information system (SIGPAC), environment, cadastre, planning and also some public-private partnerships applications related to coordination of underground pipes.
SITNA and IDENA are financed by the Navarra government in respect to data integration management, and warehousing, and the development of applications or tools for generic exploitation and dissemination (Viewer, web, portal). The system financing started in 2003 after the first administrative procedure with a budget of €325.000. The amount has been increasing yearly up to €700.000 in 2008. Data owners on the other hand are responsible for the financing of their own data production and maintenance, and integration with the regional system. Moreover, they cover staff and dissemination costs.

SITNA and IDENA don't represent any additional Unit at the Government of Navarra organization chart, but they represent a cultural and working methods change: every manager must handle their business using their own resources and providing solutions to satisfy their collective needs. According to this base the necessary human resources are reduced to coordinate the efforts from the different actors and it's assumed by the Coordination Commission Secretary. Taking into account SITNA organization chart, the human resources are listed below:

- Coordination Commission – Political board – 24 people
- Permanent – Policy-Technical scope – 12 people
- Technical Committee – technical board – 18

### *5.4.1 Data*

In accordance with ISPIRE recommendations data are structured according to the ISO 19100 standard. More than 183 dataset are available among which 164 are public, 7 are

[8] http://www.gim-international.com/issues/articles/id521-IDENA_Spatial_Data_Infrastructure_of_Navarre.html

corporate, and 12 are access-restricted. Available datasets include INSPIRE Annex I data: for them ISO compliant metadata are available and they can be discovered and viewed through the web interface, while only some dataset can are available for download. Annex II data and metadata (except Geology) are also publicly available. Eight Annex III data layers are available for the public. Different scales are available depending on the data layer and the use of the information.

### *5.4.2 Services*

The services provided in Navarra are accessible though both the SITNA geoportal and the IDENA portal which are closely linked. The Government of Navarra and the Pamplona City Council have so far developed seven discovery, view (WMS), download and geo-processing (routing) services, which are not accompanied by metadata but are available for free to the public.

IDENA Metadata are ISO 19115 compliant. There are 42 metadata elements in total of which 36 from the Spanish set recommended by the national High Council for Geography, and 6 that are specific to IDENA.

As indicated in Table 6, the usage of the different elements of the Navarra SDI is very heavy, particularly for the SITNA. This is not only for the high number of access from the public administration staff, but particularly because SITNA provides on-line access to the cadastral information system for registred users.

**Figure 11: IDENA and SITNA portals**

**Table 6: User Statistics for the different portals in Navarra**

| 2007 Month | WEB SITNA | WEB 3D | SIGPAC | IDENA | IDEPamplona | TOTAL |
|---|---|---|---|---|---|---|
| January | 1.753.861 | 815.075 | 216.909 | 134.298 | 50.545 | 2.970.688 |
| February | 1.859.162 | 720.761 | 269.344 | 132.399 | 53.696 | 3.035.362 |
| March | 2.066.082 | 950.223 | 461.391 | 133.194 | 40.362 | 3.651.252 |
| April | 1.615.931 | 646.467 | 424.508 | 102.172 | 30.136 | 2.819.214 |
| May | 1.670.519 | 742.030 | 254.335 | 98.565 | 25.961 | 2.791.410 |
| June | 1.501.478 | 848.395 | 172.296 | 100.880 | 27.673 | 2.650.722 |
| July | 1.257.749 | 493.646 | 146.904 | 111.027 | 26.106 | 2.035.432 |
| August | 1.501.241 | 635.111 | 179.287 | 86.911 | 19.389 | 2.421.939 |
| September | 1.643.962 | 516.677 | 162.434 | 98.943 | 15.135 | 2.437.151 |
| October | 1.897.677 | 554.103 | 192.812 | 121.693 | 22.639 | 2.788.924 |
| November | 1.952.225 | 520.716 | 314.569 | 171.654 | 24.001 | 2.983.165 |
| December | 1.432.170 | 385.013 | 182.623 | 104.113 | 24.631 | 2.128.550 |
| **TOTAL** | **20.152.057** | 7.828.217 | 2.977.412 | **1.395.849** | 360.274 | **32.713.809** |

### *5.4.3 Impacts*

There has been no formal study yet of the impact of the Navarra SDI. Nevertheless, what is critical is that cultural change and new methods of work that has been incorporated to daily work in an irreversible way, investing in specialized model of uses and users.

**Links**

http://www.idee.es
http://www.idena.es
http://sitna.cfnavarra.es
http://ww2.pcypsitna.navarra.es/default.aspx

# 6 WALLONIA

## 6.1 Regional Setting

Wallonia occupies the Southern part of Belgium (see Figure 12) covering an area of 16,844 km² (55.18% of Belgium) and a population of 3,435,879 (2007). Wallonia is divided into five provinces, two of which (Hainaut and Liège) have a population of over 1 million people, while the other three have less than half a million. Only Charleroi, Liege and Namur have a population bigger than 100 thousand inhabitants while more than one hundred centers have a population between 100,000 and 10,000.

**Figure 12: Location of Wallonia**


Source: Assembly of European Regions www.aer.eu

Wallonia's backbone is the Sillon Industriel, which runs from Mons in the west to Verviers in the east, and is home to about two thirds of its population. The Sillon Industriel was the first in area in continental Europe to undergo industrial revolution since the early 1800s developing mainly iron and coal industries. In the first half of the 20th century a share of the industrial activities moved to the Northern areas of Belgium, and since the 1960s the region of the Flanders became the major industrial development areas while Wallonia declined and started a painful period of economic restructuring. Recently, some parts of Wallonia still suffer from high unemployment rates, while some other parts in the South have been positively influenced by the economy of the neighbouring Luxembourg. Wallonians are currently working to reinforce the role of their

region as hub of European industry, thanks to its central position and well developed transportation network. The Region has also taken advantage of this asset to increase its level of exports and to encourage new enterprises to locate in the region. In 2004 the GDP per capita (PPP) in Wallonia was €21,858.

## 6.2 Policy Framework

### *6.2.1 National Level*

The development of SDI in Belgium has been characterized by the strong regional dimension of the country, with regional SDIs in Flanders, Wallonia, and the Brussels Region. The adoption of the INSPIRE directive and the need to transpose it into national legislation have influenced positively the dialogue among the key stakeholders and have lead to the establishment of a coordination structure which includes:

- a National Contact Point - Flemish Region;
- a National Spokesperson (advisory committee) - Walloon Region;
- a National Forum (focused on environment and geo-data) - Federal level.

Collaborations have also been formalised between the regional SDIs and the federal agencies, including the National Geographic Institute (IGN/NGI), which coordinates reference system and geographical names; the General Administration of Patrimonial Documentation (AGDP / AAPD) which deals with cadastral parcels.
I

### *6.2.2 Regional Level*

Since 2000 the Government of Wallonia started work defining and developing an interoperable Spatial Data Infrastructure to meet the needs and requirements of all users in the region. An early objective of the Government was the integration of the various cartographic projects in an open, consistent and coordinated system, to ensure information interchange and to avoid duplications and incompatibilities. To achieve this objective the Cartography Technical Committee (CTC) was established to coordinate spatial information projects of the Walloon Government's Services and develop the Walloon SDI and its Geoportal (project InfraSIG). Since 2002 the availability of Regional cartography to the public via the internet became a priority within the Walloon e-Government project.

The legal transposition of the INSPIRE Directive will result in a new legal framework for the Wallonia Region and in the enlargement of the CTC composition to include other regional authorities, provinces, local authorities, networks organisations, and to representatives from private sector and from the universities. Moreover, discussions have been undertaken with energy/water suppliers and sewage managers to share underground spatial data sets (e.g. water-main, pipelines, cables).

## 6.3 Organization

The InfraSIG project was started with the support of a number of working groups that involved officials from the cartography departments of the Wallonia Region. These Working Groups (WG) included:

- WG - Geoportal : audit and maintenance of the Geoportal content and structure
- WG - Metadata : production and maintenance of data, services and applications metadata

- WG - Data : data production and InfraSIG DB management
- WG - Services : development of new services and applications
- WG - Legal : uniform licensing models to make spatial data available
- WG - Socio-economic : definition of a global pricing policy

The activities of these groups proceeded in accordance with the INSPIRE initiative, and in compliance with International Standards (ISO TC211, OGC, W3c, etc) and with the e-government actions.

### 6.4 State of Development

Since 2003, the InfraSIG project achieved the following results:

- 2003: Geoportal, ISO 19115 metadata, secured viewers for professionals (base data : large scale topographic data, ortho-photos, streets network, hydrography), WebGIS facilities for various thematic data (Natura 2000, nature conservation, geology, sewage management), uniform licensing model to make geo-data available, download facilities;
- 2004: ISO 19139 v6 Metadata, W3C Location Web Services (SOAP/XML/WSDL), OGC and ISO 19128 Web Map Services, proposal of a pricing policy;
- 2005: base data modelling (INTERLIS) for interoperability and update by topographers;
- 2006: new Geoportal version with viewer for citizens, ISO 19119 services and applications metadata
- 2007: discovery metadata, new security and access management system (UM/AM, SSO with SAML standard), new WebGIS applications for thematic data (land use, floods areas)
- 2008: new Location Web Services and Web Map Services

INTERLIS (http://www.interlis.ch/index_e.htm) was introduced in 2005 as a methodology to develop the SDI of Wallonia. INTERLIS uses an object-oriented conceptual language and includes :

- Communication media: UML graphic language;
- Clear syntactic and semantic rules: Textual language;
- Characteristics related to geographic features (coordinates systems, geometry, topology, attributes, graphic display...);
- Multilingual models:
- Based on standards (UML, ISO TC 211);
- A sequential transfer format, open and neutral, based on W3C codification rules (XML) and complementary models.

INTERLIS is used as interoperability tools for the integration of Wallonia Region, Local Authority and surveyors models, allowing sequential-incremental updates, and quality and integrity control. The data modelling constitutes one of the preparatory steps to the second phase of the InfraSIG project, with the intention of exchanging the spatial data with the other GI actors in the public and private sectors.

### *6.4.1 Data*

The production of spatial data sets by the Wallonia Region and other data suppliers cover most of the requirements of INSPIRE Annex I, II and III. In Wallonia only few spatial data sets are produced by local authorities. Hence, most of data production is done at the regional level, and then made available to local authorities through the Geoportal (viewers and download) or CDs. Only one Province uses Web Map Services to develop specific viewers to solve local spatial problems.

Other partnership have been agreed between Wallonia region and Provinces to produce common spatial data sets such as the geo-referenced raster of the local streets Atlas of 1841, which fixes legal limits between private and public land. The next step will involve the definition of the way to integrate the legal limits in current vector reference databases (PICC, cadastral parcels, etc.). Another project, PICVerts (local greenways plan) projects involves local authorities to produce greenways data for a collaborative GIS application.

### *6.4.2 Services*

The Geoportal (http://cartographie.wallonie.be) currently constitutes a one-stop, federating and interactive entry point for the dissemination of spatial information and data. It offers WebGIS facilities for various thematic domains (including a geo-environmental decision support system), a tool for public access, and a separate secured access interface for professionals. The Geoportal also includes a Location Web Service.

The metadata management system METAWAL offer the following features:

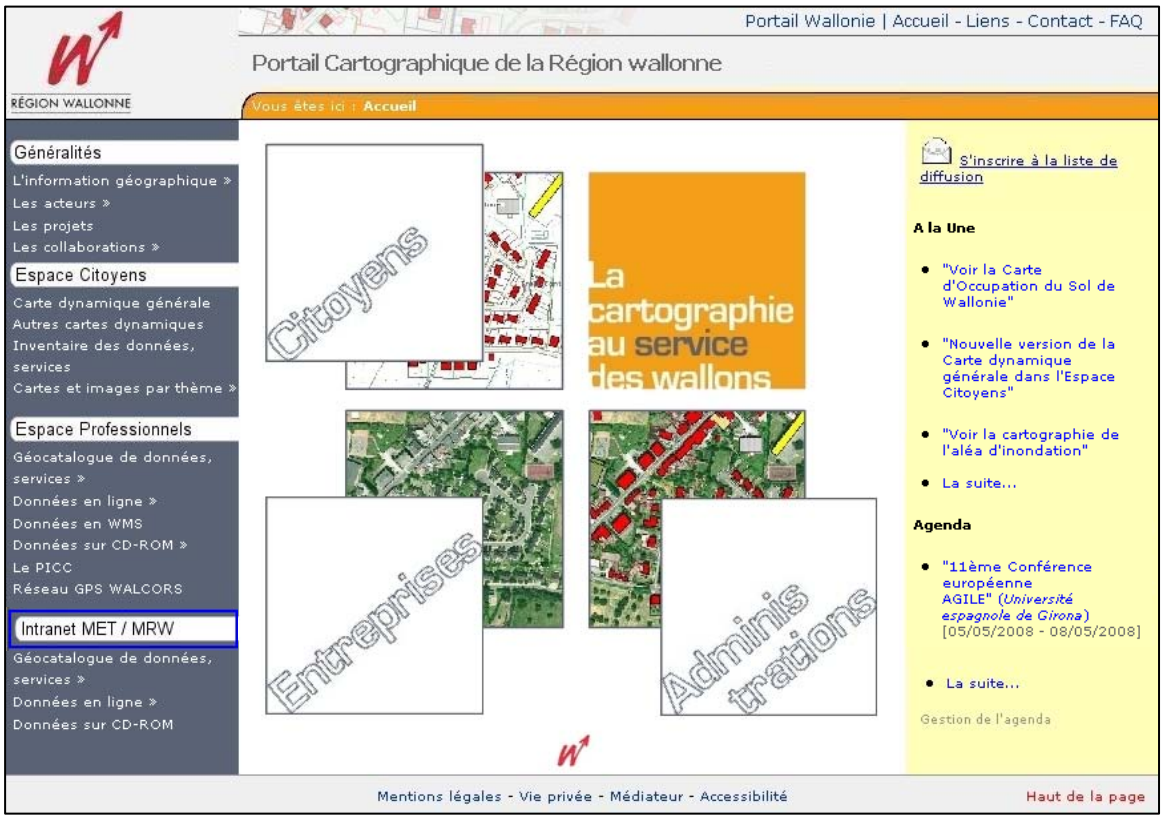
- Data dictionary of the Walloon profile compliant with the ISO 19115 and 19119 standards;
- UML models of the ISO and Walloon metadata profile;
- Models implementation in an Oracle DB (or MySQL DB);
- User-friendly coding interfaces;
- Multi-criterion search and retrieval information interfaces;
- Discovery and exploitation metadata;
- XML import/export tools in accordance with pre-ISO 19139 V6;

Future planned development of InfraSIG include:

- Ergonomic and graphic maintenance of the Geoportal;
- A Content Management System for the Geoportal;
- Refining the rules on data access (for example, secured WMS can depend on geographic extent);
- METAWAL adaptation after INSPIRE discovery service implementing rules entry into force;
- Dissemination of additional spatial data sets through view services, download services, WMS and WFS in accordance with INSPIRE implementing rules ;
- Decision making tools for public sector;
- «Life Lines» for citizens and private companies.

Moreover, the second phase of the InfraSIG project include the spatial data exchange with the other GI actors in the public and private sectors

**Figure 13: The Geoportal of Wallonia**




### *6.4.3 Impacts*

Since 2004, the Geoportal include between 10,000 and 20,000 visits per month, with a volume of download files from 5 Mb to 5 Gb. The number of users of local authorities grew from less than 100 in 2004 to 650 (including the provinces, 137 communes (52%), police services, fire brigades, utility facilities services). These authenticated users have access to secured viewers and download facilities. Most of the local authorities access the system for planning purposes (78%), for road and transport networks and mobility (33%), for sewage management 32%, environment protection (27%), public building management (21%), cemetery management (20%), energy/water supply management (15%).

# 7 FLANDERS

## 7.1 Regional Setting

Flanders has historically been a region overlapping parts of modern Belgium, France, and the Netherlands. Today, Flanders designates either the Flemish Region, a territorial circumscription, or the Flemish Community, which indicates the cultural community of Dutch-speaking Belgians, including Dutch-speaking residents of the Brussels-Capital Region. The parliament and government govern both the Community and the Region, even though they are not entirety co-extensive. The total area of the Flemish Region is 13,521 km² with a population of 6,117,440 in 2007.

The Flemish Region consists of 308 municipalities and it is divided into 5 provinces: Antwerp, Limburg, East Flanders, Flemish Brabant, and West Flanders. The region is limited by the North Sea in the North, while sharing its borders with the Netherlands on the North, with France and Wallonia on the South (see Figure 14), and it includes the Brussels Capital region as an island.

**Figure 14: Location of the Flanders**


Source: Assembly of European Regions www.aer.eu

The leading sectors in the Flanders economy are chemicals and plastics, automotive, life sciences, logistics and food. The communications infrastructure is highly developed. According to a survey carried on in 2005, 96% of Belgian companies are Internet-

connected (70% broadband) compared with the European Union average of 89% (53% broadband). In 2004 the GDP per capita (PPP) in the Flanders was €27,356.

## 7.2 Policy Framework

### *7.2.1 National Level*

See Section 6.2.1

### *7.2.2 Regional Level*

Flanders already started in 1995, by Ministerial Decision, to set up a framework for cooperation to develop and implement a sound communication and management system for geographical information: GIS-Flanders. Initial activities involved:

- transformation of analogue geo-data into digital geo-data;
- distribution of geo-data on CD-ROM;
- first common data specifications;
- first attempts to build a meta-database;
- participation in geo-related projects.

During this initial period, the conversion of digital data (CAD) to geographic database (GIS) was carried out at the local level and was characterized by scattered initiatives, lack of coordination and common methodology, and duplication of costs. In July 2000, a framework decree was issued to stimulate cooperation and to coordinate the optimal use of geographic information in the Flanders between all regional, provincial and local government bodies. According to this decree, a new process started leading to:

- common acquisition of geo-data;
- production, maintenance and distribution of reference datasets;
- development of thematic datasets;
- exchange of geographic information;
- coordination of the implementation of GI in administrative procedures;
- creation of a knowledge centre for GI, the Agency for Geographical Information Flanders (AGIF);
- a hierarchical and programmatic GI planning process.

A second important initiative consisted of the development of the first generation of electronic services. The SPIDI meta-database was created according to the pre-CEN 287 norm, whereas on-line visualization tools were developed for key geographic datasets, via the geo-Vlaanderen portal. Free access to geo-Vlaanderen, combined with a standardized user-interface and focus on policy related use cases, resulted in geo-Vlaanderen being used intensively by public authorities as well as companies and citizens.

A third important process for the diffusion of GI in the Flanders was the development of the Large Scale Reference Database (GRB). The process started with an in depth user-requirements analysis, involving both public authorities and utility companies to define a data model which could serve as a common denominator for as broad as possible a range of administrative and utility management use cases. A business plan was prepared based on a long term development perspective and public-private partnership. This was underpinned by a specific decree issued in 2004, which provided security about continuity, stability and structural funding. The process was run with the

involvement of many parties with the fixed 50% co-financing of the utility sector. Thus, the GRB was developed on the base of a specific legislative framework for usage under the Flemish government ownership, specifying co-financing agreements between the utility sector and the Flemish Region with regards to:

- the creation and role of the GRB-council
- the role of the steering committee GIS-Flanders;
- GRB specifications;
- planning and financing of the production;
- maintenance and management;
- property and usage rights.

While the Flemish government retains the ownership of GRB, the partners of GIS-Flanders, and the utility companies get free access to GRB. The GIS-Flanders Steering Committee proposes access conditions for third parties, to be confirmed by the Flemish government, after advice from the GRB Council. Moreover, the gradual obligatory introduction of GRB in administrative notification between various levels of government in the Flanders is being implemented.

## 7.3 Organization

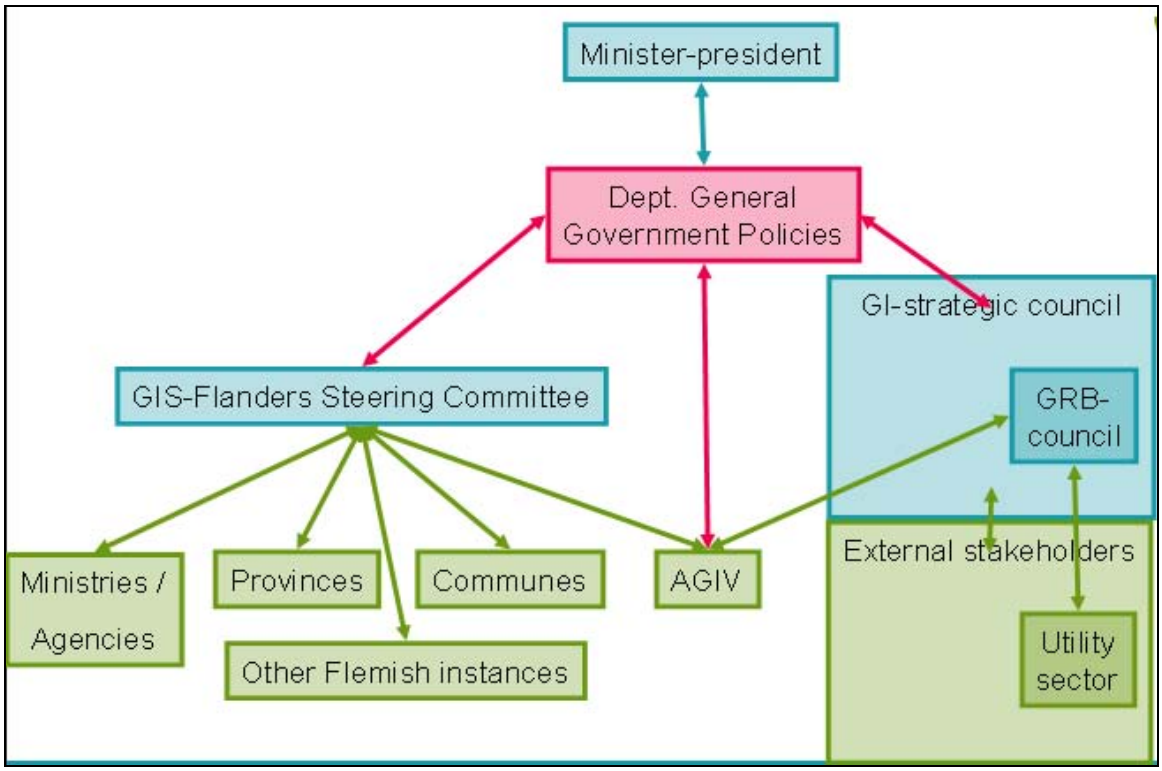
Many stakeholders have taken part in the development of GIS-Flanders including all the departments of the Flemish government, the Flemish Public Agencies (e.g. environmental agency, land agency, institute for nature conservation…), the Provincial authorities, 308 Municipalities, and third parties (e.g. port authorities).

