JRC Scientific and Technical Reports

The Socio-Economic Impact of the Spatial Data Infrastructure of Catalonia

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European Commission
Joint Research Centre
Institute for Environment and Sustainability

EUR 23300 EN - 2008

JRC EUROPEAN COMMISSION

ies Institute for Environment and Sustainability

UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA

CPSV CENTRE DE POLÍTICA DE SÒL I VALORACIONS

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JRC 44168

EUR 23300 EN
ISBN 978-92-79-08728-8
ISSN 1018-5593

Luxembourg: Office for Official Publications of the European Communities

Printed in Italy

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EXECUTIVE SUMMARY

This report presents the finding of a study 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 is 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.

In addition to evaluating the socio-economic impact of the SDI in Catalonia, the study reflects on the indicators used for the study and the limitations encountered in collecting the necessary information, with suggestions for future work in this important field of research.

SECTION I: INTRODUCTION AND CONTEXT

1 Introduction

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 the 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, had the following objectives:

- Analyse the cost and benefits related with the setup and maintenance of the Catalan SDI as well as the services utilised by different organisations and user groups;
- Define clear and transparent methodologies for the quantitative and qualitative evaluation of the socioeconomic benefits of SDI;
- Evaluate critically the lessons learned from the study as input for future research in this important field.

This document reports the findings of the study and is organised in three sections: Section I introduces the study region of Catalonia (Chapter 2) and its spatial data infrastructure (Chapter 3) including the history of development and investments made. The broader context of the IDEC is briefly discussed in Chapter 4 which reports on three studies undertaken recently, or in progress, that give a measure of the GI sector in the region both in the private and public sectors. Section II enters in the details of the study focusing on the methodology deployed (Chapter 5), and the results obtained among public administrations (Chapter 6), and other end users (Chapter 7). Section III, analyses the findings in terms of social and economic impacts, and methodological lessons learned from the study (Chapter 8).

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

2 Catalonia context

2.1 Organisational structure

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.

Figure 1: Location of Catalonia

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.

Figure 2: Map of the autonomous communities of Spain

The current economic framework stipulates that territorial strategy is the domain of the *Generalitat*, whereas territorial development, planning and housing are the domain of the municipalities. This means that coordination is needed between the *Generalitat* and municipalities, especially in terms of territorial information.