The process was run according to a multi-step planning procedure including:

- multi-annual strategic GIS-Flanders planning by a Steering committee and with the approval of the Flemish Government;
- annual (operational) GIS-Flanders planning by the Agency for Geographic Information Flanders (AGIV) with the collaboration of other partners and the Steering Committee;
- provincial GIS planning;
- municipal GIS planning.

The AGIV was created in 2004 with a specific decree consolidating the upgrading of the support centre GIS-Flanders to a Flemish Public Agency, with the establishment of a board of directors and a multi-annual obligatory management contract with the Flemish government. The innovations introduced by the decree include more detailed AGIV tasks as compared to the decree on GIS-Flanders, such as the establishment of a documentation centre, the inclusion of services, the coordination of SDI-Flanders, and the specification of financing mechanisms.

**Figure 15: Partners of GIS Flanders**




The GRB development process is coordinated by the GRB Council constituted by the Advisory Council and representatives of the utility companies. In this process, AGIV is responsible for:

- production and maintenance of the GRB;
- installation and management of the GRB;
- coordination of the usage of the GRB;
- advice and support to the partners;
- quality control.

The GRB development is implemented according to a multi-annual business plan (up to 2013). The GIS-Flanders Steering Committee proposes the annual project-zone planning and the Flemish Government decides on the annual project-zones, with the advice of the GRB Council. The production process is project based.

### 7.4 State of Development

The result of the GIS-Flanders process led to the adoption of interoperability standards, and the supply of data and services. The development of the GRB is expected to be completed in 2014 with the integration of different data sources such as photogrammetry, topography, and ancillary data. The resulting database includes buildings, engineering structural works (bridges, tunnels ...), parcels, roads, watercourses, water-surfaces, railroads at a scale between 1:250 and 1:2500. The GRB is implemented with minimum technical requirements for large scale GI data, including

uniform geo-positioning based on the Flemish positioning system (FLEPOS), and standard call for tender specifications. GRB coverage has currently been completed in 32 communes, while it is in progress in 150 other communes.

From a technical perspective, the INSPIRE transposition process requires the development of a distributed service architecture with integration of end-user applications into a single environment, and focus on middleware service layer. Both AGIV, and other agencies and provinces offer to host services for communes. The upgrade of core-data to ensure the quality level needed for input in interoperable services is also required.

AGIV has a structural funding from the Flemish Government budget, governed by the multi-annual management contract. The funding covers all basic tasks as described in the GIS-Flanders decree, and the AGIV decree. The total cost of the GIS-Flanders on a yearly basis is roughly 25 m€, divided in several funding trances as follows (2007 consolidated figures):

**Table 7: Cost structure of GIS-Flanders**

| | |
|---|---|
| Development and management of GRB | 18,96 m€ |
| AGIV operations | 4,08 m€ |
| AGIV Investments | 0,76 m€ |
| KLIP | 0,25 m€ |
| External resources | 1,25 m€ |

The number of person involved in the GIS-Flanders development process grew from 3 (FTE) in 1995 to 110 in 2008, with more than 50% belonging to the 26-35 age cohort.

The GRB development funding relies on a yearly subvention from the Flemish government to AGIV and the revenues from charges to the utility companies, with distinction between various categories of utilities. To this aim a distribution key has been developed taking into account the nature of the utilities, and the length of utility lines/pipes in a commune to calculate their contribution. In the future revenues from third party access will complete the funding stream.

### *7.4.1 Data*

AGIV plays an active role in the data production process being responsible for data transformation, multi-format data production, quality control, and data distribution. Right from the start, it has been considered of paramount importance to distribute spatial data in a vendor-independent context, and therefore to support systematically the most frequently used data formats. More than 50 full coverage dataset are available, including:

- Street network (TeleAtlas, now Navteq);
- Flemish Hydrographical Atlas (AMINAL[9]);
- Orthophotos (in cooperation with Provinces);
- Redistribution of a raster version of the topographic maps 1 : 10 000 (NGI);

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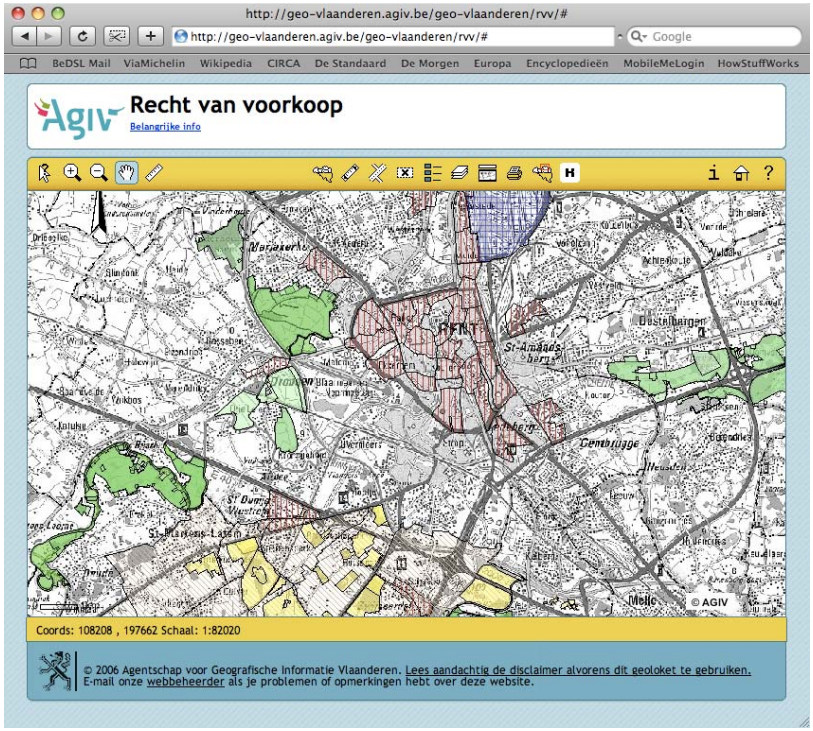
- KADSCAN / KADVEC (in cooperation with the Cadastre);
- High definition DEM (in cooperation with AWZ[10], AMINAL);
- Sector plans / RUP (RWO[11]);
- Flemish Ecological Network-areas (AMINAL);
- Land cover ;
- Central Reference Address Base (CRAB) which includes details of some 80,000 street names and 2.25 million addresses continuously updated;
- Soil map.

### *7.4.2 Services*

Several applications have been developed, including:

- Geo-Flanders: application for visualization and querying tools as well as an ISO 191xx compliant meta-database and a meta-data editor
- GIRAF: application for spatial data tailoring, ordering, and download;
- FLEPOS: Flemish Positioning Service (network of ground stations for differential GPS measurements)
- KLIP: Centralised plan-request module for digging and excavation requests works to prevent damage to subsurface utility lines;
- CRAB: Central Reference Address DB. Through this service, the communes become the starting point for its maintenance according to specifications for the exchange of address information.

**Figure 16: Visualization and querying of the various rights of pre-emption, integrated in a single application in Geo-Flanders.**




[10] Administratie Waterwegen en Zeewezen

[11] Ruimtelijke ordening Woonbeleid en Onroerend erfgoed

### *7.4.3 Impacts*

Geo-Flanders includes some 30 data themes and usage figures show raising popularity for all themes every time a new theme was added. As an example, the Cable & Pipeline Registration Service KLIP featured, after the first year of operation, more than 300 utilities companies and more than 2000 stakeholders registered, with more than 40,000 plan requests processed for digging and excavation requests.

Along with the evolution of the legal framework and the development of the GIS–Flanders, several results have been obtained thanks to coordination efforts, including:

- important reduction of scattered initiatives with no more basic mapping initiatives taken independently at communal level;
- coordination amongst provinces has become the default practice;
- recognition of AGIV as centre of gravity for Flemish GI activities (basically from ministerial depts. & agencies);
- multi-usage has become the default perspective for new data collection initiatives (Ortho-imagery, GRB, CRAB, etc);
- much earlier warning on new initiatives, resulting in better coordination and avoidance of unnecessary duplication, though still not 100 % efficient.

The GRB has led to a steady growth of registered update reports; nonetheless too few actors are actively involved in the maintenance process so far.

The harmonization efforts have resulted in the acceptance and use of the data sources made available through GIS-Flanders as the single reference source for new data themes throughout Flemish Public Authorities. The common usage of agreed specifications, services, and recommendations makes the technical exchange of Land Use Planning data and of cadastral information also feasible.

With regards to services, the Flemish Positioning Service FLEPOS has been so successful that it is used regularly by all topographers in Flanders.

**Links**

GIS-Flanders: http://www.agiv.be ,
Meta-database: http://metadata.agiv.be
Spatial data visualization: http://www.agiv.be/gis/diensten/geo-vlaanderen/?catid=8
Spatial data download: http://giraf.agiv.be
Positioning network: http://www.flepos.be
Cabling & utility registration: http://www.klip.be

# 8 NORTH-RHINE WESTFALIA

## 8.1 Regional Setting

North Rhine-Westphalia (NRW) is the westernmost and one of the largest states of Federal Germany with an area of 34,080 km², and a population in 2007 of just over 18 million inhabitants. NRW shares its border with Wallonia and the Netherlands on the West, and with the other German Federal States of Lower Saxony on the North, Hesse on the South-East, and Rhineland Palatinate on the South (see Figure 17). The region is centred on the Rhine-Ruhr urbanized region, which contains the cities of Düsseldorf, Bonn and Cologne as well as the Ruhr industrial Area.

The NRW Federal State is divided in 5 government regions (Regierungsbezirke), which in turn include 31 rural districts (Landkreise) and 23 urban districts (kreisfreie Städte).
The overall territory is constituted by 396 municipalities including the urban districts which are municipalities themselves. The GDP per capita in 2008 was of 25600 (PPS).

**Figure 17: Location of North-Rhine Westfalia**


Source: Assembly of European Regions www.aer.eu

## 8.2 Policy Framework

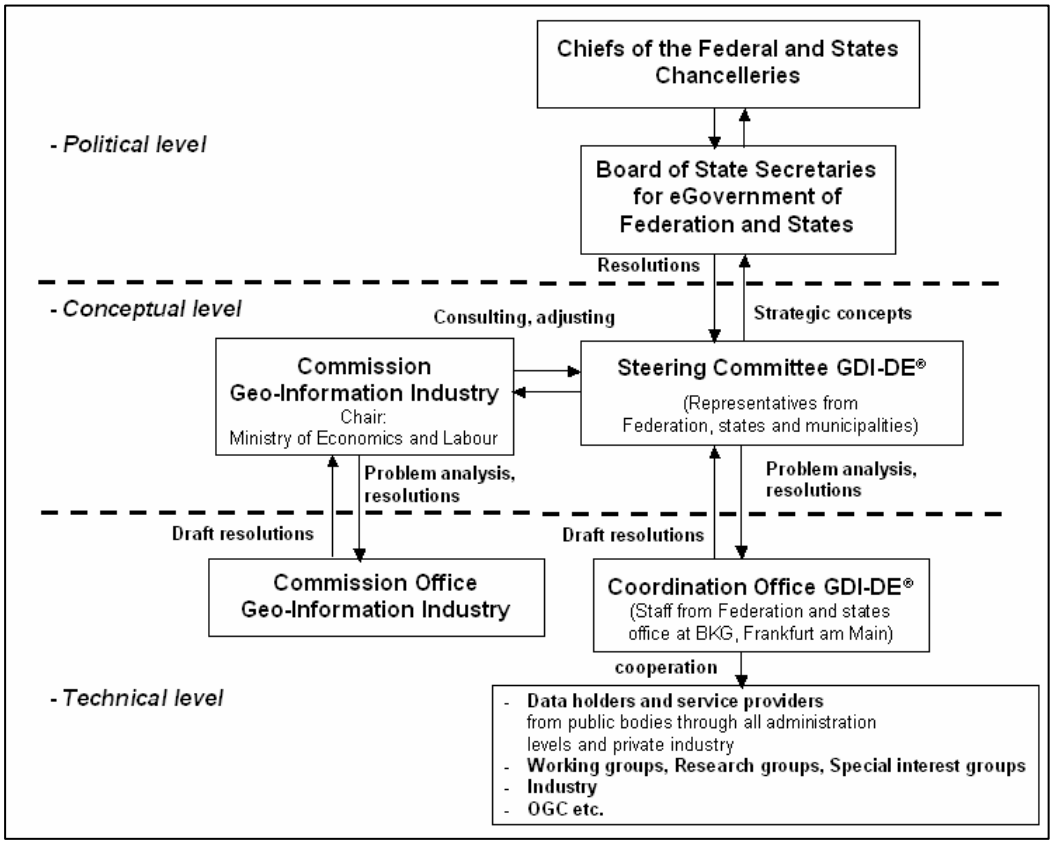
### *8.2.1 National Level*

In 2001 the German Bundestag requested with a resolution that the Federal Government take political measures to drive forward the establishment of an SDI for Germany. The public sector is responsible for its development, and all the federal states have taken political, institutional, and technological actions to establish regional SDI.

The structure of government in Germany has three distinct levels, including some 14,000 local authorities, 16 states, and the federal government, all of which are generators and holders of public information. This structure has an influence on the development of the German SDI.

In 2008 the national SDI in Germany (GDI-DE) is a public infrastructure coordinated by a common steering committee (LG GDI-DE) comprising members from the federal government, the federal states and the communal head associations. The organisation structure of GDI-DE is completed by the GIW-Kommission (Commission for Geo-Information Business), which can be seen as consulting body inside the development of SDI in Germany (see Figure 18)

**Figure 18: Organisational structure GDI-DE**




In Germany, each of the 16 federal states is responsible for its own topographic and cadastral service, environmental and statistical data collection, and in general for data policies. One of the major current projects is the development of the “Official Cadastral

Information System" (ALKIS), adopting the same data model of the updated "Authoritative Topographic and Cartographic Information System" (ATKIS). The use of the same data model and the systematic semantic harmonization of the object catalogues will provide a high level of integration between these two core systems which are at the basis of multiple applications.

Some federal states of the Federal Republic of Germany have already implemented or are in the process of implementing geoportals featuring a wide range of commonly used services. The GeoPortal.Bund (http://www.geoportal.bund.de) will be functioning as a central point of entry for GI in Germany, provided by the German Federal administration. It will be linked to the geoportals of the federal states, as well as to thematic databases and services. It shall also provide facilities for publishing data and metadata, and act as a node of the INSPIRE infrastructure. In 2004, the Geodatenkatalog was established as a part of GeoPortal.Bund. It is an online metainformation broker and central entrance point to the metadata catalogues of the emerging German NSDI. As an interdisciplinary search engine on distributed metadata Geodatenkatalog can be the main interface for the enquiry of core thematic metadata in Germany. Geodatenkatalog has also access to all UDK catalogues (Environmental Data Catalogues) in Germany via PortalU® catalogue interface (http://www.portalU.de).

In 2007 the guidelines for the implementation of GDI-DE Architecture V 1.0 were published. The document is available for the public (www.gdi-de.org). It describes goals, preconditions, technical issues and a roadmap (masterplan) for establishing the GDI-DE. It is seen as the common guideline for all public institutions dealing and using geo information. Technically it follows the Service Orientated Architecture and describes in details the key necessary components like Discovery-, View- and Download-Services. The guidelines identify three groups of functionalities depending on the level of maturity of available specifications and products, with varying levels of obligation for public administrations: GDI-DE Essential, GDI-DE Optional, and GDI-DE Future (see table 8).

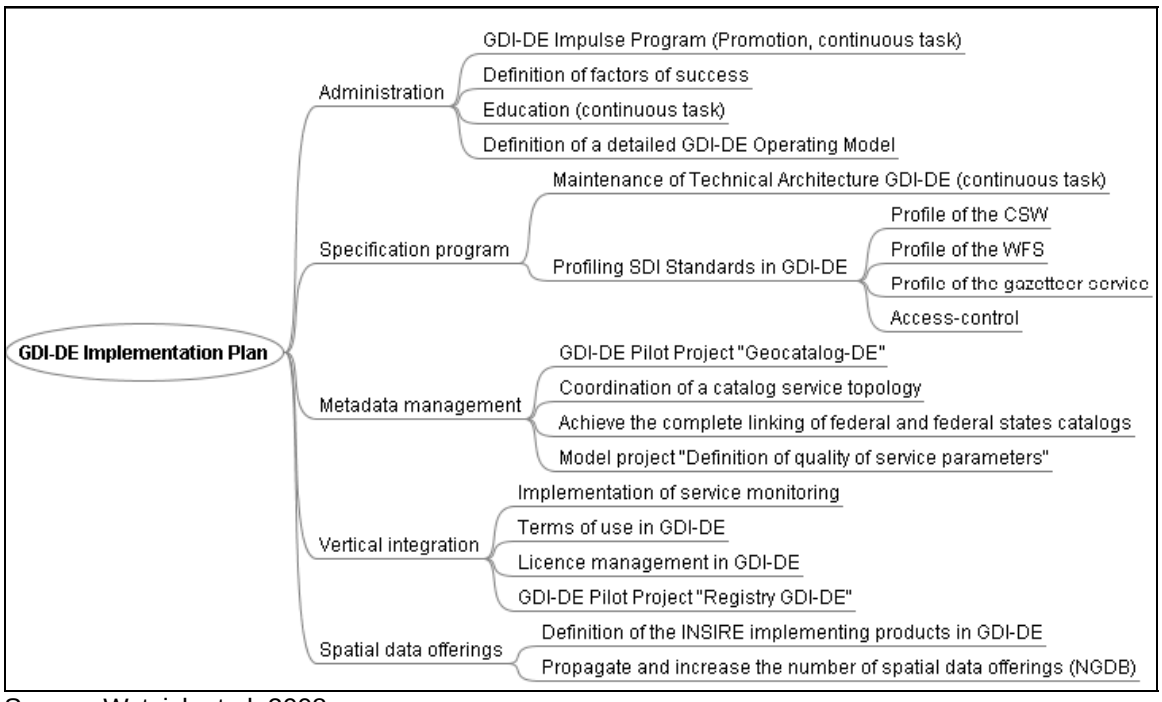
The Business and Coordination Office GDI-DE and the Architecture Working Group devised a comprehensive implementation plan for the construction of the German SDI (GDI-DE) that involves federal, state and local government levels. This GDI-DE Implementation Plan is based on the Technical Architecture GDI-DE and determines activity fields, procedures and instruments which shall be implemented on different administrative and organizational levels of GDI-DE. It also lays down – in a more general way – the central tasks of the GDI-DE for the years after 2009 (Wytzisk et al. 2008). Figure 19 provides an overview of the implementation plan.

**Table 8: Grading of Functionalities Supported in GDI-DE**

| Grading / Function | Solutions and stable specifications exist. (GDI-DE Essential) | Solutions exist, but currently stable specifications are not available. (GDI-DE Optional) | No solution and no stable specifications currently available. (GDI-DE Future) |
|---|---|---|---|
| Data provision and management functions | • Metadata catalogues: Registration and Lookup of spatial data, geoservices<br>• and applications<br>• Provision of vector data<br>• Provision of raster data<br>• Gazetteer | | • Registers<br>• Thesauri<br>• Sensor data |
| Visualization | • 2-D Visualisation | • 3-D Visualisation | |
| General functions | | • Service monitoring<br>• Access control | • Ordering functions<br>• License management |
| Applications | | • Geoportals | |
| Information models | • National spatial data base (NGDB)<br>• Defined CRSs<br>• Description of spatial resources<br>• Defined data formats<br>• (Vector, Raster) | | • Common license model |

Source: Lenk et al. 2008

**Figure 19: GDI-DE Implementation Plan**




Source: Wytzisk et al. 2008

### *8.2.2 Regional Level*

North-Rhine Westphalia (NRW) started its regional spatial data infrastructure in 1999 through two main initiatives: GEOBASIS.NRW and GDI NRW. The former is a large pilot project headed by the Ministry of Interior with the objective of integrating all the geo-data handled by local communities on the basis of the ALKIS standard. The challenge is to achieve interoperability among the many different solutions adopted over time by local authorities. Some 100 cities, counties, GI companies, NRW State offices, research institutes and users are participating in GEOBASIS.NRW (Bruggemann et al. 2004). The integration of ATKIS and ALKIS at state level, and the local interoperability project GEOBASIS.NRW are components of the state-level SDI initiative GDI NRW. The main goal of GDI NRW is to stimulate the geoinformation market which a study undertaken in 2000-01 identified as having achieved only 15 % of its potential (Fornefeld and Oefinger, 2001)

The following goals were formulated in establishing GDI NRW:

- Reference data of cadastre and national mapping are the official public reference sources to be used by all state authorities.
- These reference data should be easily accessible to the general public and all possible user groups.

To ensure interoperability between GDI NRW and GEOBASIS.NRW both initiatives are based on a common reference model (Kuhn, W et al., 2000). All participating institutions (state agencies, private GIS-companies, universities, GIS-users) have agreed on a common manifesto to apply uniform standards fixed in the reference model and based on international standards.

## 8.3 Organization

A permanent decision-body has been appointed by the Minister President's office to guarantee an organized development of GDI NRW. This "Inter-Ministerial Committee for the development of the SDI in NRW" (http://www.ima-gdi.nrw.de/) designs strategies for the creation of GDI, judges incoming project proposals referring to GDI, and gives advice to the ministries concerning all geo-information aspects. The Committee is also responsible for cooperation between NRW and other SDI initiatives in Germany, and for coordinating the implementation of the INSPIRE Directive in NRW. Members of the Committee are representatives from all NRW ministries being concerned with geographical information.

## 8.4 State of Development

The architecture of the NRW SDI follows the GDI-DE specifications in terms of mission, goals and organization, standards, and implementation plan. Services, applications and reference data are available free of charge to counties and cities. The development of the infrastructure has involved a series of Test beds and joint projects between 2001 and 2005 to demonstrate the application of the common reference model. Cross-border projects with the Netherlands and Belgium have also demonstrated the advantages of standards-based solutions, and the pitfalls that needed overcoming.

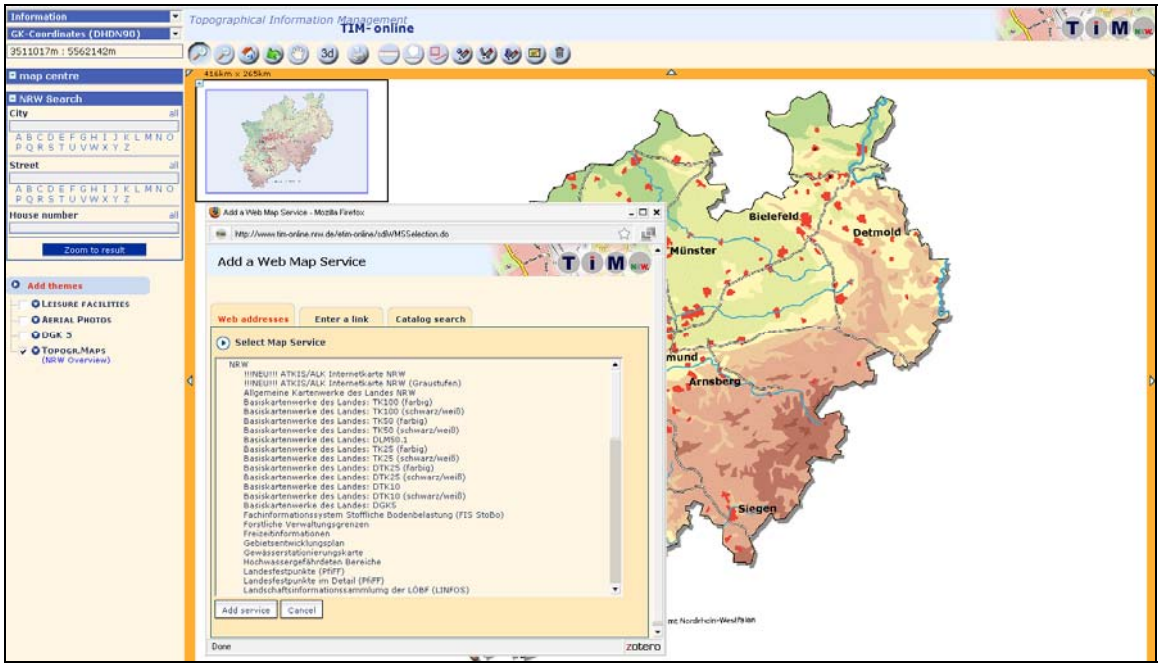
Since 2004, the application TIM online has been developed (www.tim-online.nrw.de) to provide public access to all topographic maps and digital Orthophotos of North-Rhine Westphalia (reference data).

Specifically for planning applications, a technical specification (Xplanung) has been developed as a platform independent standard for software development. Xplanung allows seamless exchange of different sector plans and different planning levels during the planning process.

### *8.4.1 Data*

All reference datasets are available as WMS-Services through TIM online. The range of data resources covers topographic data and orthophotos but also other thematic layers related to infrastructure, buildings, land use, land values, protected areas and so on. TIM online allows to focus on specific addresses via a Gazetteer service or by entering coordinates directly. A list of the themes available via WMS can be seen by selecting Add a Theme in the Tim Online applications as shown in Figure 20.

**Figure 20: NRW Data visualisation via TIM online**



### *8.4.2 Services*

As indicated earlier TIM-online (www.tim-online.nrw.de) is the main point of access to the GDI NRW. TIM online is an online application provided by the Federal State of North-Rhine Westphalia in order to display reference data of the Surveying and Cadastre Service via WMS. The service is provided to the users free of charge, but data download is not available. Moreover, the Department GEObasis.nrw (implementation of municipal geo-information systems) of the Regional Authority of Cologne promotes the use of this application to foster user collaboration in topographic data up-date, supplying the service free of charge. Other services are offered by the GEObasis.nrw according to licensing procedures but they are not free of charge.

Another thematic application on protected sites gives access to a joint map of all the relevant areas over Germany by the integration of distributed map services. Data in this application come from different sources, but they have common coordinate reference systems (CRS), common portrayal rules, and common semantics. TIM online also includes a 3D viewer

### *8.4.3 Impacts*

The declared objective of GDI NRW was to boost the market for geographic information in NRW and Gemany, based on a study carried out by MICUS in 2000-01 (Fornefeld and Oefinger, 2001). Much progress has been made in NRW both in terms of technical infrastructure and accessibility to geographic data, and this progress has been mirrored also in other federal states in Germany and at the federal level itself. Although positive benefits may have taken place on grounds of transparency of decision-making, and access to information, the economic impacts however appear to have yet to be felt fully on the market. A recent study by MICUS published in 2008 indicates that the overall market for geographic information in Germany has increased by some 50% largely due to the growth of the car navigation applications (see Figure 21 and 22), but that there are still major unexploited areas of application in the re-use of public sector information, particularly in the re-use of geographic and statistical information. As argued by MICUS,

> *By comparing the most recent results for 2007 with the results obtained by the MICUS study in 2003, the following picture emerges: Content-based growth only took place in the private sector of the geo-information market. Conversely, the geo-information market on the basis of public sector information remained at or developed below the status-quo scenario (Fornefeld et al, 2008, pg 7).*

The conclusions of this study are that aside from technology-lead developments, there is a need for major changes in data policy to lower access costs and ease licensing agreements if the full impacts of the data infrastructures is to be harnessed.

**Figure 21: Growth in the geo-information market in Germany 2000-2007**

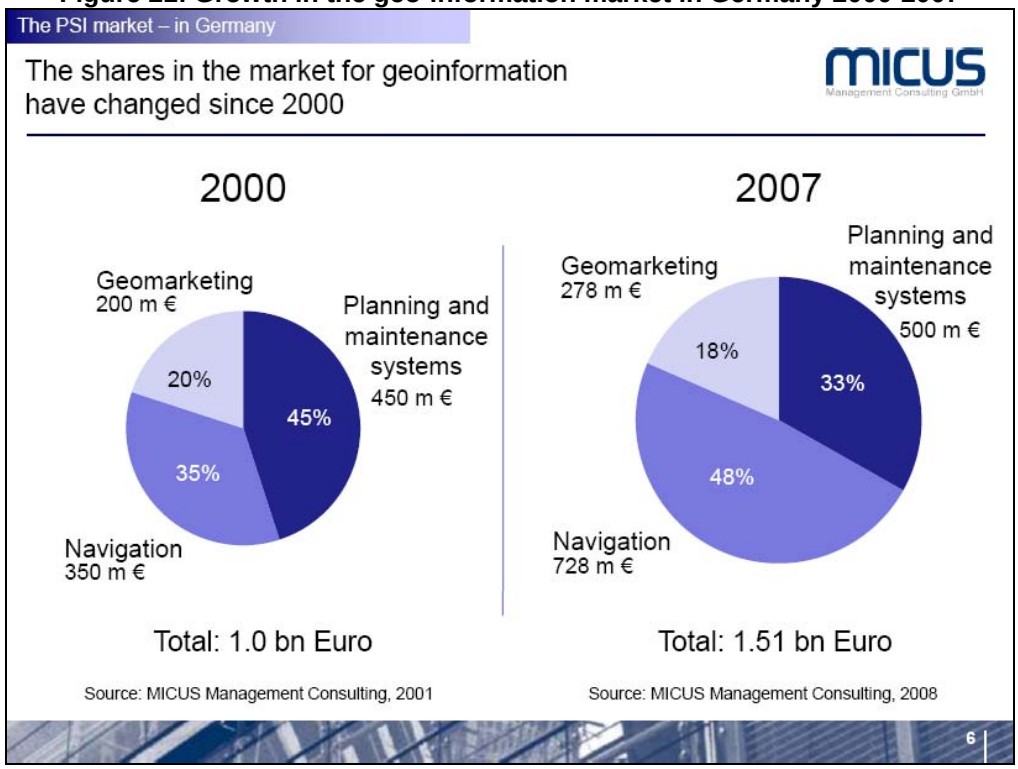
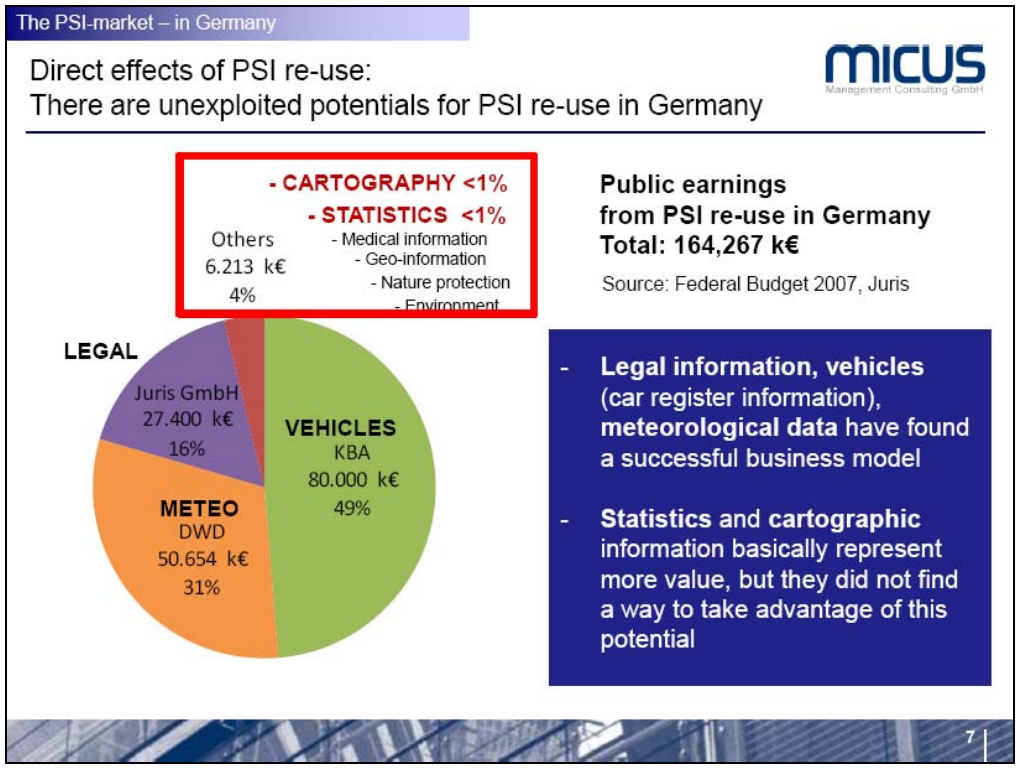



**Figure 22: Unexploited potential for Public Sector Information in Germany**




Source: Fornefeld M. 2008, http://www.oecd.org/dataoecd/27/9/40047551.pdf

**Links**
Real Estate information system: BORISplus: www.boris.nrw.de
Germany online : DO-Viewer: www.do-viewer.nrw.de

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# 9 BAVARIA

## 9.1 Regional Setting

Geographically, Bavaria is the largest federal state of Germany with an area of 70,553 km² Bavaria hosts almost 12.5 million inhabitants. More than the half of the area is used for agriculture. Its territory lies in the south-eastern part of Germany and it shares its border with Austria and Switzerland in the South, with Czech Republic in the East. Neighbouring federal states are Baden-Württemberg, Hesse, Thuringia and Saxony (see Figure 23).

**Figure 23: Location of Bavaria**


Source: Assembly of European Regions www.aer.eu

Bavaria is divided into 7 regional districts, 71 counties and 25 urban district, for a total of 2,056 municipalities. Main Bavarian cities are München (Bavaria's capital, approximately 1.3 million inhabitants), Nürnberg, Augsburg, Würzburg, Ingolstadt, Regensburg, Fürth and Erlangen.

For a long time Bavaria has one of the most powerful and fittest economies of any region in Germany. Its GDP in 2007 exceeded 434 billion Euros. In the last few decades Bavaria has become an extremely modern economic location for major international companies, strong medium-sized firms, and future-oriented research organizations. Another important economic sector is agricultural production which in Bavaria is widely

in the hands of family businesses, which mainly concentrates on growing corn, milk production, and cattle farming.

## 9.2 Policy Framework

### *9.2.1 National Level*

See Section 8.2.1

### *9.2.2 Regional Level*

In Bavaria the regional spatial data infrastructure (SDI-BY) development process is part of the e-government strategy. It is developed in compliance with the GDI-DE® and with the INSPIRE Directive respectively. Since August 2008 Bavaria has the legal mandate for transposition of the INSPIRE directive by adopting a law about geospatial data infrastructure.

The SDI of Bavaria has been built up since 2004. The different tasks of the Bavarian Ministries are coordinated by the Bavarian Ministry of Finance following a decision by the council of ministers (cabinet).

The coordination committee SDI Bavaria vote on strategic decisions concerning SDI Bavaria. It consists of representatives of all Bavarian Ministries, the Bavarian Municipal Umbrella Organisations and the Bavarian economy associations. So data providers and data users meet each other two times a year, fix standards in a concept paper and initiate projects referring nation-wide projects.

## 9.3 Organization

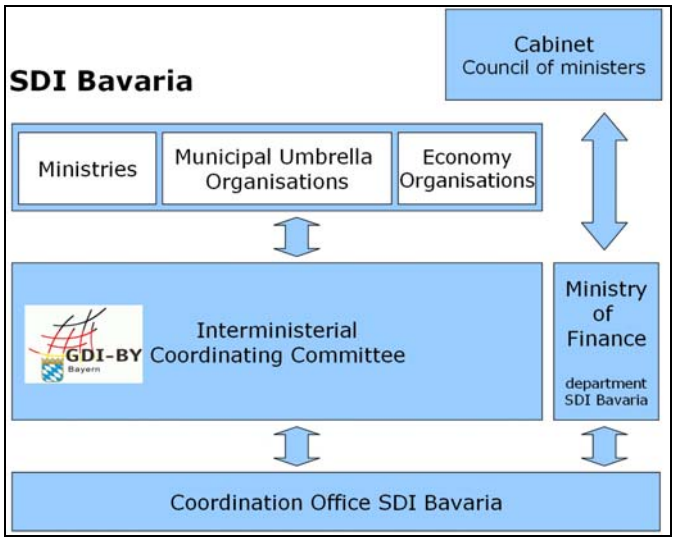
The Office SDI Bavaria is the regional contact point for INSPIRE and coordinates the process on operational level. Main responsibilities for the SDI-BY Office, which was established in 2004, include:

- INSPIRE implementation; implementation of the Bavarian INSPIRE law
- Monitoring of SDI-projects;
- Analysis and supporting the development of technical standards;
- Development of application profiles out of a huge variety of standards;
- Cooperation with national and international standardization organizations
- Cooperation with other SDI initiatives, particularly with GDI-DE® and INSPIRE;
- development of a strategic concept
- Public relations and promotion for SDI-BY.

The Office SDI Bavaria has five staff members.

The SDI-BY is built according to a stepwise approach by implementing a customer oriented SDI: Specific projects are used to meet the specific requirements. Data production and data distribution are considered as separate processes, which are carried out in close cooperation of the involved stakeholders. Reference data are supplied by the surveying agency while thematic domain data - such as agriculture, environment, interior, etc. -are supplied by sector domain users. Data are structured in a geo-database that provides WMS, WFS, Metadata and download services.

**Figure 24: Organisational structure GDI Bavaria**




## 9.4 State of Development

The SDI Bavaria tries to collect all spatial data, spatial data services and metadata of the public authorities in the services oriented integral geodata base.

Considering the national (DIN), European (CEN) and international standardisation bodies (ISO and OGC), the Bavarian IT standards (BayITS) are adopted as binding specifications for the Bavarian administration. Moreover, in the SDI-BY development process according to feasibility assessment, the federal recommendations on standards and architecture for E-government applications (SAGA) will be applied.

Inter-ministerial projects are funded by the e-government budget. The Bavarian cabinet has made decisions on e-government and IT-integration. As a result the defined IT-base-components, such as the integral geodatabase, e-government portal, and geospatial data and services, have to be used by the ministries and their associated authorities. Building up the SDI in the sense of INSPIRE is regarded as an e-government-task. So the implementation of INSPIRE is covered by the e-government-budgets of the ministries. Main projects are:

- digital ancient monuments,
- digital property prizes,
- digital land-use plans,
- digital system for state funding for farmers,
- digital protected sites,
- digital soil information system.

### *9.4.1 Data*

The following data layer are available for the SDI-BY applications as web services (WMS, WFS) at the moment:

1) Reference data:
- DOP Digital Ortho Photo
- DTK Digital Topographic Map (scales 1: 500.000; 1:50.000, 1:25.000)
- DOK Digital Map (scale 1.10000, with road names)
- DFK Digital cadastral map (scale 1:1.000)
- Gazetteer Service

2) Thematic Data:
- Soil map (scales 1:200.000)
- Geological maps (scales 1:500 000, 1:200.000, 1:100.000, 1:25.000)
- Protected sites
- maps of ancient monuments
- street maps, cycle ways
- maps of business parks

### *9.4.2 Services*

The metadata of the Bavarian spatial data are collected in an ISO 19115 conformant metadata database administrated by the ministry of the environment (http://www.uok.bayern.de/portal/). The geoportal (http://www.gdi.bayern.de/) provides the entry point for data, metadata, and services.

**Figure 25: Geoportal of Bavaria**

Several viewing applications are available in the SDI-BY geoportal including thematic viewers for agriculture, water system, noise, ancient monuments and protected sites. Moreover, further applications have been implemented using the OGC WMS standard:

- WMS for GIS
- soil information system, developed by Bavarian State Geological Agency;
- commercial sites information system, developed by Chamber of Industry and Commerce;
- viewer for ancient monuments
- flood information system
- street information system
- grant application system for farmers.

### *9.4.3 Impacts*

The common usage of agreed specifications, services and recommendations encourages the technical exchange of data, and as a result, data are not stored redundantly. For a study of the broader economic impacts in Germany see Section 8.4.3

# 10 NORTHERN IRELAND

## 10.1 Regional Setting

Northern Ireland is a constituent country within the United Kingdom along with England, Scotland and Wales. It lies in the northeast of the island of Ireland (see Figure 26), covering approx. 14,000 km², about a sixth of the island's total area. Total population estimated in 2006 is under 1.75 million.

**Figure 26: Location of Northern Ireland**


Source: Assembly of European Regions www.aer.eu

Northern Ireland consists of six counties which are no longer used for local government purposes; instead there are 11 Government Departments and 26 local councils of Northern Ireland which have different geographical extents. The 26 local councils are to be reduced to 11 in 2011.

Northern Ireland has a GDP of €37.3bn. The per capita GDP of €19,603 is higher than in other regions in UK. Agriculture accounted for 2.4% of economic output. Livestock is one of the major industries, while the service sector accounts for almost 70% of economic output, and 78% of employees.

## 10.2 Policy Framework

### *10.2.1 National Level*

A milestone in the evolution of Geographic Data Handling in Britain was the Chorley Report published in 1987 (DoE, 1987). The most important recommendations in the Report relate to digital topographic mapping, data availability and linking, and the role of government, 24 out of 64 recommendations are related to the role and activity of Ordnance Survey Great Britain, it also outlines important issues such as education, training and research and development. It represents an important framework for awareness raising among both the public and private sectors who were involved in the early stages of consultation in the report preparation, and will be in terms of geographic data handling processes in the years to come.

In 2005, the Geographic Information (GI) Panel was announced by Yvette Cooper MP, Minister at the Office of the Deputy Prime Minister. The Panel was created as an expert advice body with the aim of focusing on medium to long term issues and encouraging more effective, extensive and systematic use of geographic information. Recently, the preparation and submission to the Minister of a Location Strategy for the United Kingdom[12] has been a key focus of the GI Panel. *Place Matters: The Location Strategy for the United Kingdom* was published on 25th November 2008. The Strategy proposes the establishment of a Location Council chaired by the Department for the Environment, Food, and Rural Affairs (DEFRA) to drive the process forward, and a set of actions in line with the INSPIRE Directive. Figure 27 shows the proposed governance structure envisaged by the Strategy.

### *10.2.2 Regional Level*

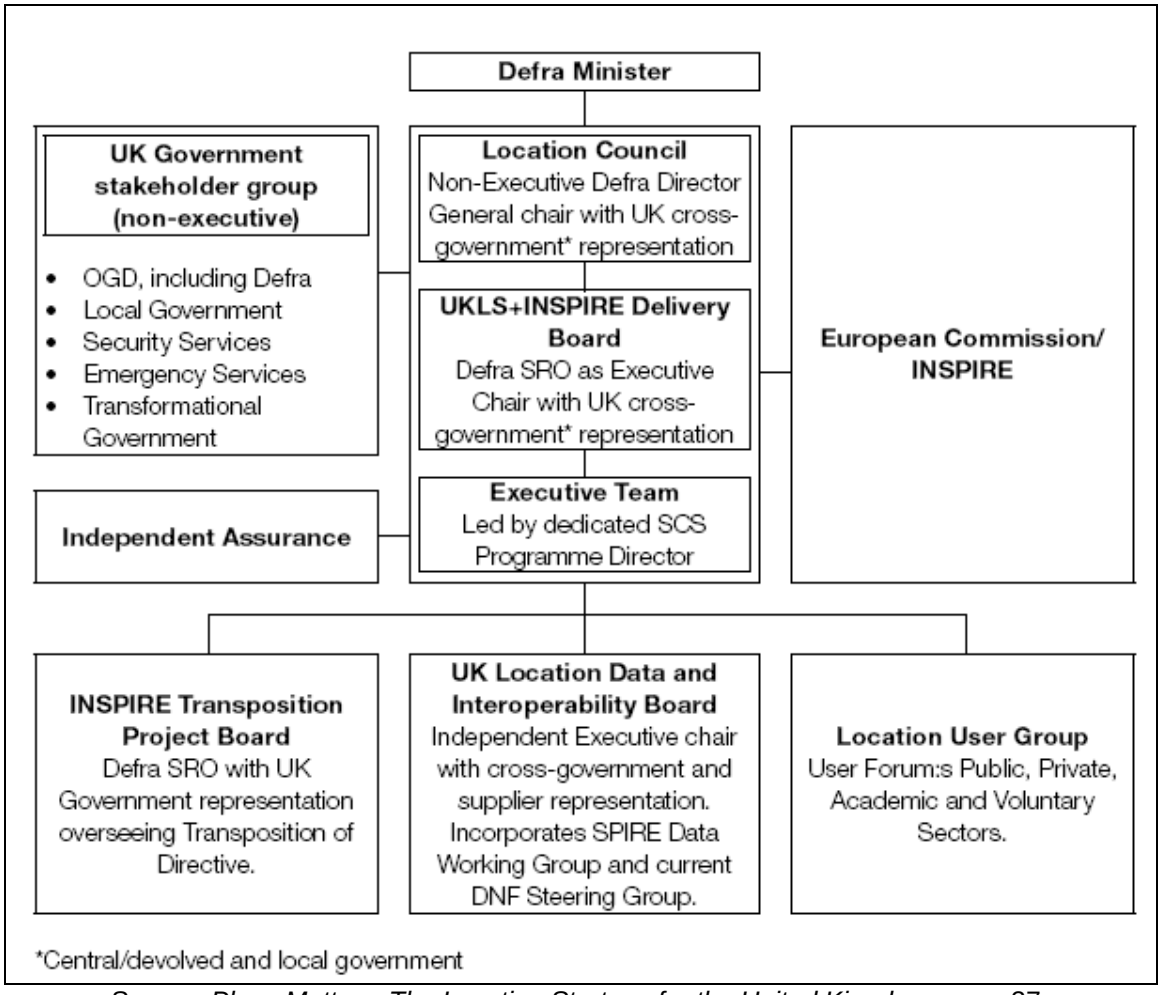
The political history of Northern Ireland has led to a strong central government structure and very limited devolution to local government, reducing institutional complexity in SDI development by working predominantly with a single tier of government.

Recently, the restored devolved government in May 2007 has focused on economic development in its Programme for Government (Northern Ireland, 2008). In the public sector a wide-ranging reform programme has been undertaken, with the creation of a number of shared service centres (for ICT support, financial transaction processing, personnel management, etc) recently implemented. Within the Review of Public Administration published in 2006, Rate Collection Agency, Valuation and Lands Agency (VLA), Ordnance Survey of Northern Ireland (OSNI) and Land Registers Northern Ireland have all now merged to become Land and Property Services (LPS).