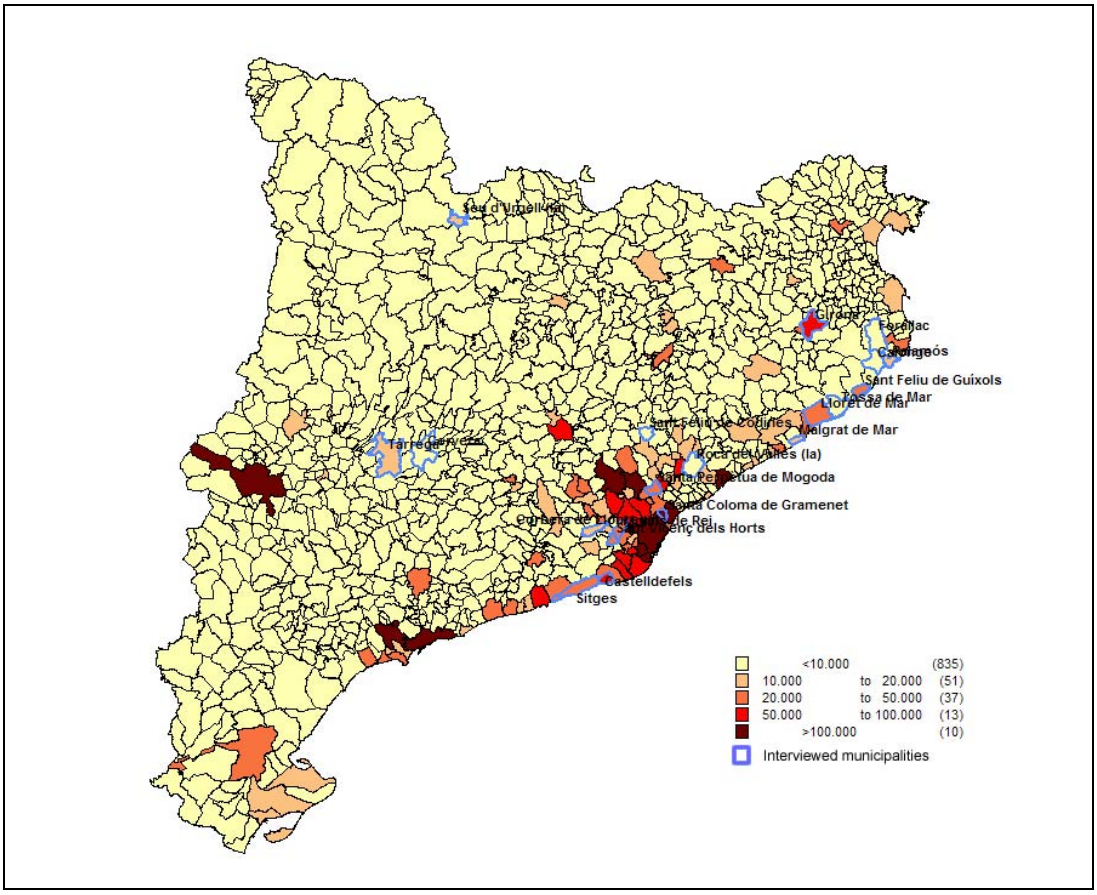
Territorial administration is divided among the four provinces and the 41 counties. The counties play a crucial role in Catalan territorial organisation, together with municipalities composed of a cluster of neighbouring towns. The counties have authority over cooperation, coordination and compensation of municipal services, and collaboration with services of the *Generalitat*.

The network of county authorities (in Catalan, *Consells Comarcals*), outlined in the County Action Plan (*Pla d'Actuació Comarcal*), was formed to support economic activity, improve quality of life, protect the environment, and collaborate with other administrative bodies and public organisations. The county authorities support town halls and improve the range of services available to the public.

Figure 3: Map of the counties of Catalonia

Figure 4 shows the municipal boundaries of Catalonia, and their population distribution. The municipalities that were interviewed for the Study are highlighted on the map.

Figure 4: Municipalities of Catalonia and Population Distribution.



Source: CPSV

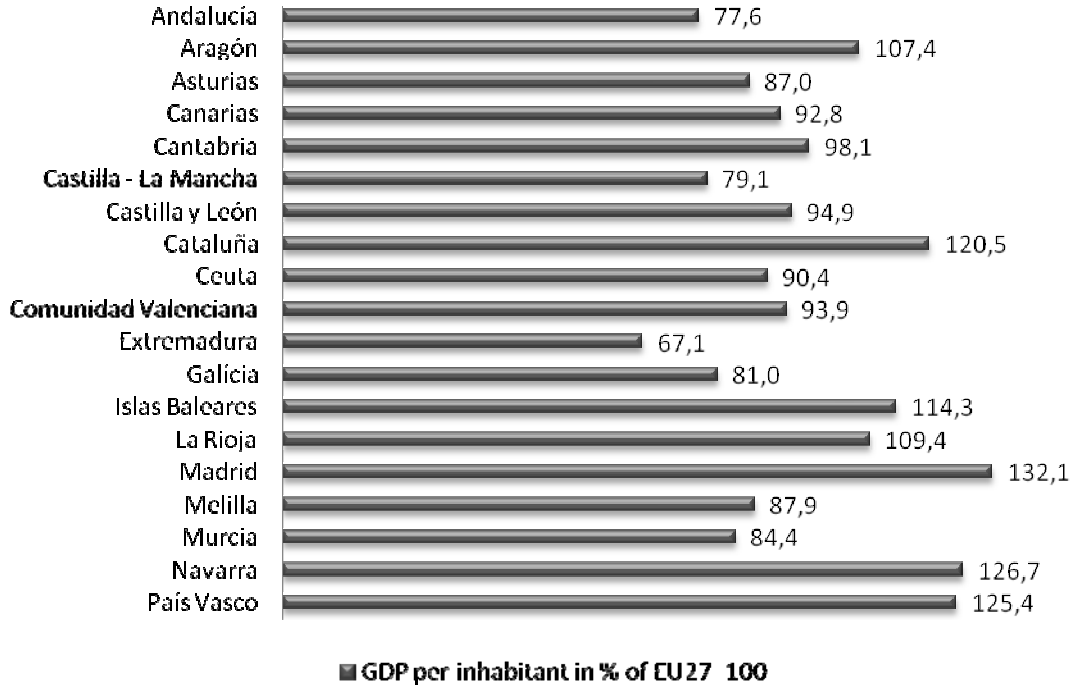
2.2 Economic profile

According to the 2001 Census of Population, Catalonia had a resident employed population of some 2,815,000 persons, representing 17.24% of the national total. This figure for Catalonia was distributed between the principal economic sectors as follows: agriculture and fisheries (2.46%); industry (25.18%); construction (10.35%); and services (62%). Compared with the corresponding figures for the whole of Spain, what stands out is the lower proportion of the employment in agriculture and fisheries (6.34% for Spain) and the considerably higher proportion employed in the industrial sector (18.36% for Spain).

The key indicator of economic integration across Europe is GDP per capita, relative to the average for the European Union (EU). Over the period 1995-2004, Catalonia's GDP, measured in Euros per inhabitant as a percentage of the EU27 average, has risen from 96.9% in 1995 to 109.4% in 2004. The region's GDP rose above the 100% level for the first time in 2000, when it measured 100.7% of the EU27 average. Over the same ten year period there has been a noticeable decline in the differential between the GDP for Catalonia and that of the EU15 group of countries – in 1995 the GDP of the EU15 stood at 123.5% compared with the previously cited 96.9% for Catalonia, while in 2004 the corresponding figures were 120.0% for the EU15 against the 109.4% for Catalonia.

Figure 5 below shows the distribution of GDP per capita across the Spanish autonomous communities. As indicated, Catalonia is one of the more prosperous regions in the country contributing for over 17% of the national GDP against a population share of less than 16%. Its prosperity and degree of autonomy set the context for the development of its Spatial Data infrastructure discussed in the next Section.

Figure 5: GDP per inhabitant of the autonomous communities of Spain (2004)



3 The Catalan spatial data infrastructure

3.1 Scope and objectives

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 *Generalitat*, 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 IDEC was initially intended for compiling information on existing data resources and products, and to create a software platform for making this data available to users throughout the region. The first stage of the IDEC project focused on data sharing within the

departments of the *Generalitat*. This was followed in 2005 by the second stage, which sought to achieve the same goals with local governments in Catalonia.

The IDEC was the first initiative to create an SDI in Spain. Other regional initiatives followed after a few months. Hence, the State initiative to create a National SDI, named IDEE[2], was conceived from the beginning as the sum of the regional initiatives and projects. A working group (GT-IDEE) under the umbrella of the Geomatic Commission of the Cartographic Council (a national board in which all the ministries, autonomous communities and local authorities are represented) coordinates the regional activities, and makes recommendations in common areas of interest using a consensus approach. The IDEC collaborates intensively with all the groups, areas and proposals managed by IDEE.