The creation of LPS was based on the assumption that, while reducing of the number of public sector bodies, an integrated set of land and property related services for citizens and government would aid the regeneration and economic development of Northern Ireland. The immediate priority for LPS is to continue to integrate the people and processes of the legacy agencies. Once this integration is complete LPS can start delivering a fully integrated ‘One Stop Shop’ for rating, valuation, registration and mapping services in Northern Ireland.

[12] http://www.gipanel.org.uk/docs/uk-location-strategy.pdf

**Figure 27: Proposed governance structure for both the UK Location Strategy and INSPIRE implementation**




Source: *Place Matters: The Location Strategy for the United Kingdom*, page 37.

This first devolved government in 1999 provided a context for the creation of the regional SDI and a Northern Ireland Geographic Information Strategy was published in 2003. Its implementation is now recognised as a key component of the reform agenda in Northern Ireland and it is supported from the highest levels. The 2003 Strategy has been subject to review in 2008 and a revised 10 year Strategy (2009 – 2019) is due for publication in 2009. The new draft strategy aims to build on four key areas; realising the business benefits of GI, increasing skills and education, data sharing and data collection and project collaboration. The proposed new vision is:

*"We will improve services and thereby develop the economy, the environment, and the society of Northern Ireland by placing information about location at everyone's fingertips and supporting the development of sufficient skills and knowledge to exploit this information".*

The goal is that by 2019 that Northern Ireland has become a spatially enabled society.

## 10.3 Organization

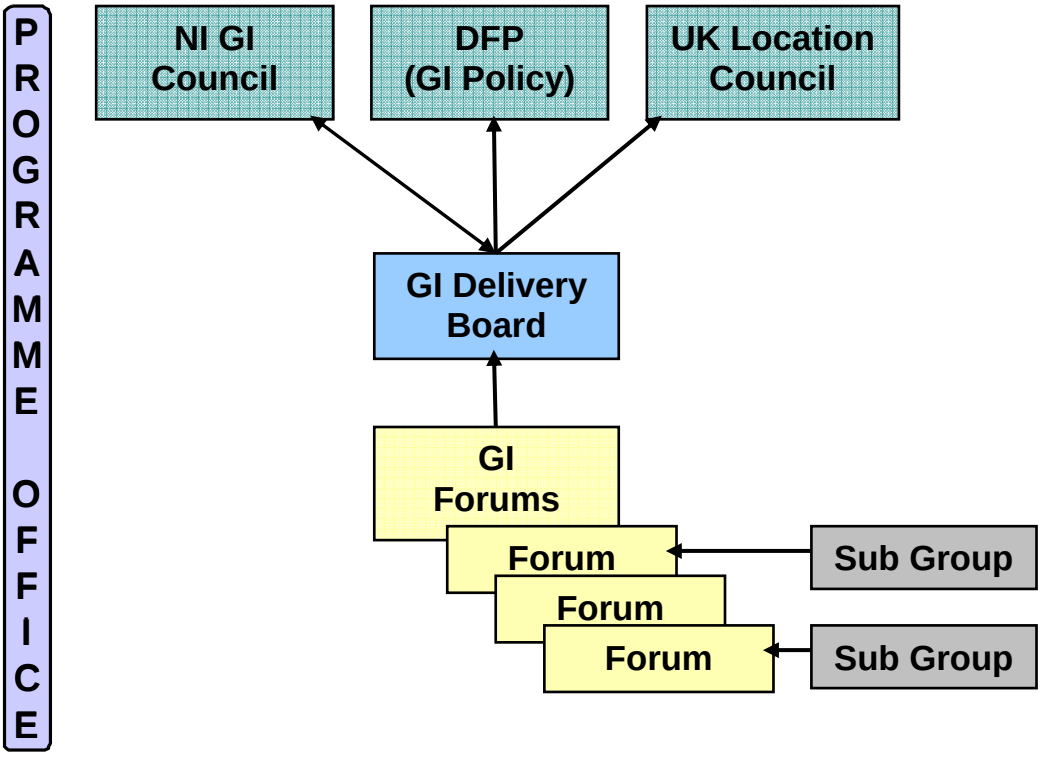
The current organizational structure was set up under the 2003 GI strategy. Interested parties joined up to different stakeholder groups depending on their interest. The initial sectoral groups were:

- Environment and agriculture
- Land and property
- Transport
- Utilities
- Statistics
- Emergency services and public safety
- Cross cutting group on key datasets

A chair person was nominated from each group to represent that group on the steering group. The steering group also consisted of a representative from the Association of Geographic Information (AGI) to represent the broader GI community and a representative from the local government, the Society of Local Authority Chief Executives (SOLACE). The chair of the steering group (to be renamed the GI Delivery Board under the new proposed structure) is the Chief Survey Officer of Land and Property Services. The structure of the steering group allows flows of communication both upwards and downwards. A dedicated programme office based in Land and Property Services (LPS) manages the day to day running of the strategy. This current organizational structure is under review as part of the production of the new GI Strategy for 2009 – 2019. Some changes are envisaged, including aligning NI more explicitly with structures being put in place at national level, in particular establishing formal links with the UK Location Council. It is also proposed to develop a NI GI Council as a consultancy and advisory group. See Figure 28 for the proposed new governance structure diagram.

While developing the appropriate staff skills among the involved actors has been recognized as a major issue for using and exploiting spatial data resources, the situation has been until recently not homogeneous: while many organizations can rely on a small team of skilled personnel, in others the skills and resources are lacking. In this regard, to improve the current status and fill the gap, LPS has recently established a GI Consultancy Team, providing training and technical support to the NI Assembly staff and other organisations. Another model being considered is based on the Northern Ireland Statistics and Research Agency (NISRA) approach whereby statisticians are seconded out to other organizations according to their needs; the same approach could be applied to staff with GIS expertise.

**Figure 28: Proposed governance structure for the GI Strategy for Northern Ireland (2009-2019).**




## 10.4 State of Development

Mapping activities in Northern Ireland started in the 1830s for taxation and land valuation under the military. In the latter part of the Twentieth Century control of mapping activity passed to civilians. Digital mapping uptake started in the early 1980s, with digital conversion being completed in the mid-1990s. Within this process, the NI Geographic Information Strategy project was commenced in 1981 with the aim of developing a distributed fully integrated GIS on a countrywide scale to link the varied spatial data holdings of Government Departments and public utilities to be fully exploited for the benefit of the entire Northern Ireland community (Brand, 1991).

IN 2001, OSNI, VLA and the Royal Mail jointly launched Pointer, a definitive address dataset for Northern Ireland. In the same year, the process of developing the GI Strategy for Northern Ireland began under the aegis of the Department of Culture, Arts & Leisure (DCAL), through its Agency, OSNI. The GI Strategy, with a brand name Mosaic, was published in 2003 and highlighted the positive impacts of GI integration, and proposed a number of pilot projects to demonstrate the benefits of joining spatial data from different sectors (e.g. public safety and emergency services, land and property, transport, environment, utilities and networks) together. It also set out a vision and a governance model for the strategy implementation. The vision was that all public servants would

have access to the necessary geographic information at their desk tops and use it as a standard tool within their work.
After the consultation and design phase of the GI Strategy, the pilot projects were managed by the sectoral groups. More recently in 2008, the third phase has been completed with the go live of GeoHub NI®[13], providing a system to which a wide range of organizations can supply their data and metadata (more than 100 datasets are currently in the process of being loaded at the time of writing). Stated objectives in the GeoHub development are:

- to make spatial data (specified by the EU INSPIRE Directive) accessible to government and the general public;
- to make government spatial data available to citizens and the private sector;
- to assist in policy making in Northern Ireland government;
- to eliminate duplicated effort in capturing and maintaining spatial data;
- to increase demand for public sector spatial data;
- to facilitate the sharing of spatial data across government;

The GeoHub implementation sits within an SDI model based on six elements: vision, governance, data, funding, systems; and skills (Greenway *et al.,* 2008). Under the Northern Ireland Mapping Agreement (NIMA), all NI public servants can access all OSNI data for free at the point of use. This central model of financing removes funding as a constraint to the wide use of spatial data, enabling the wider use of spatial digital data securing the vision of the GI Strategy. NIMA also provides funding for the implementation of the GI Strategy, including GeoHub NI.

### *10.4.1 Data*

The following datasets (predominantly INSPIRE related) are currently available through GeoHub NI® (with more being loaded on a daily basis):

- EuroRegio Layers (Land & Property Services) including political boundaries, powerlines, coastal areas etc.
- Topographic data (Land & Property Services) consisting of all OSNI scaled mapping including:
  - Large Scale Mapping (1:1,250/ 1:2,500)
  - 1:10,000
  - 1:50,000
  - OSNI ortho photography
  - Road Centre Line
  - Administrative Boundaries (Wards, Townlands, County boundaries etc)
- Field Boundaries (Department of Agriculture & Rural Development)
- Potato Cyst Nematode (Department of Agriculture & Rural Development)
- Marine Nature Reserves (Northern Ireland Environment Agency)
- Areas of Outstanding Natural Beauty (Northern Ireland Environment Agency)
- Areas of Special Scientific Interest (Northern Ireland Environment Agency)
- National Nature Reserves (Northern Ireland Environment Agency)
- RAMSAR (Northern Ireland Environment Agency)
- Special Areas of Conservation (Northern Ireland Environment Agency)
- Special Protection Areas (Northern Ireland Environment Agency)

[13] http://www.geohubni.gov.uk

- Births 1999-2006 (Northern Ireland Statistics & Research Agency)
- Flood Defences (Rivers Agency of Northern Ireland)
- Designations (Rivers Agency of Northern Ireland)

Each dataset is updated based on a schedule agreed between the GeoHub support team and the data supplier with some datasets updated on an annual basis and others on a quarterly basis, the scheduling can be revised if required.

Access to datasets can be restricted where required, using GeoHub NI's user management functionality, where datasets contain sensitive information access to the data is restricted to users with the appropriate rights access to that information (using a username & password log-in), the vast majority of the datasets currently available on the GeoHub are public interest datasets and are available to the GLOBAL user group, however others are restricted to specific user groups.

All datasets must be supplied with UK GEMINI standard metadata, if not supplied the data will not be loaded onto the GeoHub. It is envisaged that the GeoHub metadata standard will be updated to the new INSPIRE metadata specification during future system upgrades. The GeoHub itself has been designed inline with open standard specifications; in particular the web services are developed following OGC standards for WMS & WFS.

### *10.4.2 Services*

GeoHub NI® provides discovery, view and geo-processing services (users can spatially query the data). Web services such as web mapping and web feature services are currently under development utilising SOAP protocols.

Metadata is collected to UK Gemini standard and there is a searchable metadata catalogue. No data set can be added to the hub without having metadata.

Web services are currently being developed, various agencies and government departments are already interested in using these to provide background mapping from GeoHub NI® to their own web service.

Users of the GeoHub NI® are predominantly public sector as it facilitates a means to share data within and between government organisations. The hub however is open to the public and does also host private sector datasets as well.

### *10.4.3 Impacts*

The costs of data collection have not been increased by this initiative, as each organisation determines the data that it requires to collect and manage. Over time, costs of collection should reduce as duplication is observed and removed; and costs of management will significantly reduce in individual organisations through their use of GeoHub.

The costs within OSNI/ LPS in developing and running GeoHub amount to something like €3 million to date. This includes capital and cash expenditure and staff costs.

Although a specific impact analysis has not been carried out, within the GI Strategy, implementation the pilot projects supplied convincing examples to the stakeholders of the positive value of the initiative. As an example in the utilities sector, a number of organizations required to know where cables and pipelines ran. The actors involved in the project agreed to integrate all available data in a single system which reduced the time needed to access others' information 'from 6 weeks to 6 minutes' with substantial efficiency improvement.

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Northern Ireland Geographic Information Strategy 2009 – 2019 (DRAFT)

# 11 BRITTANY

## 11.1 Regional Setting

Brittany is located in a peninsula in the North-West of France, lying between the English Channel to the North and the Bay of Biscay to the South. Its capital city is Rennes (209,900 inhabitants in 2005). The region features an area of 27,209 km$^2$ and a population of 3.1 millions inhabitants in 2007 (see Figure 29)

**Figure 29: Location of Brittany**


Source: Assembly of European Regions www.aer.eu

In France there are three main tiers of local administration: the commune, department and region. These are both districts in which administrative decisions made at national level are carried out and local authorities with powers of their own. There are approximately 37,000 communes, the vast majority of which (80%) have less than 1000 inhabitants. To pull resources together, small communes are encouraged to merge into urban communities (communautés urbaines) or group together in associations of several communes (syndicats intercommunaux). There are 100 departments (96 in mainland France, and 4 in overseas administrations), and 26 regions (22 in mainland France and 4 overseas). Since the decentralization reform of 1982, departments and regions have taken the status of local authorities. The department essentially has competence in

health and social services, rural capital works, departmental roads, and the capital expenditure and running costs of colleges. The main spheres of competence of regions are planning, regional town and country planning, economic development, vocational training, and the building, equipment and running costs of schools (Source: United Nations, 2006). In addition to these local structures, each department has also a Prefect who is the local representative of central government. The Prefecture coincides with the territorial unit of the department. Its administrative functions include issuing passports, ID cards, and riving licenses, civil protection, control of public order and immigration, and management of European funds. (source: http://www.conseil-general.com/prefecture-prefectures/prefecture-prefectures.htm). There are also prefectures for each region.

Brittany is one of the 26 French regions, and is divided into four departments, 201 cantons, and 1,268 communes. 97% of the communes participate in one of the 119 inter-communal structures. Brittany contributes 4.2% of the national GDP and provides 4.8% of the jobs in France. Traditional economic activities are agriculture and fishing, and recently industrial activity has developed in agribusiness, ICT and automotive, and services**.**

## 11.2 Policy Framework

### *11.2.1 National Level*

The State of Play report for France for 2007[14] indicated that a national policy to develop a spatial data infrastructure had yet to emerge, although the transposition of the INSPIRE Directive into national law may well change that in 2009. There are however several important initiatives at both national and regional level that contribute to the development of a French SDI.

At national level, key building blocks are:

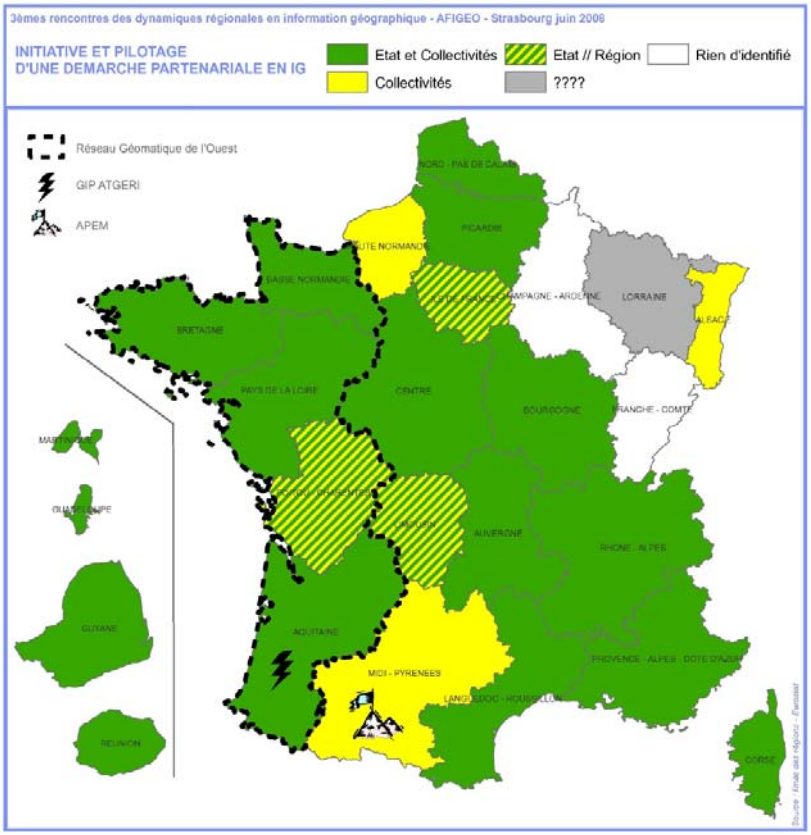
- The development of a national framework of reference at large scale (Référentiel Géographique à grande Echelle - RGE), coordinate by the National Geographic Institute (IGN), which includes relevant topographic databases, the cadastre, administrative boundaries, postal addresses, and orthophotos.
- The launch in 2006 of the French national geoportal (www.geoportail.fr) as part of the government action plan for e-government (ADELE). The General Directorate for State Modernisation (DGME) created in 2006 as part of the French Ministry for Economy, Finance, and Industry is in charge of this project and IGN and BRGM (the National Geological Bureau) are responsible for the realization (View services for maps, orthophotos by IGN and Discovery services by BRGM).

Other key actors at the national level are the National Geographic Council (CNIG) which is a consultative interministerial council with representatives from all major government departments and GI-related agencies (www.cnig.gouv.fr), and AFIGéO, the French Association for GI, which is a forum to coordinate activities and to promote the development and use of GI among both public and private sector organisations (http://www.afigeo.asso.fr ). The latter has been promoting a series of meetings to

[14] http://inspire.jrc.ec.europa.eu/reports/stateofplay2007/rcr07FRv82.pdf

monitor the GIS and SDI-related initiatives at the regional level. The most recent meeting took place in June 2008, with the participation of 20 of the 26 regions. The report of the meeting[15] shows a very dynamic environment at the sub-national level, with a number of different governance models: initiatives internal to the regional or departmental councils in partnerships with national agencies and central government departments, local associations, or public-private partnerships. Figure 30 shows the distribution of these different types of initiatives. As shown the majority are a partnership between central and local government, and local communities (collectivités).

**Figure 30: Regional Initiatives for Geographic Information in France**




Source:
http://www.afigeo.asso.fr/pics/wysiwyg/generated/dynreg08/strasbourgpresentationstr.pdf

### *11.2.2 Regional Level*

The start of a regional SDI development process in Brittany was a joint initiative of the *Prefecture* of the region, and the Regional Council. State authorities started the project in 2005 with the main aim at establishing a partnership among state regional authorities. With a decision to limit the number of partner in the initial phase in order to limit the process complexity, around fifteen state members have joined the project. One year later, the Regional Council initiated a partnership with four department councils, ten urban conglomerations, local authorities, environmental associations, urban agencies. Around 72 members are currently involved.

[15] http://www.afigeo.asso.fr/pics/wysiwyg/generated/dynreg08/actes3rdr.pdf

In April 2007, the project has been included in the CPER (Contrat de projets État-Région) 2007-2013, which is a contract between the public administration and the territorial administration. The project was supported with €1 Mio by European Regional development Fund (ERDF), € 1 Mio. by the State, and €1 Mio. by the Regional Council, and managed by two technical administrators and two project mangers from the State and from the Regional Council.

The aim of the SDI is to share data not only between public authorities, but also with the entire public sphere, including towns, communities, consular chambers, urban planning agencies, water suppliers, maritime research authority and others partners. Moreover the authorities at the department level are joining the partnership.

The operative objectives to be achieved with the regional SDI development are:

- data sharing among public organizations;
- development of geographical information systems in public services;
- add value to spatial data;
- joint purchase of data to reduce costs (reference data have been acquired as SCAN25® and BD Carto® from the French National Geographic Institute, to be used by all actors);
- support better knowledge about the territory for sustainable decision making;
- give response to the INSPIRE Directive creating metadata and online services, developing a policy for data dissemination, and a partnership to ensure that data is stored, maintained and made available at the most appropriate level.

## 11.3 Organization

The partnership associates public authorities at regional and departmental levels, representing an important number of ministries, towns, communities. The partnership is organized around four main components: A follow-up committee State-Region, a Technical Committee, thematic working groups, and a charter. The charter, signed by all the partners in the project, defines the organisation, the conditions for access and use of the data sets, lists the data sets and the contributions for each partner, defines the responsibilities of each, and formalises the procedures necessary to the quality of the data available, and the maintenance procedures.

Four Working Groups have been also established addressing: data catalogue, standardization and digitalization, cadastral surveys, and joint data purchase. Moreover, thematic groups were created to work on the implementation of spatial databases in various sectors and to proceed on the harmonization of all data structures. The thematic working groups address various domains related to sustainable development, such as:

- Integrated coastal zone management (ICZM);
- Crisis management;
- Large scale cadastral data;
- Digitalization of urban planning documents;
- Digitalization of restricted or regulated areas;
- Land use on sea regions;
- Protected sites;
- Habitat and biotopes;
- Natural risk zones;

- Wind resources.

## 11.4 State of Development

The project has achieved a number of concrete objectives including: a common letter of agreement with the Cadastral administration, shared metadata and databases, sharing of tools, joint purchase of data sets, common development of GIS applications. Building and developing the partnership among all actors continues to be the main focus. The architecture of the system is based on independent blocks, which allows the enhancement of each separate unit. The architecture is based on the rules of interoperability between local, regional, and national levels and open-source components (see Figure 31). Within GéoBretagne, the three core components are the metadata catalogue, core data, and applications (see Figure 32).

**Figure 31: Architectural Overview GéoBretagne**

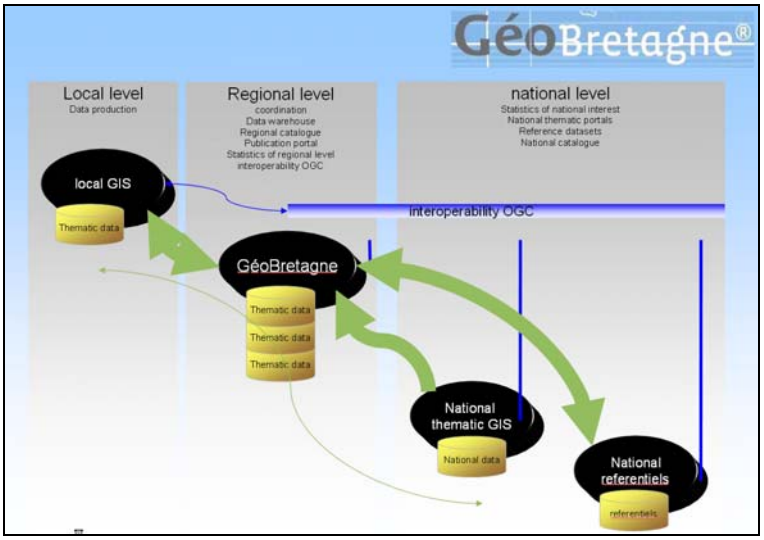
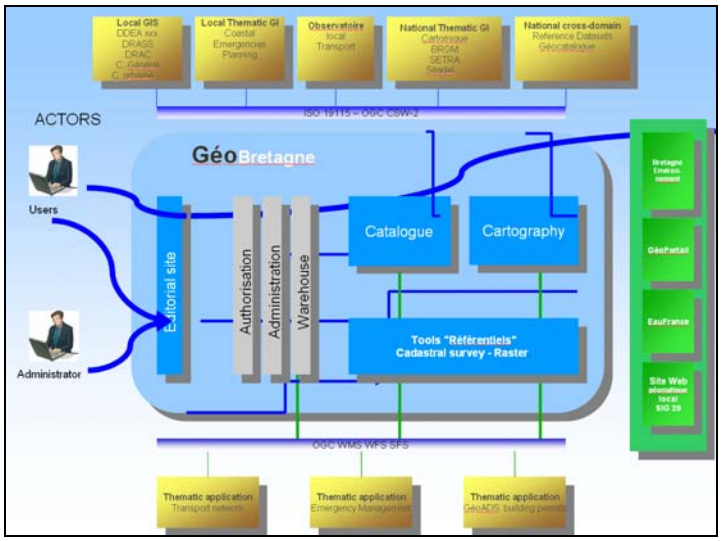



**Figure 32: Core components of GéoBretagne**



GeoBretagne® data sets include reference data, such as administrative boundaries, topographic maps, ortho-imagery, Road and rail infrastructures, hydrography, shoreline, cadastral parcels, and thematic data.

From central government, there are more than 30 datasets available on-line from 17 different public administrations. From the local level, there are datasets at regional and local levels. Thematic data include indicators and statistics as well as databases and cover topics such as demography, economy, financial data about towns, environment and risks, education, farming, man-made structures, cultural artefacts.

An example of the level of local detail available is provided by the application on coastal zone management, which includes information on hotels, camping sites, authorization for temporary occupation of public spaces (AOT), natural harbours, ports, the cadastre of sea-food farming, land use, footpaths, and locations of interest (see for example Figures 33 and 34).

### *11.4.1 Services*

The Brittany SDI development include the development of GeoBretagne®, a geo-portal which will allow to comply with the INSPIRE Directive at regional level. The first version of the GeoBretagne® -which allows spatial data query, data editing and map-making- is available online (http://geobretagne.fr), but the access is restricted to the project partners only.
At the current state of development the following services are available:

- View services to display, navigate, zoom in/out, pan, or overlay spatial data sets , and to display legend information and any relevant content of metadata;
- Discovery services for spatial data sets and services searching on the basis of the content of the relevant metadata and to display the content of the metadata.

A second version of the application will be developed to implement new functionalities to answer further needs, such as:

- Enhanced proprietary data storage;
- Users' right management;
- Reference and large scale data download;
- Enhanced query functions;
- New web contents;
- Online technical assistance.

Opening access to the public is inhibited by the lack of adequate human resources (Dewynter 2008, pg 10).

**Figure 33: Land use of the Brittany costal area**

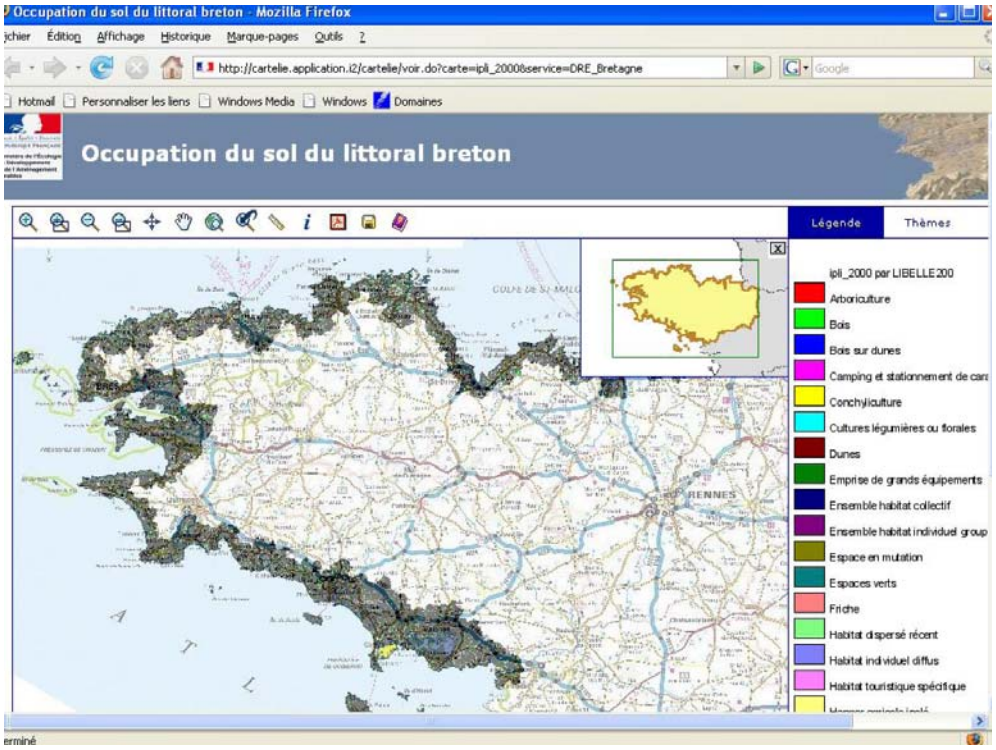
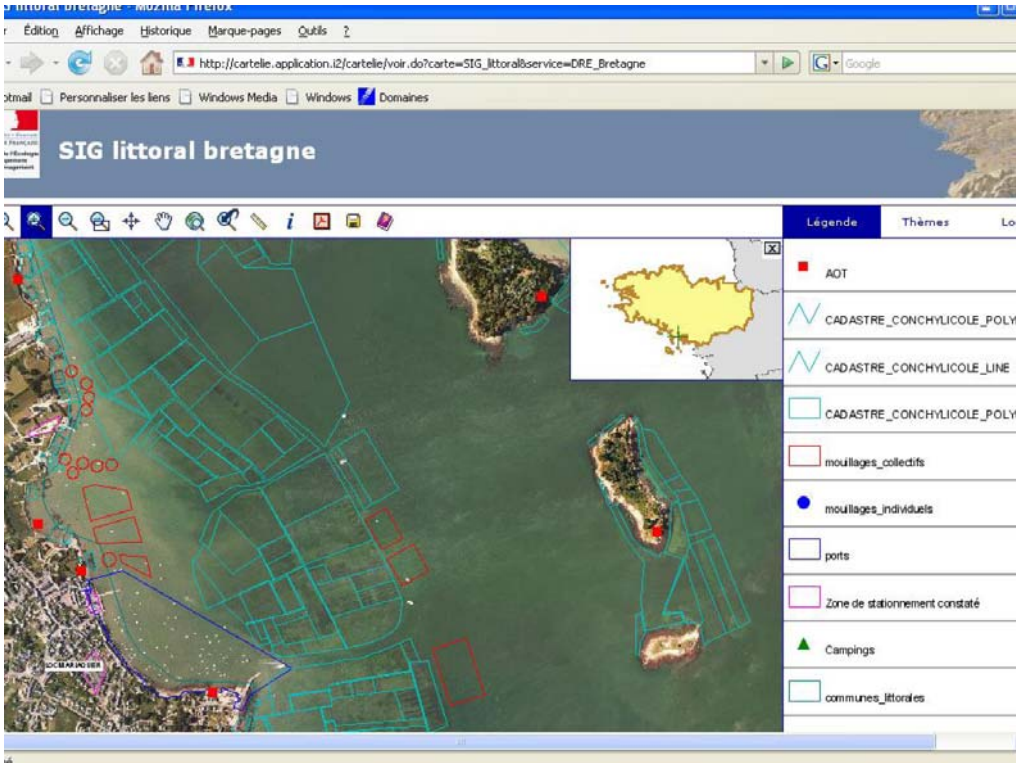



**Figure 34: Details of sea-food farming sites (cadastre conchylicole) and temporarily authorized areas (AOT)**



### *11.4.2 Impacts*

A formal study on the social and economic impacts of the project has not yet been carried out. The project is nevertheless having important effects in the development of a culture of sharing resources and understanding of the regions among the partners in the project, which contributes to more effective decision-making by the partners themselves.

In a broader perspective, the conclusions of the Third meeting on Regional Dynamics and Information Systems organised by AFIGEO in Strasbourg indicate the need to communicate in a simple language the benefit of geographic information to decision-makers so that the necessary awareness can be raised at the political level (Dewynter, 2008).

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# 12 VYSOČINA

## 12.1 Regional Setting

The Vysočina Region is an administrative unit of the Czech Republic, located partly in the south-eastern part of the historical region of Bohemia and partly in the south-west of the historical region of Moravia. It extends 6,795 km² hosting a population of 511,645 in 2007. Vysočina shares its borders with Jihomoravský to the South and East, Jihočeský to the West, Středočeský to the North-East and Pardubický to the North-East (see Figure 35)

After the Public Administration reform in 2000, the Czech Republic is divided into fourteen regions. More than 6,000 municipalities are grouped in 205 districts. According to the same reform process, since 2003, Vysočina includes 15 districts and 704 municipalities. There are only four major towns with population over twenty thousand; Jihlava, the regional capital, has a population of about fifty thousand. The increasing standards of living and mobility lead to the expectation that this situation will prove to be an asset. People in Vysocina are able to enjoy the advantages of living in the countryside while being guaranteed an easy access to modern facilities offered by local urban centers.  Per capita GDP in 2007 was €.7,351

**Figure 35: Location of Vysočina**


Source: Assembly of European Regions www.aer.eu

## 12.2 Policy Framework

### *12.2.1 National Level*

The first project for the creation of a National Geo-Information Infrastructure (NGII) in Czech Republic started in 1999, leading in 2001 to the involvement of major administrative bodies and private sector actors. Within this first project coordinated by the Nemoforum, a cadastral and GIS user forum, ten priority areas were considered covering five SDI-components such as legal issues, reference and core data, metadata, access services and standards.

In the development of the national SDI, the Czech Association for Geo-Information (CAGI) also played an important role for awareness rising and thematic working group creation. The transposition of the INSPIRE Directive in Czech Republic is coordinated by the Ministry of the Environment (MoE) and the Ministry of Interior (MoI), which is responsible for the e-Government policies, in collaboration with the Czech Office for Surveying, mapping and the Cadastre (COSMC). The MoE and MoI are preparing the transposition of the INSPIRE Directive into national law. Moreover, the Czech Environmental Information Agency (CENIA), established in 2005 as research and technical supporting body for public administration, is responsible since 2006 for INSPIRE implementation. In this process eight working groups have been established involving eight Ministries and central bodies.

CENIA maintains a central geoportal (http://geoportal.cenia.cz) for the INSPIRE relevant data themes as a component of the Portal of the Public Administration, which in turn is under the responsibility of the Ministry of Interiors. The geoportal gives access to 4 terabyte of data through 90 local and 15 remote map services, and it is the base for 60 user applications. Discovery and view services are available free of charge in the geoportal while download, transformation and invoke services are available according to charging procedures. Data produced and maintained completely by state budget are generally available free of charge, but for specific uses different access conditions are regulated by a licensing framework.

Other geoportals, which are also components of the national infrastructure, are run by the Czech Mapping Agency, by the Ministry of Agriculture and the Forestry Management Agency, by the Transportation Research centre and by the COSMC. CENIA also maintains since 2006 a meta-information portal which interconnects 12 environmental organisations and 15 public administrations.

Discovery and view services are available free of charge in the geoportal while download, transformation and invoke services are available according to charging procedures. Data produced and maintained completely by state budget are generally available free of charge, but for specific uses different access conditions are regulated by a specific licensing framework.

The COSMC have been playing a major role in data production since, according to its mandate, it is responsible for 5 Annex I, 2 Annex II, and 2 Annex III INSPIRE data themes, including geographic and cadastral reference data, DTM and ortho-imagery, buildings and land use themes. In 2005 the COSMC launched a new geoportal in Czech and English languages which includes a business module, web map services, the GPS stations network, and geodetic control points. COSMC metadata are currently compliant with the national and cadastral standards. Along with the process of the application of

the INSPIRE Implementing Rules the transition to the ISO metadata standards is currently under development. The compatibility of the individual state administration bodies' metadata portals has been tested.

### *12.2.2 Regional Level*

The development and use of GIS in public administration in the Czech Republic has been documented in a study in 2003, the first of this kind in the country. The study identified a number of existing projects, and formed the basis for the sharing of best practice, and the definition of minimum common standards. The study also included advanced features such as conceptual data models and lists of available datasets. As a result of that study, a regional working group has been established among the 14 regions to cooperate in strategic GI issues, and work on common projects including:

- Methodology for spatial planning
- Specifications for large scale digital maps
- Development of state digital maps and use of the cadastre in public administration
- Development and maintenance of the addresses database
- Metadata.

Since 2006, this regional GIS working group has developed a common geo-portal connecting the regional level ones (see links in Section 12.4.3). Among Czech Regions, Vysočina plays a key role in Public Administration Information system and information policies development. The Vysocina Fund, a tool designed to assist in the implementation of regional policies within the approved Vysocina Regional Development Plan, was instituted by a resolution adopted by the Regional Council in 2002. The Fund assigns a part of the development funds allocated by the Vysocina Region to different areas based on specific rules, and in accordance with approved priorities. With this fund the Vysocina Region supports a number of sector activities in the region, including information technology diffusion. Thanks to this framework GIS projects have been funded and new WMS and WFS have been developed. Vysocina region currently support through the same fund local web GIS development in sub-regions (Zalesi, Senozaty, and Kosetice).

## 12.3 Organisation

The Regional Authority set up a young, highly qualified IT team of professionals which supports the Regional role in maintaining effective contacts with local municipalities. This small group of 3 people, interacts with users in other departments in the region and cooperates with local, national, and international projects.

## 12.4 State of Development

- Geoinformation technology is an integrative instrument**,** to join the heterogenous geodata sources and geoinformation, for effective cooperation based on standards.

- SDI in Vysocina region is distributed, server-client 3 level architecture based, using standards, sharing data content, RSDI based on ESRI GIS SW, at the application level using open source GIS
- Distributed system: even municipalities are managing map servers, geoportals. Region shares their geodata content remotely.
- Open web services used routinely
- Experience from European projects (Naturnet-Redime…)
- Strong regional internet development (ROWANET I, II)

### *12.4.1 Data*

The development of the regional SDI combines data from central level (e.g. cadastre, topographic, and environmental data) with local level held information. Most of the developments are based on proprietary software with OGC-compliant services for data visualisation and download where possible. Example at the local level are shown in Figure 36 and 37, which show for the region of Kosetice, cadastral parcels and addresses, orthophotos, urban plans, and the possibility of overlaying the proposed route of a planned electrical line.

**Figure 36: Town of Kosetice cadastral parcels and addresses**

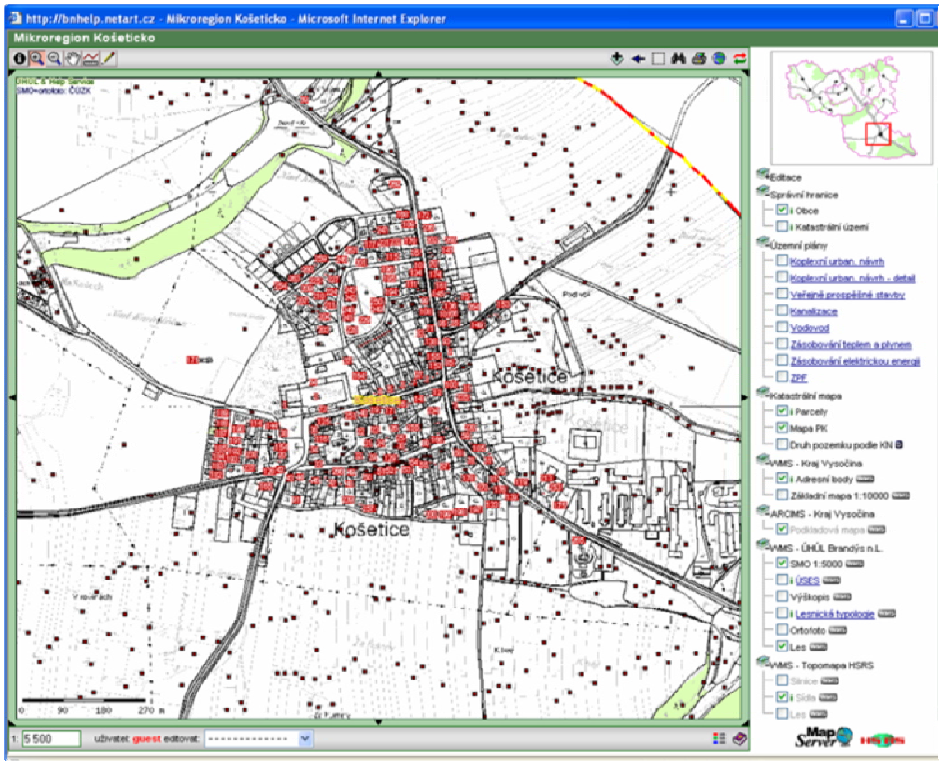
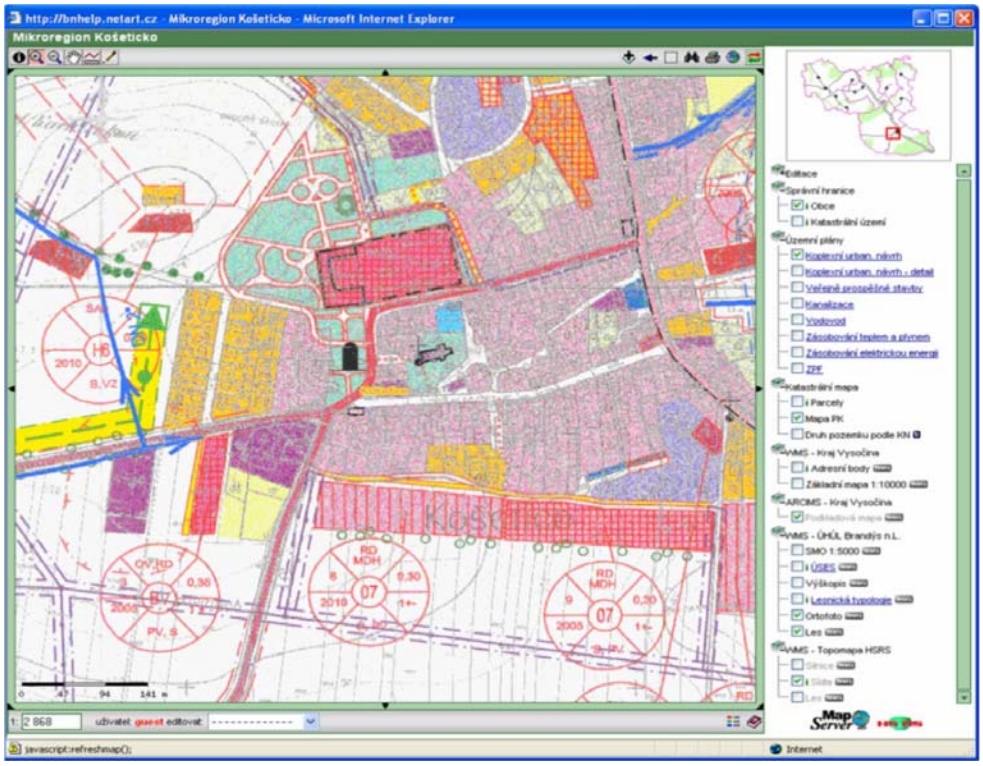


**Figure 37: Town of Kosetice urban plans and route of proposed power line**




*12.4.2 Services*

A number of services based on the INSPIRE Directive have been developed or are in the process of being developed in the region. Figure 38 provides an overview.

**Figure 38: Overview of services available in Vysocina**

| Service class | Map Services at Czech PA Portal |
|---|---|
| DISCOVERY | Metadata system METIS (2004, 900 records), MICKA (2007), CWS tested in FP6 Naturnet-Redime project |
| VIEW | Routine ArcIMS, WMS services, OGC WMS Reduced access, integrated login for different users |
| DOWNLOAD | ArcIMS and OGC WFS (working, next version under construction) Limited access, Transaction part, partially manual service on demand |
| TRANSFORMATION | Web processing services sucessfully tested To be further developed |
| INVOKE | Not yet developed |

The region has developed a geo-portal (http://www.kr-vysocina.cz/www/gis) from which it is possible to access information on relevant evens, metadata, datasets and services, including a map viewer.

### *12.4.3 Impacts*

No formal evaluation of the projects and initiatives in the region have yet been undertaken, but there is an important effort to develop further the human and technical resources through awareness raising and capacity building programmes supported by CAGI.

**Links**

Geo-portals of the Czech regions
A - Pražský – http://wgp.praha-mesto.cz
B - Jihomoravský - http://mapy.kr-jihomoravsky.cz/
C - Jihočeský - http://gis.kraj-jihocesky.cz/
E - Pardubický - http://gis.pardubickykraj.cz/
H - Královéhradecký - http://gis.kr-kralovehradecky.cz/
J - Vysočina - http://gis.kr-vysocina.cz/
K - Karlovarský - http://mapy.kr-karlovarsky.cz/
L - Liberecký - http://gis.kraj-lbc.cz/ http://maps.kraj-lbc.cz/
O - Olomoucký - http://mapy.kr-olomoucky.cz/
P - Plzeňský - http://mapy.kr-plzensky.cz/
S - Středočeský - http://mapy.kr-stredocesky.cz/
T - Moravskoslezský - http://www.kr-moravskoslezsky.cz/mapy.html
U - Ústecký - http://mapy.kr-ustecky.cz/
Z - Zlínský - http://mapy.kr-zlinsky.cz/

# SECTION III: COMPARATIVE ANALYSIS

# 13 COMPARATIVE ANALYSIS

## 13.1 Socio-Economic and Administrative Characteristics

The eleven regions presented in Section II include some of the more advanced instances of regional/sub-national SDIs in Europe. Although they share many similarities, particularly in respect to technology deployed, they differ considerably in territorial size, and population as shown in Table 9. In respect to population, North-Rhine Westfalia and Bavaria clearly stand out, followed by Lombardy, Catalonia, and Flanders, with Vysocina and Navarra being the smallest. In respect to area, Bavaria is by far the largest. while in economic terms Lombardy tops the table of GDP per capita being 30% above the EU average while the Czech Republic is some 25% below (Table 10).

Most regions have a large number of small municipalities and other administrative territorial organisations, which include a middle tier like Provinces in Italy, Comarques in Catalunia, Regierungbezirke in Germany, Département in France, and/or sovra-communal bodies associations of small municipalities like the Comunità Montane in Italy, and the communautés urbaines and syndicats intercommunaux in France. This is significant because engaging users in the development of a regional SDI requires significant efforts when so many different actors are present in the territory, with different levels of resources and technical skills, political orientations, and priorities. It is thus not surprising that developing and sustaining partnerships is a major objective and measure of success of several of the experiences presented. Whilst this “vertical” collaboration affects some regions more than others, the challenge of developing partnerships horizontally across different departments of public administration and with other stakeholders (in both public and private sectors) is shared by all.