3.2 The IDEC building process: 2002 to 2006

The process of developing the IDEC can be divided into an initial launch period, from 2002 to 2003, and a subsequent operational one, starting in 2004, when the first IDEC services were made available. The year 2002 was mainly focused on preparation, including the definition of the business model, relationships, institutional arrangements, project presentation, project planning, selection and study of the metadata standards, development of a metadata editor tool, and software testing. At the beginning of 2003, a new Geoportal became available which hosted different services (e.g. documents, links and a forum) and a Web Map Service (WMS)Client–Viewer which accesses data from the Cartographic Institute of Catalonia (ICC) WMS (orthophotomaps) and the Department of the Environment WMS, as well as some thematic maps. Many new layers were added to the service; and by the end of the year 123 layers were available for visualisation through IDEC Viewer, including topographic maps and orthophotomaps at different scales (from the ICC), land use maps (from CREAF, the Centre for Ecological Research and Forestry Applications), data from local networks (LOCALRET[3] and STSI), environmental thematic maps (Department of the Environment of the *Generalitat*), and contributions from several municipalities. A new, multifunctional version of the metadata editor tool MetaD was developed, and made freely downloadable from the Geoportal.

The Geoportal also includes an OGC-compliant web Catalogue Service, which contains several thousand sets of metadata describing the published layers, with an emphasis on the ICC topographic maps and orthophotomaps. By the end of 2003, the Catalogue contained around 15,000 records (in three languages) from 30 organisations. The IDEC's first thematic SDI, related to data for coastal management, was developed as part of the European project EUROSION. The IDEC also contributes to the development of the EU Geoportal.

To raise awareness of the applications and benefit of the project, the IDEC organised several workshops, participated heavily in the annual GIS FORUM on new technologies, and published and distributed several brochures on the meaning, goals and impacts of SDIs.

In 2004, a new version of MetaD was released with the ISO 19139 metadata implementation, a more usable publication interface and new functions that facilitate the capture and import of data from other environments. The Metadata Catalogue also offered a new search interface, with new search possibilities. Several municipalities and new departments published their

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[2] www.idee.es

[3] www.localret.cat is a network supporting local authorities in Catalonia.

metadata. By the end of the year, 18,300 metadata records (52,000 in total, including Spanish and English language records) were available. Nearly 12,000 visits to the Catalogue were registered. A new interface of the WMSClient-Viewer was published. New Web Feature Service (WFS) and Web Coverage Service (WCS) were added, enabling downloading of topographic layers and administrative boundaries at 1:50,000 scale (in GML) and orthophotomaps at 1:5,000 and 1:25,000 scales. New layers from other municipalities, from the National Mapping Agency and other bodies, and using different Web Map Servers, were included in the list of available GI. By the end of 2004, more than 150 layers of reference and thematic data were available. The IDEC created, tested and made available for all users its first geoprocessing service, which uses WSDL and SOAP standards.

The legal status of the IDEC was formalised in December 2005 in a law passed by the Catalan Parliament (see Annex 1). This established an independent support centre to manage the IDEC within Cartographic Institute of Catalonia.

The IDEC continued to expand its services in 2005 and 2006 engaging new stakeholders and partnerships, and making available an increased number of metadata records and GI layers and services. A new Metadata Catalogue for services was set up, offering more than 40 web geoservices (WMS, WFS, WCS and geoprocessing services) from various public and private providers. IDEC participated in a European project, AWARE, collaborating on the design and implementation of several geoprocessing services, and on the implementation of web processing services (WPS). It was also involved in several thematic SDI projects, such as the one for coastal areas, which seeks to promote greater user participation in the management of the Catalan coast by making relevant data easily accessible. IDEC also created two new and important thematic SDIs for municipalities and universities: IDE.LOCAL (see Section 3.4) and IDE.UNIVERS. The latter is aimed at integrating several Catalan university departments (14) into the regional SDI. Its goal is to promote active participation of these entities in the building of the infrastructure, creation of metadata on the geodata they have obtained in their academic research and projects, and publication of these metadata records through the IDEC network. It is envisaged that by the end of the project (March 2008), a total of 5,000 metadata records and roughly 3,000 new GI layers should be available. This initiative was undertaken as part of the Interreg III Medoc project, led by the Secretary for the Information Society of the *Generalitat* and includes partners from Spain (Andalusia), Italy (National Research Centres of Milan and Emilia Romagna), and Greece (Aegean University).

The development of applications for the users of the thematic domains is currently one of IDEC's most intense activities. Tables 1 and 2 show how the use of IDEC services has changed over the past few years.

Table 1: Number of visits to the Geoportal services (2005 to 2006)

	2005	**2006**
To the homepage:	46,500	72,000
To the Catalogue:	20,500	9,500
To the Viewer	91,500	187,000

Table 2: Other statistics: resources and user data (2003 to 2006)

	2003	2004	2005	2006
Available WMS layers	123	151	195	205 (+85)
Geoportal visits	ND	37,000	46,500	72,000
Viewer visits	ND	28,000	91,500	187,000
Catalogue visits	ND	12,500	20,500	9,500
Metadata records	15,000	18,500	20,200	20,300
Geoservices records	------	-------	30	39
Metadata providers	30	62	69	76

3.3 Investments and costs

Tables 3 and 4 present the total investment made to set up and maintain the IDEC over the period 2002-06. Table 3 is organised by key component of the infrastructure, setting out the investments per annum in respect to capital costs (hardware, software) and human resources. Table 4 highlights the different structure of the investments in the initial set-up period (2002-03), and during operations and extension (2004-06).

To understand these figures, which are made available by the IDEC Annual Reports, a number of important points need to be made:

- Only direct costs are presented, i.e. the costs do not take into account of the indirect costs associated with using the physical and technological infrastructure (e.g. office space, communications, technological support, and time spent by other managers) provided by the ICC.

- The starting point of the IDEC is that reference and thematic data already exists, and is available in digital form. Therefore, the mission of the IDEC is to promote online accessibility to these data resources, which entails description through metadata, publication of the metadata in the catalogue to enable discovery, viewing and downloading, and network services that allow users to connect with the WMS in which the data layers are stored. Therefore, the **creation, maintenance or updating of data** is **not** considered part of the SDI, and consequently, the costs associated with these activities are not included in the economic analysis.

- The cost of publishing the data is however included, as this is a critical task to meet the objectives of an SDI, especially for large provider organisations. These costs refer to the activities undertaken by the ICC to convert its digitized cartography files into a

numeric database. These operations included data model creation for each kind of dataset (topographic maps 1:1000, 1:5000 and 1:50000, orthophotomaps 1:5000, 1:25000); creation of the database (Oracle); development of an automatic data conversion processes; downloading of hundred of files containing the digitized sheets to the Oracle database; configuration of the map servers; and publication of different data products; the creation of a balanced system of map servers; tests and other complementary work.

- The Metadata component includes both the development of specific software for editing and exporting metadata records that are based on ISO 19115 (Versions 1 and 2) and ISO 19139 (Version 3), and the work needed to document all the cartographic datasets of the ICC and other large providers, as well as support to many other organisations.

- Metadata Catalogue Server is commercial software which has been implemented and adapted to IDEC requirements, and has required several complementary developments as well as maintenance.

- The WMS Client is a continuous software development activity which is the basis of the WMS client of the IDEC Geoportal and of the different viewers developed for IDE. Local and other thematic SDIs.

- Web Geoservices and applications include development of OGC WMServices for the ICC (e.g. WMS, WFS, WCS and WMC), support to other organisations to create their own services, development of geoprocessing services (*e.g.* coordinate transformation, gazetteer and geocoding), and several applications for different organisations, including thematic SDIs.

- Applications include customisation for different participating organisations, and thematic activities for example in the field of planning or environmental protection.

Tables 3 and 4 indicate that the total direct costs to set up, maintain and expand the IDEC was €1.5 million over a five year period (2002-06), of which some 57% for the technical and data-related components, and 43% for awareness raising (diffusion) and management activities.

Human resources are the major cost factor during both the initial 2-year set up (76%) and operations (91%), while capital expenditure is relatively modest at a total of €230,000, most of which took place as expected at the setting up stage.

The average annual cost for all activities (including management and diffusion) during the launching period was €325,000, and in the operational period was €280,000.