**Table 9: Key features of selected regions**

| REGION | POPULATION [* 1 million] | AREA [*1,000 square kilometres] | N° OF LOCAL AUTHORITIES |
|---|---|---|---|
| Lombardy | 9.5 | 23.0 | 1,546 |
| Piedmont | 4.4 | 25.3 | 1,206 |
| Catalonia | 7.1 | 32.0 | 946 |
| Navarra | 0.6 | 10.4 | 272 |
| Wallonia | 3.4 | 16.8 | 262 |
| Flanders | 6.1 | 13.5 | 308 |
| North-Rhine Westfalia | 18.0 | 34.1 | 396 |
| Bavaria | 12.5 | 70.5 | 2,056 |
| Northern Ireland | 1.7 | 14.0 | 26 |
| Bretagne | 3.1 | 27.2 | 1,268 |
| Vysočina | 0.5 | 6.8 | 704 |

**Table 10: GDP per capita selected regions**

| **GDP** *(PPS per inhabitant in %. EU 27 = 100)* | | | |
|---|---|---|---|
| **Regional GDP** | **2005** | **National GDP** | **2005** |
| Lombardia | 136.5 | Italy | 104.8 |
| Piemonte | 114.7 | | |
| Catalonia | 122.1 | Spain | 102.6 |
| Navarra | 129.2 | | |
| Brittany | 99.5 | France | 112 |
| Wallonia | 90.9 | Belgium | 120.7 |
| Flanders | 117.3 | | |
| North-Rheine Westfalia | 112.4 | Germany | 114.6 |
| Bavaria | 124.8 | | |
| Northern Ireland | 97.0 | UK | 120.6 |
| Vysočina | na | Czech republic | 76.2 |

Source EUROSTAT(NOTE: 2005 is the latest year for which comparable figures are published by Eurostat)

## 13.2 Legal Framework

The existence of legal frameworks to support the development of the regional SDI is in a state of transition. Some regions already have such a framework as is the case of Lombardy, Catalonia, Bavaria, NRW, and Flanders. Others do not have such legal backing but have developed strategies, and partnerships on the basis of government initiatives or programmes. These variations are likely to narrow as the INSPIRE Directive gets transposed into national legislation, thus providing an overall legal framework at the national level, and in case of Germany also at the State level.

## 13.3 Characteristics of the Infrastructures

The technical characteristics of the SDIs described in Section II share many similarities and indicate the current state of the art in the field. They have all adopted distributed and Service Oriented Architectures and are managing a transition between many GIS systems in different organisations towards a shared SDI. OGC-based services and ISO-compliant metadata (either already in that format or transitioning towards it) provide the glue linking together existing datasets and applications.

In some cases, like Navarra the starting point is a corporate GIS that is being opened up to external use via a linked geoportal, in others like that of Vysočina and Brittany, web services are providing an opportunity to link different GI Systems at the local and national level with a relatively weak regional core, while in others the regional dimension is very strong (e.g. Germany, Belgium, Italy, Spain) partly as a result of the institutional mandates and attributions for data collection and maintenance.

Geoportals are widespread in all regions as an entry point for discovery view, and download services. Invoke services, or service chaining are still very limited, and only in few cases we see advanced geoprocessing services providing data analysis. To note that whilst most regions provide public access to the geoportal, and to discovery and view services, with more advanced services restricted to registred paying users, Brittany's portal is internal to the project partners and not open to the public.

Linking and sharing existing datasets and applications appears to be the main focus of most SDI reviewed. Lombardy and Flanders however stand out for the efforts in developing large scale topographic databases for their region. These efforts are significant from a financial and organisational perspective, and challenging because they are long term projects during which it is important to maintain momentum and show also quick wins.

Whilst a solid topographic database is clearly important, particularly when maintained locally through administrative processes, the case of Navarra also shows the enormous value of the cadastral layer for so many local applications, and for the financially important real-estate business. The value of the cadastre is indicated by the difference in usage of the Navarra geoportal (SITNA) compared to all the others: while usage figures are in the range of a few thousands (Piedmont) to tens of thousands of hits per month (Wallonia, Catalonia), in the case of Navarra, the usage is one order of magnitude higher (hundred thousand hits per month) for the IDENA portal, and two orders of magnitude higher (1-2 million per month) for the SITNA portal. This clearly indicates the value of having the institutional responsibility for this key layer for local applications, as well as a system already institutionalised in daily practice.

## 13.4 Resources

The level of financial resources varies significantly depending whether the SDI is intended as only including data preparation, documentation, and publishing through web services or it also includes data production and maintenance. The "weight" of data production is indicated by comparing the cost of setting up and maintaining an SDI without data costs (in order of €300,000 per annum in the case of Catalonia) with those of an SDI with data included (approximately €10 million per annum for Lombardy and Flanders). In many cases the funding of the SDI is embedded in e-government programmes.

The level of human resources also reflects the different perspectives (with or without data production), and organisational model. At one end of the spectrum, Flanders employs over 100 people to develop the SDI and the large scale topographic database. At the other end of the spectrum, Catalonia, employs only 4 people. To note that 3 regions (Lombardy, Piedmont, and Navarra) use an external IT public agency to support their technical development, while the other regions appear to operate with in-house staff, sometimes part of the mapping and cadastral agency or the regional council. Partnerships with the private sector are very rare and limited in scope while Universities can play an important supportive role as in the case of North-Rhine Westfalia, Lombardy, and Catalonia.

Whilst it important to note that it is possible to set up and maintain an SDI with a small group of very committed individuals and a relatively small budget as shown in the case

of Catalonia, it is also clear that small teams are vulnerable to organisational and personal changes so that a strategy for human resource development and management must be in place as argued by the representatives of Northern Ireland, Brittany, and Piedmont who emphasized the lack of adequate human resources as a barrier to further development.

## 13.5 User Involvement

In Section I it was argued that the second generation SDIs are characterised by extensive involvement of users and by a process-oriented approach which emphasizes partnerships, agreements, and a broad set of applications, and not just the completion of national databases. In this respect, it is clear that all the experiences presented in Section II qualify as Second Generation SDIs as all of them have spent significant time and resources to build alliances, partnerships, agreements, and user involvement from the local level, through to regional, and national. These efforts have taken place with or without formal mandate but are very significant as they are the basis for a sustainable future development. Whilst it is relatively easy and quick to set up the technical infrastructure, building and maintaining these relationships and trusted partnership is much more onerous, and credit must be given for the inclusive way in which these efforts have been carried out.

The difficulty of building relationship is due in no small measure to the lack of awareness still widespread about the benefits of SDIs, and of sharing resources, particularly at the local level but also among many decision-makers in different government departments at regional level. An example of the obstacles often faced is that one of the first building block of an SDI is a catalogue of the resources available. This requires the creation of metadata, which is an onerous task for those organisations, particularly in local and regional governments, that have no tradition of documenting are sharing their resources. Hence, these stakeholders are often asked to undertake a time consuming task which to them has little visible benefit, as a first step in building an SDI, with the promise that in the longer run they would also benefit. This is clearly very challenging, and different strategies have been deployed in the cases presented in Section II to overcome this initial hurdle. They include the centralisation of metadata creation by a support agency, as in Lombardy, Piedmont, and Navarra, the creation of dedicated teams in other organisations, or the payment of a small amount (€30 per metadata record) in the case of Catalonia. This is just an example of one of the obstacles in setting up and maintaining an SDI: costs are upfront (in financial and human terms) while benefits are down the line. In the light of these considerations, it is surprising that so few studies have been undertaken to date of the impacts of SDIs, even among the advanced examples presented in Section II.

## 13.6 Impacts

Of the 11 regions presented in this report, only one, Catalonia has undertaken a full impact study, which was instigated and funded by the JRC. Two others are in progress: Lombardy, in collaboration with the JRC, and Piedmont in the framework of the ESDInet+ project (see Section 16). The remaining regions have expressed qualitative assessments of the benefits including:

- Positive cultural change in the stakeholder organisations with greater willingness to cooperate and share resources;
- More coordinated initiatives at the local level in data collection, and reduction of duplication and costs;
- Agreement on the common usage and maintenance of reference datasets;
- More evidence-based applications, particularly in land use planning and infrastructure planning and maintenance;
- Time and cost reduction in finding and accessing data held by other organisations. For example, in the case of utilities in Northern Ireland it takes now 5 minutes on the web to do what used to take 5 weeks in writing to find out where the utilities of other organisations are.
- Improved shared understanding among public agencies of the problems and issues affecting the region.

These are all important benefits that must not be underestimated. Nevertheless, they should also be supported by more quantitative evidence of benefits and their relationship with the investment made to maintain political support and user engagement. In this sense the Catalonia study not only provides good evidence of how quickly the investments made can be recovered (if data production costs are not included), but also points to the direction SDIs should take, i.e. towards those applications that are routine, and that save time and money, even in small quantities, to large number of users among citizens, businesses, and the public sector. Small savings, times many users, can amount to larger and more durable benefits that one-off large (potential) savings. In this sense, it is very interesting to see how all the experiences presented are making a real effort to engage local authorities, which are the one closer to the citizens in providing essential services. This bodes well for achieving positive impacts. It is also worth noting that the benefits reported by all the regions analysed (either quantitative or qualitative) are in terms of increased efficiency, effectiveness, and broader social and economic development outcome. No significant benefits are reported as accruing from data sales. In fact, in the case of Piedmont, it was argued that the cost recovered through sales of data is worth less than the salary of the one member of staff assigned to administer the process.

# SECTION IV: CROSS-BORDER EXPERIENCES

# 14 The GRISI project

## 14.1 The Project Regional Partnership

The Geomatic Regional Information Society Initiative (GRISI) was a project co-funded by the European Union through its Interreg IIIC Sud programme. The project ran from July 2005 to June 2008 to demonstrate how the use of geographic information and geoportals can support European regions to improve governance, economic development, identity promotion and cooperation with other European territories.

Twenty-five local and regional organisations from four European regions (Midi-Pyrénées from France, Navarre from Spain, Abruzzi from Italy and Latvia) have been involved in GRISI activities. The main goal of the GRISI project was to share experiences in the creation of GIS application and geo-portals, building capacity and technical expertise in view of the adoption of the INSPIRE Directive.

## 14.2 Organisation

Given the differences among the partners in technical skills, backgrounds, and language, it was decided to organise the project through four regional SDIs with similar characteristics, integrated through the common GRISI portal. Within each region, a call for proposal was launched to identify between thematic sub projects who would participate in the project. The sub-projects were required to have the following characteristics:

- each sub-project should involve one or more initiatives related to one of the GRISI project thematic domains;
- each sub-project should be set up by at least two different regions partners;
- each sub-project must produce a thematic Geoportal. This Geoportal should highlight the GIS interest on the chosen theme;
- all sub-projects results are public and must be published in the GRISI SDI.

As a result of the call for proposals, five interregional sub-projects were finally accepted, with a total of twenty-six local and regional public partner organizations involved. All of these sub-projects lasted one year and were hosted and coordinated by a project leader, who was assisted by the regional partners (Midi-Pyrénées, Navarra, Abruzzo and Latvia) in the administrative and technical issues.

## 14.3 Project Results

The most important results of the project are the new interregional partnerships which have led to the production of spatial data, metadata and web services. They allowed developing applications in the following domains:

- e-governance : geo-localization of publics services;
- e-economy : offering new geo-services for “green tourism”;
- e-economy (2) : tracing, certifying and promoting typical food products;
- e-identity : promoting the rural areas appeal to attract new citizens
- e-cooperation: looking for new European regional partners within the framework of REGIS project.

**Table 11: Regional Organisation of the GRISI Project**


The GRISI project produced:

- 150 spatial data sets;
- 426 metadata records;
- 16 geoportals and 12 websites for cooperation and dissemination purposes;
- 28 presentations, training and dissemination events.

Each regional SDI provided at least the following services:

- Multilingual geoportal;
- Viewer;
- Geo-catalog;
- WMS/WFS services
- Medium-scale reference database useful for text data geocoding.

The main result of the project was to learn to work together and share experiences on the value of geographic information for territorial governance, and the practical meaning of interoperability at technical and professional levels. This shared experience has built a long term partnership and support for the implementation of the INSPIRE Directive. More information on the GRISI project can be found in the project website at http://www.grisi.org

# 15 The X-Border-GDI project

## 15.1 The Project Regional Partnership

X-Border-GDI (cross-border geodata infrastructure) is a collaborative program to develop and implement an infrastructure for the supply of cross-border geographic information in North Rhine-Westphalia (NRW) and the Netherlands. The project builds on the long-term co-operation between NRW and the Netherlands in the area of spatial information in several main focus areas, such as: land planning, water management, disaster relief, tourism, nature, and environment as well as transportation and economy. X-Border GDI involved 4 Euregions, 4 Dutch provinces, 3 Belgian provinces, 12 Germans counties, 6 German cities with a population of approx. 11.5 Mio inhabitants in the interested area (see Figure 39) and received 50% Interreg IIIA / ERDF funding support on a total project amount of approx. 7.5 Mio. € (until June 2008)

**Figure 39: Geographical Extension of the X-Border Project**


## 15.2 Project Objectives

The programme targets all (potential) providers and users of geographic information, including public and private organisations at all levels (national, regional and local). Along the trans-national working framework the partners cooperate to:

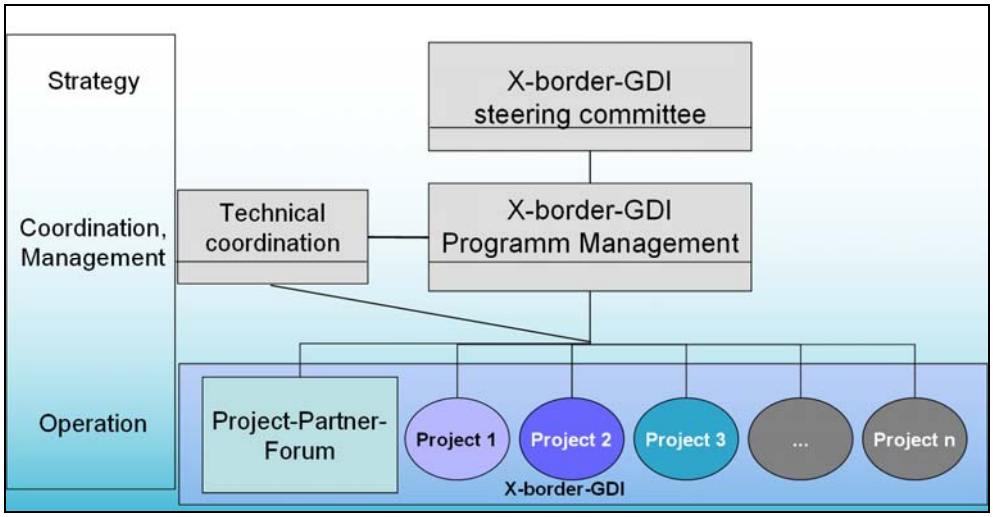
- Provide cross-border specific SDI components and expertise;
- Involve bi- / multinational staff in the activities;
- Conduct projects with a defined user-demand;
- Transfer applications and components, share know-how and experiences;

- Minimise licence restrictions and resulting barriers for users, especially local public bodies;
- Fund their “own” projects and cooperate with others.

## 15.3 Organisation

The X-Border program involves partner collaboration at both strategic and managerial levels in an integrated way focusing on user needs though result oriented projects. A three tiers organization structure was set up for the X-Border framework with a steering committee defining the strategy, two offices for program management and technical coordination, and a project-partner forum where the individual projects at an operational level were able to exchange experiences and results.

**Figure 40: Organisation of the X-Border Project**




X-Border involved 20 bi-national projects, mainly relating to environmental issues or traffic. Common profiles for metadata, portrayal, and web map services were set up. Each one of the 20 X-Border SDI projects has been assessed in terms of plan, compliancy with international standards, reusability and transfer issues, feasibility. Monitoring procedures are applied during project development and a final assessment on content and financial issues is given after the completion.

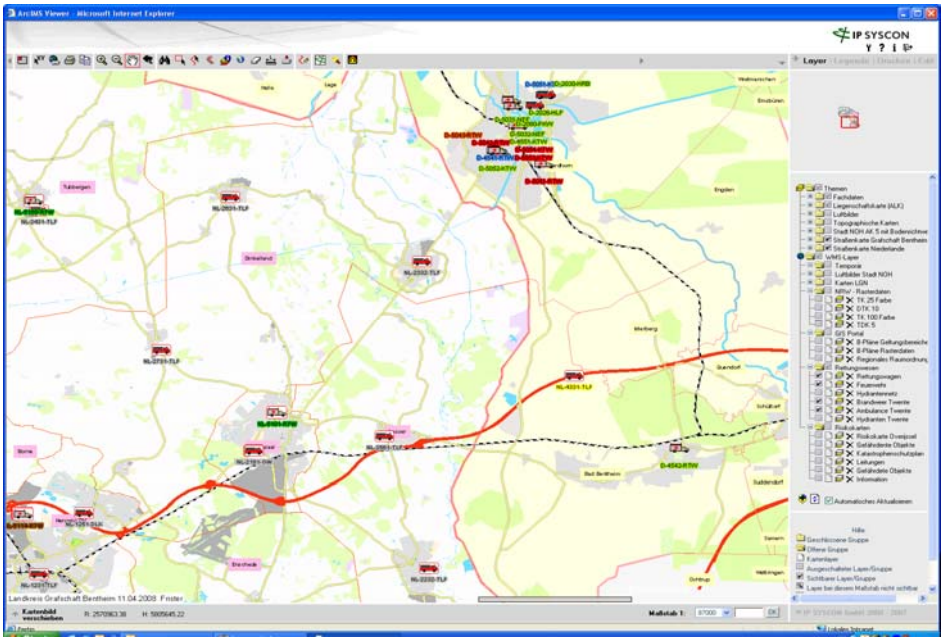
## 15.4 State of Development

X-Border-SDI was designed as a spatial data infrastructure based on existing structures and developments on regional, national and international scale (GDI-DE, RGI space for Geo-information NL, GDI-NRW, GDI-Nds, etc). A first task was therefore to inventory existing projects, for example in tourism, to avoid duplication. X-Border was built according to international standard (INSPIRE, ISO, OGC) in order to ensure the usability of data at the source. Services are intended to support regional demands and make use of existing technology solutions. From this perspective X-Border represent a collaborative framework for knowledge and experience transfer and exchange among the partners.

Applications were built using basic topographic data provided by mapping and surveying agencies free of charge. Among other applications the following were developed:

- Geoviewer animal disease. This project was set up in six weeks for €20,000. It is no longer operational after the end of the crisis on pig disease.
- Tourism project “eRIGG”
- Risk management across Lower Saxony and the Netherlands with positioning and status of ambulance and fire brigade (see Figure 41). This cooperation enables to share some specialized equipment across the border with clear savings and increased response time.
- Cascading mapping services from the different agencies to achieve combined output.

**Figure 41: Example of X-Border applications: Location and Status of Ambulances and Fire Brigade across the Border Regions**




### *15.4.1 Impacts*

At the current level of development the X-Border SDI represents an open and standardized access to public data by local administration every-day information needs and by citizens. The architecture proved to give advantages in terms of time and money savings. Moreover, the X-Border program development showed cross-border activities bring along some special requirements in terms of cultural integration, integration of partners (the users), transparency and marketing, public financing, and political and juridical differences: from this perspective the case study showed communication and cooperation is a key factor in integrating regional SDI.

More information on the X-Border project can be found in the project website at http://www.x-border-gdi.org/en/index.html

# 16 The eSDI-Netplus project

The eSDInet+ is a Network for the promotion of cross border dialogue and exchange of best practices on Spatial Data Infrastructures throughout Europe. The project was launched within the e-content plus programme 2006.

The main task of the Network activities is the study and evaluation of sub-National SDI according to a common methodology. To this end, a first workshop was held in Rome in 2007 where several issues were discussed to build a common base in order to prepare the individual studies on such issues as:

- Functions of a SDI
    - Data
    - Services and Platform
    - Networking people and organisations
- Sustainability of a SDI
    - Requirements: Strategic, Performance
    - Sustainability: Financial, Political, Human resources
- Users of SDI: Government agencies, Private Sector, Citizens

The single studies are carried at the national level on sub-national SDI experiences by the network partners by interviews to relevant stakeholders. To this end each study starts with the identification of the sub national officials (i.e. the person that chairs the “executive” committee of the SDI and the person that is responsible for the SDI management). Stakeholder are then contacted for individual interviews and invited to participate at the national workshop. Oral interviews are then integrated with any material supplied by the actors, and with internet search and geoportal evaluation. Case study reports and assessment-sheets are then produced according to a common template. The Network nodes experiences are shared among partners and relevant stakeholders within national workshops to be held during the project duration. The evaluation framework for the sub-national SDIs is synthesized in Table 12.

The expected outcomes of the project include:

- Synthetic assessment sheet for each identified sub-national SDI written in the national language
- Synthetic spreadsheet for the country written in the national language and translated into English
- Verbatim of the workshop written in the national language
- Executive summary of the workshop written in the national language and translated into English

More information about the eSDI-NET+ are available at:http://www.esdinetplus.eu/

**Table 12: eSDI-NET+ evaluation framework for sub-national SDIs**

| | |
|---|---|
| 1 | Sub-national SDI identity card |
| 2 | SDI data and services |
| | 2.1Qualitative Analysis |
| | 2.1.1 Data |
| | 2.1.2 Metadata |
| | 2.1.3 Services |
| | 2.2 Quantitative Analysis |
| | 2.1.1 Data |
| | 2.1.2 Metadata |
| | 2.1.3 Services |
| 3 | SDI Usage assessment |
| | 3.1 SDI usage |
| | 3.2 Usage and users satisfaction assessment |
| | 3.3 Social impact |
| 4 | Networking and consensus building |
| | 4.1 Networking |
| | 4.2 Awareness raising |
| 5 | Socio-economic impact |
| | 5.1 Direct analysis |
| | 5.2 Indirect analysis |
| 6 | Organisational aspects |
| | 6.1 Administrative area governance |
| | 6.2 Funding and responsibility aspects |
| | 6.3 Other organizational aspects |
| 7 | Legal aspects |
| | 7.1.1 Legal compliance |
| | 7.1.2 Legal status |
| 8 | General remarks |
| 9 | Evaluation of geoportal |
| | 9.1 Visibility |
| | 9.2 Multilingualism |
| | 9.3 Consistency in nomenclature |
| | 9.4 Effectiveness on the view service |

# SECTION V: EXPERIENCES OUTSIDE EUROPE

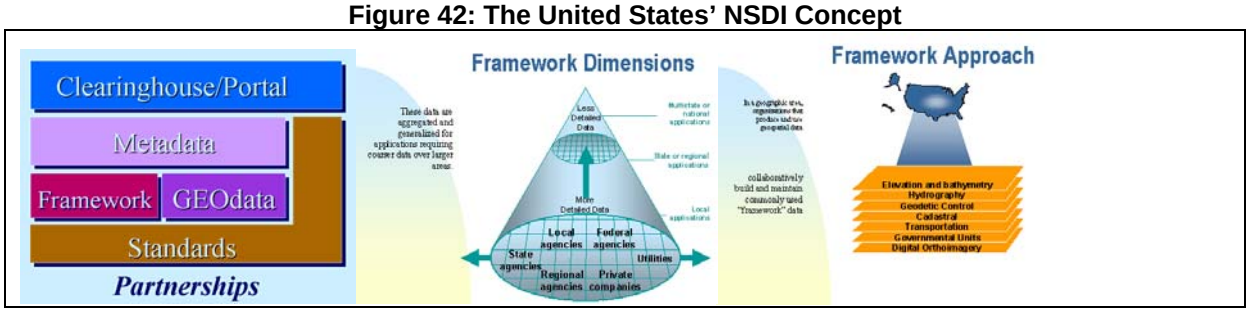
# 17 UNITED STATES[16]

## 17.1 Introduction

The United States is among the first countries to embrace the idea of building a National Spatial Data Infrastructure (NSDI). The impetus is initially given by President Clinton's Executive Order 12906 issued in April of 1994 (Federal Geographic Data Committee - FGDC - web site), but also by the Office of Management and Budget's (OMB) Circular A-16 and E-government Act of 2002 (OMB web site). The importance of building a viable and useful NSDI becomes particularly apparent after the events of 9-11 in 2001 in New York (CAD DIGEST web site; GIS Monitor web site) and hurricane Katrina in 2006 in New Orleans (UCGIS web site).