Figure 6 shows that the distribution of expenditure for each of the technical and data-related components of the IDEC is well balanced with a relatively narrow fork of percentages between 16.5% for data preparation and publishing, and 9.4% for the Web geo-services.

Although the overall expenditure for each component is relatively similar, the difference in composition between capital costs and human resource expenditure is considerable as shown in Figure 7.

Table 3: Annual distribution of costs of IDEC components

	2002	2003	2004	2005	2006	Sub-Total	%	Total
Metadata Creation								**130,000**
Capital costs	15,000				20,000	35,000	26.92%	
Human Resources	35,000	30,000	10,000	10,000	10,000	95,000	73.08%	
Geoportal								**90,000**
Capital costs		20,000				20,000	22.22%	
Human Resources	20,000	10,000	20,000	10,000	10,000	70,000	77.78%	
Metadata Catalog								**90,000**
Capital costs		10,000	20,000	10,000		40,000	44.44%	
Human Resources		20,000	10,000	10,000	10,000	50,000	55.56%	
WMS Client								**90,000**
Capital costs	10,000					10,000	11.11%	
Human Resources	10,000	20,000	30,000	10,000	10,000	80,000	88.89%	
Web Geo-Services								**80,000**
Capital costs								
Human Resources		30,000	20,000	20,000	10,000	80,000	100.00%	
Data Publishing								**140,000**
Capital costs								
Human Resources		60,000	40,000	20,000	20,000	140,000	100.00%	
Applications								**100,000**
Capital costs								
Human Resources			20,000	20,000	60,000	100,000	100.00%	
Web and Map Servers								**130,000**
Capital costs	40,000	60,000			30,000	130,000	100.00%	
Human Resources								
Diffusion	24,000	24,000	24,000	24,000	24,000			**120,000**
Management	86,000	86,000	86,000	86,000	86,000			**430,000**
Other	20,000	20,000	20,000	20,000	20,000			**100,000**
Yearly Total	260,000	390,000	300,000	240,000	310,000		**TOTAL**	**1,500,000**

Table 4: Distribution of costs of IDEC during set-up and operation

	H.R	%	Capital	%	Total	Avrg per Year
Launch Period 2002-03	495,000	76.15%	155,000	23.85%	650,000	325,000
Operational 2004-06	770,000	90.59%	80,000	9.41%	850,000	283,000