United States' NSDI is defined as "a physical, organizational, and virtual network designed to enable the development and sharing of [the] nation's digital geographic information resources" (FGDC web site). It is realized through the development of spatial data and metadata standards, establishment of spatial data clearinghouses and portals, and identification and creation of national datasets (so called "framework data," Tulloch and Fuld 2001; Figure 42).

**Figure 42: The United States' NSDI Concept**




The U.S. NSDI concept envisions seamless databases and horizontal and vertical connectivity among federal, state, regional and local government agencies, utility companies, the private sector and academia. While the connectivity might resemble more a network than a clear hierarchy, three levels – national, state, and regional/local -- are distinct in their institutional setup and spatial data requirements. This chapter addresses the status, organizational structure, and impact assessment at these three levels. However, as suggested by this workshop's theme and rationale, the regional and local levels are considered essential elements of a sustainable NSDI and represent its base (Georgiadou et al. 2006a; Harvey and Tulloch 2006; Nedović-Budić and Budhathoki 2006; Rajabifard et al. 2006). In the U.S., over three fourths of population lives in metropolitan regions (U.S. Census web site) where most of urban growth and its implications occur and where large numbers of people are vulnerable in disaster situations. Also, many societal problems are tackled in a more holistic and coordinated manner at this level (Alliance for Regional Stewardship web site; Feiock 2007; Wallis – MuniMall web site), including the response to emergencies

[16] This chapter is contributed by Zorica Nedović-Budić, University of Illinois at Urbana-Champaign, Department of Urban and Regional Planning, budic@uiuc.edu

(Alliance for Regional Stewardship 2002). This is particularly true in the U.S. where the local level is the ultimate locus of decision-making and action, but is extremely fragmented, often artificially bounded, and plagued by overlapping jurisdictions of over 85,000 of different local government entities (U.S. Census Bureau web site). Finally, regional SDIs are also closely tied to the exercise of E-governance (Georgiadou et al. 2006b). The situation at the regional level as well as other instances is complex and dynamic. This chapter provides a summary of the regional and local experiences and includes references for further acquaintance with the U.S. NSDI developments.

## 17.2 Status

### *17.2.1 National*

Substantial progress has been made since the inception of the NSDI in the U.S. Following the efforts in conceptualizing the NSDI and its implementation, there have been numerous activities in developing data and metadata standards,[17] raising awareness at all levels, establishing clearinghouses, defining framework data[18] and creating partnerships to facilitate spatial data availability and access (FGDC web site). Among most notable results of such efforts are the National Map (USGS web site) and Geospatial One Stop (Geodata.gov web site) projects brought together by the National Geospatial Program Office; also the Department's of Homeland Security restructuring of institutions dealing with geo-spatial information of national interest (National Geospatial-Intelligence Agency web site; ESRI web site). Funding for NSDI-related projects at the federal level is secured through allocations by federal agencies. The FGDC Cooperative Agreement Program (CAP) that has been running since the mid 1990s is primarily intended for pilot projects and the only source for the state, regional, and local NSDI implementation.

### *17.2.2 State*

The states are approached through the National States Geographic Information Council (NSGIC web site) with the 50 States Initiative, currently focused on drafting the strategic and business plans. These plans are to "facilitate the coordination of programs, policies, technologies, and resources that enable the coordination, collection, documentation, discovery, distribution, exchange and maintenance of geospatial information in support of the *NSDI" (50 States Initiative web site).* By October 2007, strategic plans are complete in 9 states, pending in 4, in progress in 10, in final draft in 1, and starting in 8 states (N/A in 1 and unknown in 4); business plans are complete in 7 states, pending in 4, in progress in 10, and starting in 8 states (N/A in 3 and unknown in 5). FGDC's Cooperative Agreements Program (CAP) funding is used to support the development of strategic and business plans, but there are no other NSDI implementation resources committed. Otherwise, regardless of NSDI-related initiatives, coordination of geographic information is practiced in many of the 50 states (Warnecke et al. 2003).

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17 Including content standards on: cadastral data, vegetation, soil, digital orthoimagery, and utilities; and technical standards on: data exchange formats and profiles, data accuracy, and map symbolization. For the complete listing of standards see: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/fgdc-endorsed-standards.

18 Transportation, hydrography, elevation, digital orthoimagery, governmental units, geodetic control data, cadastral reference, cadastral publicly owned, and privately owned parcels.

### *17.2.3 Regional/Local*

The only comprehensive study to include the regional/local level in the U.S. is the 1998/1999 Framework Survey (Tulloch and Fuld 2001; FGDC web site). The Survey focuses on counties as the unit of framework data creation, update and/or distribution. It reveals a wide variation in the availability of individual framework data -- from 30% in elevation data to over 70% in private parcels data -- probably due to the local planning emphasis and the state of GIS data integration within the city planning agencies (FGDC web site).

Also in late 1990s, a. national GIS survey by Warnecke et al. (1998), reports that over 40% of the local governments sampled had the following components in their geospatial database: roads, hydrology, political/administrative boundaries, cadastral/land records, land-use/zoning, elevation, digital imagery, and geodetic control, indicating the common data needs at the local level. With the addition of fire, police, and medical facility information, these local databases could also meet the requirements of emergency applications.

Fundamentally and building on the local datasets (i.e., data owned by municipalities and counties), regional spatial data infrastructures are the NSDI's key components. They are dependent on developing seamless databases and techniques, securing incentives and resources for such integration, and establishing multi-jurisdictional intergovernmental cooperation. The integration of geographic data at the metropolitan (multi-county) level is explored in a survey of 388 metropolitan planning organizations (MPOs) and other regional entities by Knaap and Nedović-Budić (2003). The study results suggest that despite the major advancements in GIS technology and the extensive efforts spent in spatial data development at the local, regional, state, and national levels in the past two decades, the status of the regional GIS capacity is below what is technologically feasible. Regional datasets are available, assembled, and regularly updated in only a small segment (one third or less) of metropolitan areas. The compatibility in software and data formats is high, and there is general openness to geographic data sharing; however, the use of advanced methods for data exchange and integration is somewhat limited. For example, Internet-based access to data and establishment of clearinghouses is still rare, but probably more common since the completion of this survey. Also underdeveloped are the formalized interorganizational mechanisms and agreements on standards, rules and responsibilities, with one third or more respondents reporting the absence of such agreements. This finding is consistent with Harvey and Tulloch's (2006) recent research on local data sharing, where they report a relatively low level of formalization of the data sharing relationships and activities.

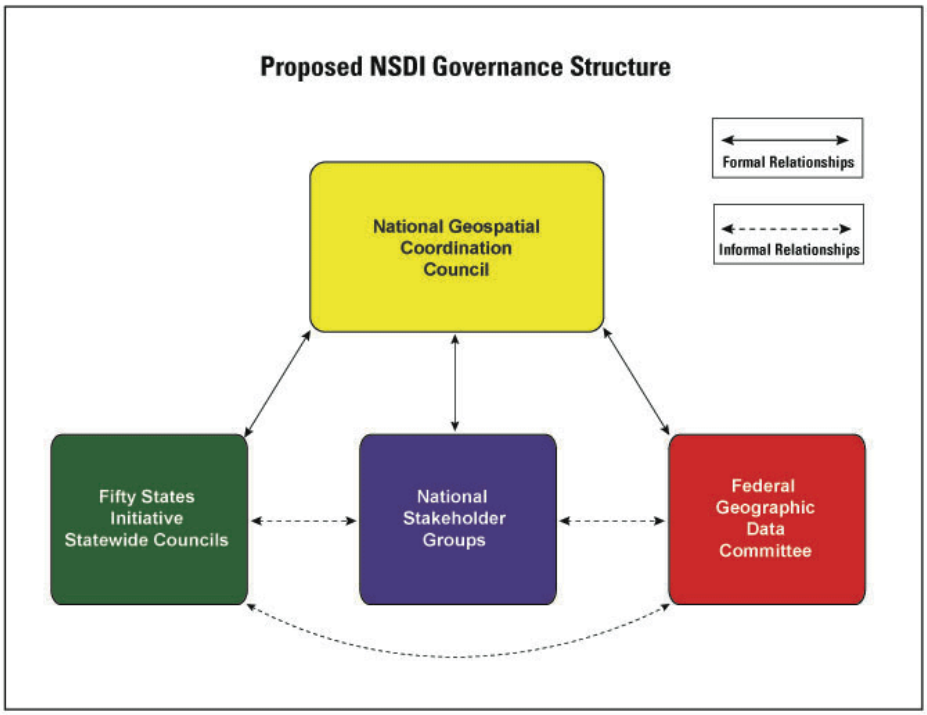
## 17.3 Organizational Structure

### *17.3.1 National*

U.S. NSDI development is supported by strategic documents issued in 1994, 1997 and 2004 (FGDC web site). These documents offer general principles, but lack operational implementation components. The latest NSDI Future Directions Initiative (2004) is still a vague guiding document without a strong plan or program. Also, these documents do not affect the sub-national levels directly. Past efforts have been focused primarily on the federal level where the standardization activity is mandatory, but where full coordination is still missing.

The main NSDI building tool are data partnerships. Hence, the local and state levels have been tackled through partnerships with national associations (e.g., National State Geographic Information Council - NSGIC, National Association of Counties - NACo, and International City/County Management Association - ICMA), as well as through direct contacts with public and private organizations. FGDC Cooperative Agreement Program (CAP) generates many seed projects and testbeds of NSDI implementation. However, the connectivity between the national, state and regional/local levels is not easy to realize. The Future Directions Governance Action Team (2005) has proposed a governance structure headed by the National Geospatial Coordination Council (Figure 43). This suggestion is not fulfilled, and the new National Geospatial Advisory Committee (NGAC web site) appointed in January 2008 is looking for alternative solutions.

**Figure 43: Proposed NSDI Governance Structure**




*17.3.2 State*

Over the past decades, the states have had initiatives in managing their geographic information resources independently from the federal level. Accordingly, the organizational structures and approaches vary across the states, from the responsibility assumed by existing government units (e.g., most often natural resources / environment, planning, or information policy / technology departments), to the establishment of specialized GI departments, appointment of chief geographic information officers (CGIOs) within the state government, and enactment of various legislations and policies (Warnecke et al. 2003). Warnecke et al (2003) state that "[t]he increasing institutionalization of state GI/GIT efforts is evidenced, with 46 states having at least one state GI/GIT coordinator in 2002." By that year, twenty nine of state-wide coordination entities are authorized and 17 are unauthorized. The state GI coordination efforts are primarily in service of state government agencies, but also devote from about one fifth to one quarter of their activities to meet the local needs.

In order to standardize the practices and share the positive experiences, the National State Geographic Information Council (NSGIC, 2003) offers the Guidelines for Coordination of Geographic Information Technologies. Following are the suggested coordination criteria (NSGIC web site):

- A full-time, paid coordinator position is designated and has the authority to implement the state's business and strategic plans.
- A clearly defined authority exists for statewide coordination of geospatial information technologies and data production.
- The statewide coordination office has a formal relationship with the state's Chief Information Officer (or similar office).
- A champion (politician or executive decision-maker) is aware and involved in the process of coordination.
- Responsibilities for developing the National Spatial Data Infrastructure and a State Clearinghouse are assigned.
- The ability exists to work and coordinate with local governments, academia, and the private sector.
- Sustainable funding sources exist to meet projected needs.
- Coordinators have the authority to enter into contracts and become capable of receiving and expending funds.
- The Federal government works through the statewide coordination authority.

The recommended criteria are advisory and many of the states apply some but not necessarily all of them.

### *17.3.3 Regional/Local*

The regions, as the key link between the local, state, and federal levels in the U.S. NSDI, are somewhat neglected. Suitability of the regional level as data assembly unit, in particular, is acknowledged early in the conceptualization of the U.S. NSDI through an idea of "area integrators" (FGDC 1995). Unfortunately, this idea is not implemented and the opportunity to build NSDI with a strong regional and local base is missed. There is currently a revival of this idea through the National Geospatial Advisory Committee (NGAC) established in January 2008. The NGAC reports to the FGDC Chair and "provide[s] a forum to convey views representative of non-federal stakeholders in the geospatial community" (NGAC Charter, NGAC web site). Local and regional governments and organizations are considered as the most important non-federal stakeholders.

Among many regions pursuing their SDI in some form, MetroGIS, a GI collaborative in the Twin City Metropolitan Area (7 counties) in Minnesota, is probably the best example of a successful and viable regional initiative. The collaborative is started in 1995 by the Metropolitan Council of Greater Minneapolis–St. Paul Area, a regional government organization with taxing and regulatory authority, to assemble parcel-level data needed for regional planning and growth management (Johnson et al. 2001; Figure 44). Thirteen functions of common purpose are identified and five strategic projects are completed by the year 2000. MetroGIS serves over 300 local governments in the area. This entity clearly has an "area integrator" function. It is worth noting that it is not legally formalized and it does not have any rights to data ownership. The organizational structure (Figure 45) includes the Policy Board (public officials), Coordinating Committee (managers), and Technical Advisory Team (GIS professionals).

**Figure 44: MetroGIS Location**

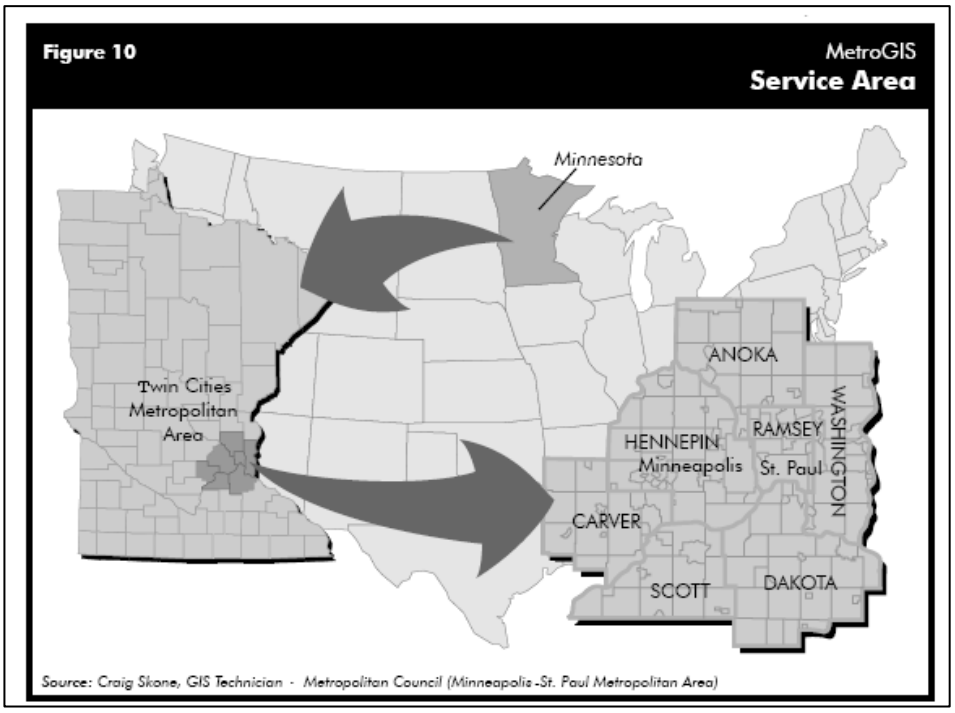
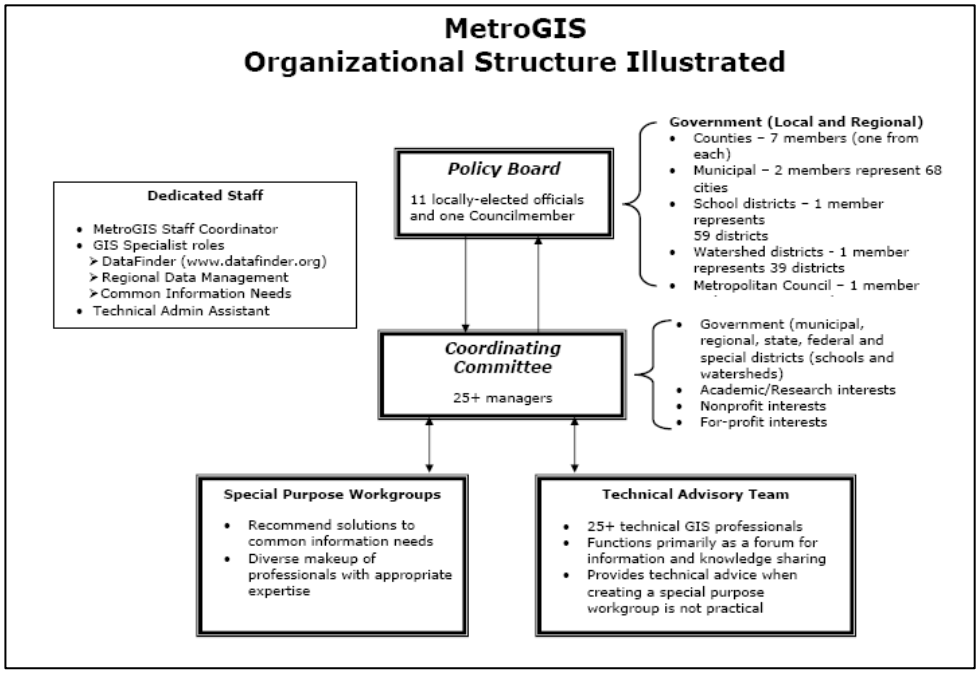



**Figure 45: MetroGIS Organizational Structure**



## 17.4 Impact Assessment

### *17.4.1 National*

The U.S. NSDI activities are not directly and comprehensively assessed, but there are some indications of their impact. The most recent assessment featured in the 2008 Report to Congress on the Benefits of the President's e-Government Initiatives summarizes the use of the Geospatial One-Stop in the following manner (OMB web site): "The Geospatial One-Stop Web portal continues to gain support from data providers and end users. The number of records in the system has grown from about 100,000 in Fiscal Year (FY) 2005 to over 150,000 in FY 2007. The portal also features a "Marketplace" for information on potential opportunities to leverage resources and collaborate on data purchases. The number of partnership opportunities in the Marketplace grew from approximately 600 in FY 2005 to over 2000 in FY 2007. The number of visits to the site has increased from approximately 30,000 per month in 2005 to about 60,000 per month in 2007."[19] Another major geoportal – the ESRI's Geography Network – a couple of years ago counts about 300,000 transactions and 50,000 users accessing the portal each day (Tait 2005).

Evaluations of the Capital Agreements Program (CAP), the main funding incentive for various NSDI-related projects across the U.S. territory and institutional levels and types, reveal that the CAP-supported projects could not amount to a nationally significant outcome (Mapping Science Committee 2001) or reach the organizations most in need of funding (MacPherson et al. 2003). The Mapping Science Committee (2001) finds that "funding incentives established by the FGDC through the NSDI partnership programs do not appear to have significantly" reduced data redundancy, decreased cost, improved access, and increased accuracy. Finally, Dresler and Woods (2000) in a summary of six community demonstration projects supported by the FGDC, point out the disconnection between the federal and local levels. Beside numerous positive developments, they report that "[i]nformation required to address very localized issues such as growth, flooding, and crime analysis often require higher resolution data than is presently collected by the Federal community" (p. 6).

### *17.4.2 State*

National States Geographic Information Council (2003) suggests the following success measures (NSGIC web site):

- Geospatial data will be available in a form that is usable to the public, private sector and government.
- The business requirements of all participants are met through coordination activities.
- Efficiencies can be demonstrated from coordination activities.
- All levels of governments are engaged.
- The statewide coordinating authority is a first point of contact for Federal grants, programs and initiatives.
- There is good coordination and communication between neighboring states.
- Duplication of effort and waste are eliminated.

[19] In 2007, the agencies implementing e-gov initiatives (including Geospatial One-Stop) saved approximately $508 million when the estimated costs are compared to the actual costs.

The suggestions are advisory and there is no formal and systematic application of these measures at the state level. However, while not explicitly tracking the impact, the NSGIC supports an inventory of the state and local GIS datasets, policies and practices with Random Access Metadata tool for Online National Assessments (RAMONA, web site). The tool is administered at the state level, but includes state and sub-state data nodes. By early 2007 it had over 1000 users.

Other research efforts to assess the impact with different criteria are conducted sporadically. For example, a study by Nedović-Budić et al. (2004a) evaluates the use of Illinois State SDI in the context of local planning. The authors find data to be too general and of limited relevance for local use in decision-making; also, data is not easily adaptable, despite the evident coordination.

### *17.4.3 Regional/Local*

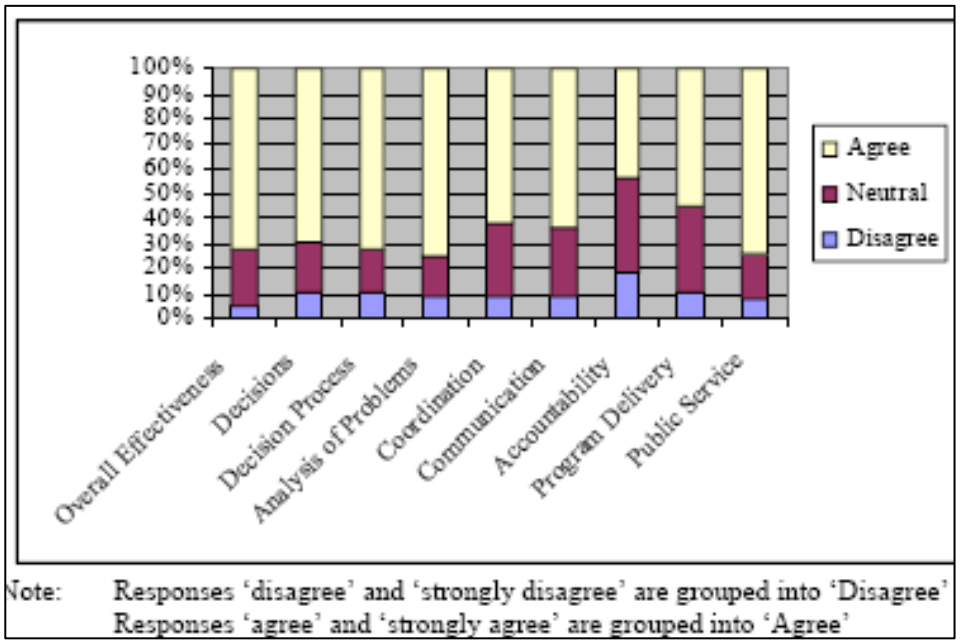
SDI research in the U.S. regional context is scarce. Following the 1998-1999 Framework Survey – an inventory of organizations that produce or use framework data, availability of metadata, data sharing practices, and key contacts (Tulloch and Robinson, 2000; Tulloch and Fuld, 2001), there has been no comprehensive attempt to find out about the status of NSDI. The Framework Survey suggests that the use of framework data in an SDI environment is challenging both technically and institutionally; technically because data are in various formats and of different accuracies, and institutionally because data producers are not fully prepared to share data. More focused and detailed case study research is put forth by Harvey and Tulloch (2006), who discuss the take up of SDI concepts by the local government and find a general lack of awareness or relevance, reinforcing the findings by Dresler and Woods (2000) in case of federal SDI and Nedović-Budić et al. (2004a) in case of state SDI.

Independent regional SDI projects like MetroGIS conduct their own assessments (MetroGIS web site). As the successful example, MetroGIS delivers many benefits that stem from the assembly of regional datasets (including cadastral); web portals with data and services (e.g., DataFinder); standardization (metadata, data, coordinate system, coding); agreements for free access for governments; and active stakeholder involvement. The benefits include: decision making, sharing, reduced data sources and time for accessing data, commitment to standards (data, metadata), improved relationships, and recognition of GIS as a business tool (Johnson et al. 2001). The most detailed assessment, however, is in terms of portal hits that, unlike other benefits and impacts, are accurately documented. The initial investment of about $3 million (1996-2001) provided mostly by the Metropolitan Council has been reduced to an ongoing funding of about $300 thousand per year and there is a sense that these figures are worth the outcomes. The bottom line is the utility of geographic information in the decision and policy-making processes. Therefore, Johnson et al. (2001) claim that “[t]he public officials who make up the MetroGIS Policy Board provide the ultimate reality check!”

In addition to studies focused on SDI, theoretical and empirical investigations into spatial data sharing processes and interorganizational relationships contribute knowledge base that is essential for SDI developments. Nedović-Budić and Pinto’s work on motivation and mechanisms that drive interorganizational GIS in the U.S. (Nedović-Budić and Pinto 1999,

2000, 2001; Nedović-Budić et al. 2004b)[20] is an example of such efforts. The results of their nationwide survey conducted in early 2000 suggest that (with accountability and program delivery excluded) about two thirds of organizations involved in interorganizational GI activities perceive improvements in the various dimensions of effectiveness (Figure 46).

**Figure 46: Perception of Interorganizational GIS Effectiveness**




## 17.5 Conclusions

U.S. NSDI has been developing since early 1990s, under the coordination and sponsorship of the Federal Geographic Data Committee (FGDC) and, more recently, the National Geodata Program Office. Many successful activities are notable in the areas of standardization of thematic data and metadata, establishment of clearinghouses and portals (Geospatial One-Stop), and identification and assembly of framework data through the National Map and other federal programs. Throughout this period, the efforts to engage other levels – state, regional, and local – and institutional partners from academia, utilities and the private sector are evident. The main means for achieving this are partnerships, with the connectivity with and between the state and regional/local levels recognized as the key to NSDI success. While the efficiencies at the national level are starting to show up in terms of cost savings and increased use of the geoportals, the NSDI strategies and initiatives have not succeeded to reach the local and regional base in a more comprehensive and complete way. This level is the most challenging and requires the strategies to be complemented with

[20] Hanseth and Monteiro (1998) suggest that some of the II characteristics may be present in certain information systems (IS), especially in interorganizational systems (IOS) or distributed information system (DIS) and, therefore, some commonalities and overlapping characteristics exist between IS and II. When geospatial technologies and information resources are distributed across organizational boundaries to include multiple local governments and nonprofit groups, or to involve private sector partners (O'Looney 2000), they form interorganizational GIS drawing on existing interdependences, but also challenged by their complexities (Nedović-Budić and Pinto 1999).

clear implementation policies and programs and supported by continuous stream of funding. While generally, the value of interorganizational GIS coordination is perceived to bring improved effectiveness, the specific benefits of the regional / local SDIs are not well documented. The middle level – the states – is addressed through the 50 States Initiative, but is also active in geographic information management regardless of the U.S. NSDI initiatives. The states also engage in documenting the state and sub-state datasets, policies and practices with Random Access Metadata tool for Online National Assessments (RAMONA). In sum, the progress towards the U.S. NSDI vision is substantial, particularly given the country's scale in terms of number of public, private, and non-profit organizations and diversity of institutional setups and cultures. But, there is still plenty to accomplish, especially at the local and regional levels. Comprehensive and more methodologically rigorous assessments of SDI impact would provide useful information for further guiding and enhancing the U.S. NSDI.

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# 18 AUSTRALIA[21]

## 18.1 Introduction

Australia is one of the very few countries in the world that has relatively mature regional SDIs. This is largely due to its institutional context. This chapter describes some of the main features of Australia's institutional context and examines three data sharing partnership projects that have been developed in three Australian states. The last section discusses the relevance of the findings of research on Australia from the standpoint of the implementation of the INSPIRE initiative.

## 18.2 The Australian Institutional Context

Australia is very interesting from the standpoint of regional SDIs for the following reasons (Masser 2005, chapter 5)

1. Virtually all large scale survey and cadastral land registration responsibilities are devolved to the eight states and territories that constitute the regional level of government in Australia. Most states have their own Surveyor General, Registrar General and Valuer General to deal with matters relating to mapping, land registration and valuation.
2. The Australian states and territories pioneered the use of computer database management techniques to handle their state wide multi purpose cadastres from the early 70s. Consequently the regional SDIs have been built on the fruits of more than thirty years operational experience.
3. The Australia Land Information Council (now the Australia New Zealand Land Information Council or ANZLIC) was set up in 1986 to facilitate the collection and transfer of land related information between the different levels of government. Its membership includes members from each of the coordinating bodies in the states and territories as well as that of the Commonwealth government.
4. As a result of all these developments Australia has a relatively mature SDI environment. The state of Victoria, for example, recently published its fifth SDI strategy, the Victorian Spatial Information Strategy 2008-2010. A comparison of this strategy with earlier strategies highlights the degree to which SDI is an evolutionary process where each new strategy builds upon the achievements of previous ones.

There are many similarities between the Australian states and territories. Land registration in all of them follows the general principles the Torrens system which was originally developed in South Australia in the mid nineteenth century. The requirements of the five year national census of population also impose a degree on conformity on the regional data holdings and most of the states have moved to a whole of industry approach to SDI development over the

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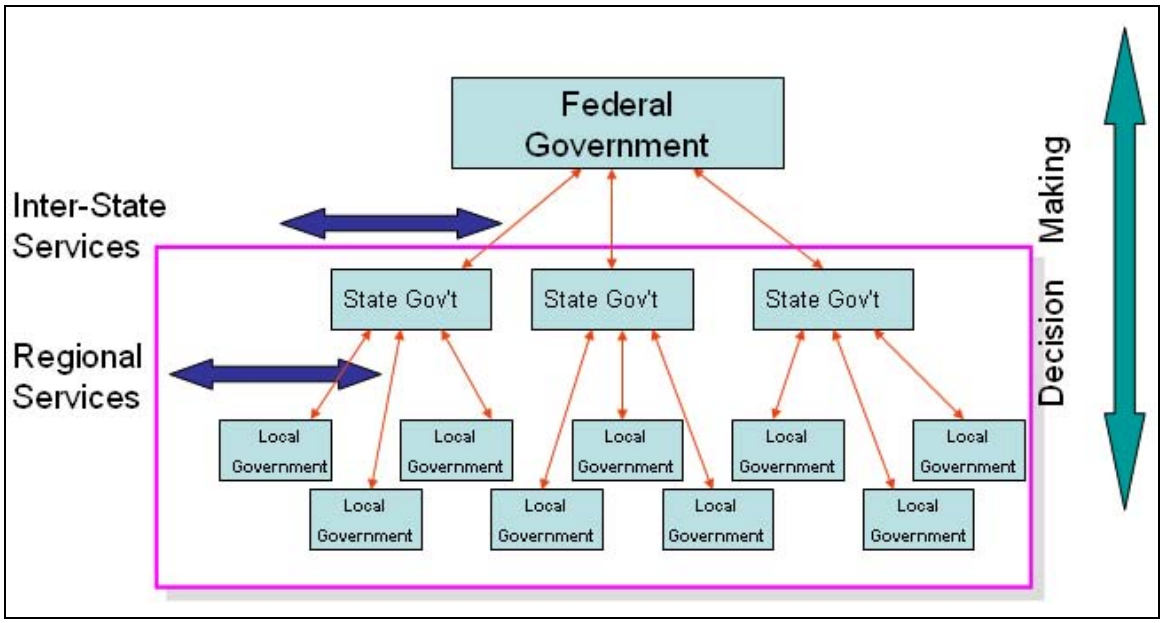
last five years. As a result there is an emerging hierarchy of SDI activities which is shown in fig 14.1 below.

**Figure 47: Emerging hierarchy of SDI activities in Australia**




Despite these similarities there are many differences between the regional SDIs that are emerging in the Australian states and territories. These reflect differences in approach and management styles. For example some states are pursing cost recovery strategies with respect to the data that they hold while others charge little more than the costs of its duplication.

## 18.3 State - Local Governmental Relationships in Australia

Kevin McDougall's PhD thesis on 'A local-state government spatial partnership model to facilitate SDI development.' describes in some detail the changing nature of the relationship between state and local government (McDougall 2006). In the past local government in Australia was in an unequal position when it came to bargain with state level bodies. The latter had the financial resources and the legal powers to require local governments to carry out their basic tasks. One consequence of the emergence of regional SDIs is that local government bodies have become equals of those of the state. The latter require data that is collected by the former and must increasingly think in terms of data sharing partnerships. The whole concept of partnerships between equals is also a new one. In the past there have been various informal and usually ad hoc arrangements between the different levels of government but this is very different from the partnership notion of more formal and more permanent structures whereby each of them makes a defined contribution and expects to receive certain benefits.

McDougall (McDougall et al 2005, 2007) undertook three case studies of land and property based partnerships in three Australian states. As can be seen from Table 13 Queensland is

the second largest state by area in the country after Western Australia while Tasmania is very small by comparison. Victoria (and Melbourne) is the second largest state in the country next to New South Wales (and Sydney). Generally the number of local governments in each state broadly reflects its land area rather than its population size.

**Table 13: Size of Australian regions**

| | Land area | Population | Local auth |
|---|---|---|---|
| | (Sq km) | (Million) | (Number) |
| **Queensland** | 1,731,000 | 3.57 | 125 |
| **Tasmania** | 68,400 | 0.89 | 29 |
| **Victoria** | 227,000 | 4.77 | 78 |
| **Australia** | 7,692,000 | 19.20 | 684 |

The research focussed upon Queensland's Property Location Index, Tasmania's Land Information System and Victoria's Property Information Project. Table 14 below gives some indication of why the partnerships were established in the first place. This highlights the extent to which Queensland differs from the other two initiatives in this respect.

**Table 14: Main reasons for establishing partnership in the three case studies**

| Reason Why | Victoria | Queensland | Tasmania |
|---|---|---|---|
| Gain Control of Data | | ✓ | |
| Organisational Goals (reciprocity) | ✓ | | ✓ |
| Organisational Uncertainty (Change) | ✓ | | ✓ |
| Mutual Business Need | ✓ | | ✓ |
| Necessary Legal or Regulatory Requirement | | | |
| Resource Scarcity | ✓ | ✓ | ✓ |

Table15 gives a more detailed summary of the main findings of the three case studies with reference to direction setting, operation and maintenance, and governance. In the case of Queensland the goals were unclear and the project was hampered by poor institutional arrangements and inadequate channels of communication. To some extent this was due to the large number of local governments involved in this case. Generally the project struggled to gain support because of poor initial funding and the constraints imposed by a restrictive policy framework. Both the other initiatives appeared to be more successful than that of Queensland. The Tasmanian one benefited from a high level strategy and clear policy goals in a small and relative homogenous state. It also had strong leadership and a reasonable level of resources at its disposal. Victoria's initiative also started out with a clear common goal and well managed negotiation processes. Despite some resource limitations overall

communications between the partners has been positive. The findings of this research highlight the need for clear strategic goals and responsive negotiation structures in partnerships of this kind. They also suggest that an important motivator for local government in the early stages is the financial incentives offered. Without such incentives many local governments are unlikely to be in a position to participate in the critical early stages (McDougall et al 2005, 11). Once the relationships have been established interaction between the partners becomes easier within a trusted and cooperative framework.

**Table 15: Main findings in the three case studies**

| Collaborative Stage | Victorian Property Information Project (PIP) | Queensland Property Location Index (PLI) Project | Land Information System Tasmania (LIST) |
|---|---|---|---|
| **Establishment and Direction Setting**<br>- Goal setting<br>- Negotiation<br>- Agreements | A clear common goal for the project. Well managed process of negotiation and development of policy and institutional structures. | Business case for the project was limited. Goals unclear and policy framework worked against data share agreements. | High level strategy and clear overall goals. Policy and negotiations strategy well structured. Agreements very detailed |
| **Operation and Maintenance**<br>- Project management<br>- Maintenance<br>- Resources<br>- Communication | Project management has been good since inception, maintenance infrastructure developed progressively, some resource limitations. Communication with stakeholders and partners has been positive. | Poor institutional arrangements led to poor resourcing and project support. Culture of inter-jurisdictional sharing only now emerging. Confused channels of communication due to dispersed organisational structure. | LIST started with strong overall leadership and project support. Project generally well resourced and technology focussed. Issues of local government communication and data maintenance now starting to emerge. |
| **Governance**<br>- Governance structures<br>- Reporting<br>- Performance management | Early project efforts focussed on negotiation and data exchange. Performance management now part of the process. Improved governance arrangements emerging. | There appears to have been little performance management or reporting. No governance structure in place which includes the key stakeholders. | Initial governance and reporting structures were appropriate, but as project matures new governance models are required. |

In many respects, organisational partnerships such as these are not so different from personal relationships in that they need to be constantly nurtured and frequent communication between the partners is essential. In overall terms the findings suggest that local governments in Australia have the capacity to contribute to data sharing. They typically have mature data holdings and clear business needs but want to engage with the states as equal partners in such activities. Generally, however, they have limited development capacity and usually rely upon or follow state led initiatives. However, while most local governments have a good level of ICT infrastructure the diversity of systems present technical challenges in terms of interoperability. It is also worth noting that the experience of previous cost recovery strategies in some states has had a negative impact on intergovernmental relations.

## 18.4 Discussion

The findings of the three case studies highlight some of the issues that are likely to be encountered in building partnerships between the regional and local levels of government in

a relatively mature SDI environment. In essence they support Nancy Tosta's (1999) dictum that:

> *'Successful SDIs will be local in nature. This is as much a function of practical matters such as the challenges of coordinating large numbers of people over large areas, as it is recognising that all geography is local and issues, physical characteristics, and institutions vary significantly across nations and the world.'*

When considering these findings it is important to bear in mind that they are based on the analysis of regional - local government partnerships in the institutional environment that surrounds SDIs in Australia, particularly the extent to which land and property related administrative responsibilities are devolved to the states and territories in Australia. It is also worth noting that the research focuses on these issues which are important building blocks in the development of SDIs but they do not constitute fully fledged SDIs in themselves. It is worth noting that one of the most interesting findings of an evaluation Victoria's Property Information Programme relates to the need for it to be seen as part of an integrated State Land Information Strategy (Tomlinson 2006). Given these qualifications, it is not clear how far the lessons from this experience can be transferred to circumstances within Europe where the relations between regional and local governments are often quite different from Australia. However, there are some obvious parallels with European experience. The National Land and Property Gazetteers/National Street Gazetteers in England and Wales has much in common with these initiatives (NPLG 2008). This project which is led by the local government Improvement and Development Agency and a private sector company, Intelligent Addressing, began in 1999 and now includes all 376 local authorities. For this reason, it can be argued that the broader outcomes of the three Australian case studies lead to a better understanding of the issues involved which is likely to be very useful in the context of the implementation of the INSPIRE Directive.

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# SECTION VI: CONCLUSIONS

# 19 CONCLUSIONS

This report presents the findings of the workshop on Advanced Regional Spatial Data Infrastructures (SDIs) organised by the European Commission Joint Research Centre in May 2008. The objectives of the workshop were to review the state of progress, analyse the different organisational models established with local and national stakeholders, and assess the social and economic impacts of the regional SDIs. Eleven regional/sub-national SDIs in Europe have been presented in the report, set in the context of the broader European framework provided by the INSPIRE Directive, the national State of Play studies, and international experiences in the USA and Australia.

*State of Progress:*
The eleven regions presented in this report have all made significant progress in the development of the SDIs, and can offer many services to their regions to find and access spatial data and services through standardised metadata, catalogues, and web services based on common specifications. Some offer a few more services than others, but by and large their similarities in respect to approach, architecture, technologies and standards are much greater than their differences. These similarities are also likely to converge further as the INSPIRE Directive and its technical specifications are implemented.

The main aspect worth highlighting here is the crucial role of this “regional” dimension of SDIs which is often neglected by professional and academic debates that tend to focus more on the national dimension, subsuming the regional in a hierarchical view of SDIs. The regional experiences are not just an intermediate level from global to local, subservient to the higher administrative authority. They are often leading the field, pre-dating national developments, or setting the example and framework, including technical specifications, for the national levels. In some instances as in Italy, Spain, Belgium, and Germany they are the key building blocks of the national SDIs, with the national level providing a thin layer on the regional infrastructures. This is of course not always the case, and institutional differences across Europe play a key part, but it is important to acknowledge the leadership role often taken by these regional experiences.

The European regional SDIs presented also compare favourably with the international experiences in the USA and Australia. Europe is by no means behind, and in many respects has many lessons to share from both organisational and technical perspectives, particularly for the complexity of the interoperability arrangements needed at the European level in a multi-lingual and multi-cultural context. In this sense, the cross-border projects and initiatives highlighted in Section IV are very important to share experiences, and build partnerships and working methods.

The awareness at the European level of the importance of regional development goes back at last 30 years with the establishment of the European Regional Development Fund in 1975, and has continued to grow with formal consultative structures at the European level like the Committee of the Regions, established in 1994. The European Union is a Union of the Member States but also a Europe of the Regions, the importance of which continues to grow. The recognition of their political importance comes through also in SDIs terms as shown in this report, and appears to translate in more funding being available at regional level in Europe, from e-government or regional development, compared for example to the USA.

From an INSPIRE perspective, the importance of regions requires a greater involvement of these actors into the process of developing the Implementing Rules, particularly for Annexes II and III (see Figure 1), in which regional and local authorities have main responsibilities.

*Organisational models*
In addition to their administrative and institutional roles, regions perform a critical role in relation to local administrations, which in many instances are many and very small, e.g. the 11 regions presented in Section II already include almost 9,000 local authorities and a host of other intermediate level administrations and groupings. The effort that all the regional SDIs reviewed are making in involving local authorities is one of the main features emerging from the analysis. A whole array of different organisational arrangements have been put in place to engage the local level in all its articulations including intermediate level authorities, such as Departments in France and Provinces in Italy, inter-communal organisations, utilities (which in some instances are private, in others public or public-private), and other stakeholders. The existence of legal backings for some of these arrangements does not seem to be a determining factor. It may help, but in the end there is no substitute for the long-term hard work of building, and maintaining relationships and trust. In this sense, the lesson emerging from this report is that SDIs are above all networks of people and organisations, in which technology only plays a supporting role. Building the technological front-end can be relatively easy, building and maintaining the social back-end is much harder and resource intensive, and there are no short cuts. This is also confirmed by the experiences in the USA and Australia reviewed in Section V.

*Social and economic impacts*
Too little attention is still being paid to the assessment of the social and economic impacts of SDIs. This is applies to Europe but is also confirmed by the review of the USA and Australia. Hopefully, this has started to change, and we will see in the coming years a greater concerted effort in analysing these impacts and sharing experiences. The ESDInet+ project highlighted in Section V is clearly a step in the right direction, but more work needs to be done at all levels and countries. As the report indicates, the regional and local levels are very promising areas of study as they are closer to large numbers of potential users of an SDI, i.e. to the operational services provided by public administrations that can be supported by an SDI. Building and supporting applications for citizens and local businesses related to land and property, planning, traffic, local services, as well as allowing new services from the private sector to be developed around addresses and locations seem to be a common thread across many of the experiences reviewed. In the case of Catalonia we also have seen the benefits that these local applications can deliver which more than justify the investments made not only in technology but also in developing the partnerships that support these applications. In other words, to achieve large economic and social benefits, think global but act local. The work is harder, but well worth it.

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**Abstract**
This report presents the findings of the workshop on Advanced Regional Spatial Data Infrastructures (SDIs) organised by the European Commission Joint Research Centre in May 2008. The objectives of the workshop were to review the state of progress, analyse the different organisational models established with local and national stakeholders, and assess the social and economic impacts of the regional SDIs. Eleven regional/sub-national SDIs in Europe are presented in the report: Lombardy, and Piedmont (Italy), Catalonia and Navarra (Spain), Wallonia and Flanders (Belgium), North-Rhine Westfalia and Bavaria (Germany), Northern Ireland (UK), Brittany (France), and Vysočina (Czech Republic). These experiences are set in the context of the broader European framework provided by the INSPIRE Directive, the national State of Play studies, and international experiences in the USA and Australia. A key finding of the report is that these regions are indeed leading actors in the development of SDIs in Europe, adopting state-of-the art technologies, standards, and models and often setting the pace through example for others to follow. Crucially important is their role in coordinating and organising developments at the local level through a large array of partnerships and organisational models. This organisational work is challenging because it involves a very large number of stakeholders operating at the local level, and requires long-term political, organisational, and personal commitment. However, the evidence available at the present time indicates that it is at the local level that the largest social and economic benefits of an SDI can be found, supporting operational day-to-day applications affecting millions of citizens and local businesses. To achieve these benefits there is no alternative but to engage locally, and invest in building and maintaining relationships and trust. From this perspective, the main lesson of the European experiences, supported by those in the USA and Australia, is that Spatial Data Infrastructures are foremost social networks of people and organisations, in which technology and data play a supportive role. The technology is cheap, data is expensive, but social relations are invaluable.

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