Figure 6: Distribution of costs by IDEC component

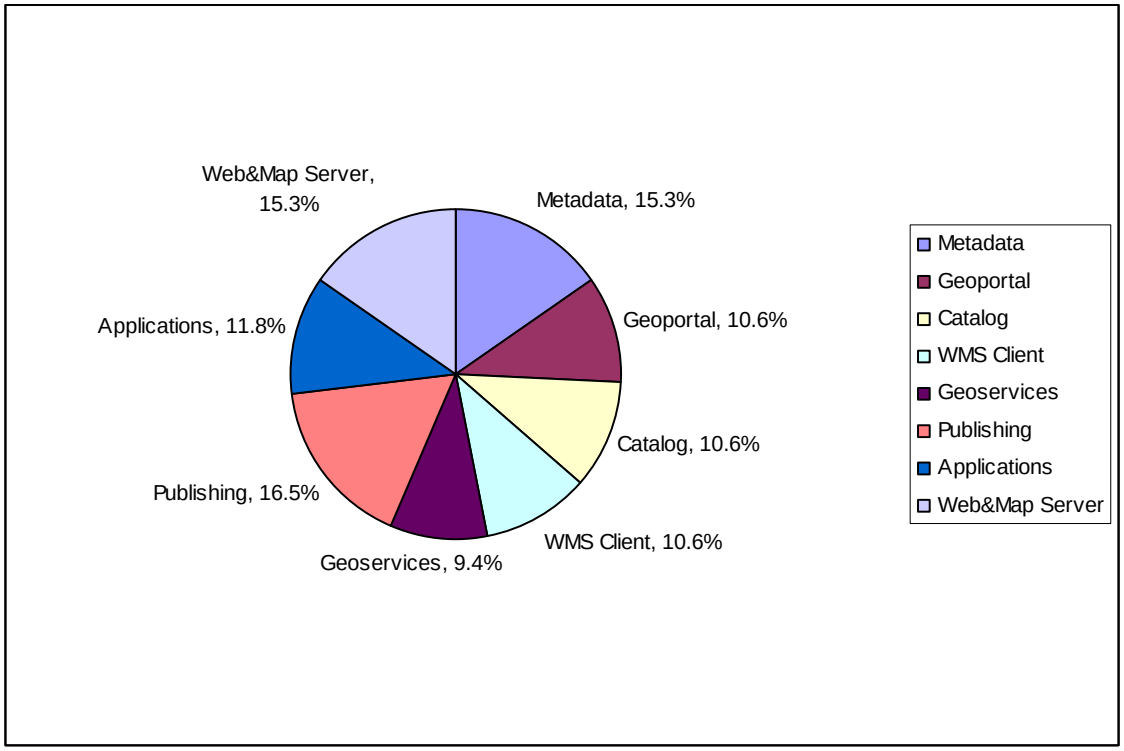
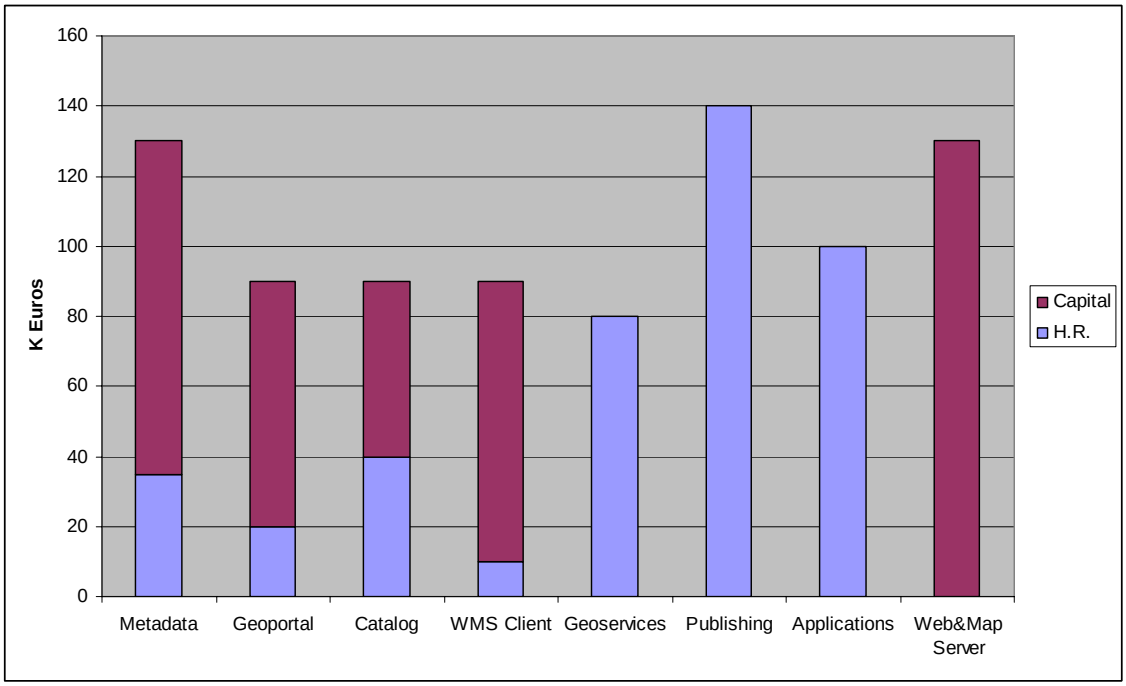


Figure 7: Distribution of human resources and capital costs by IDEC component

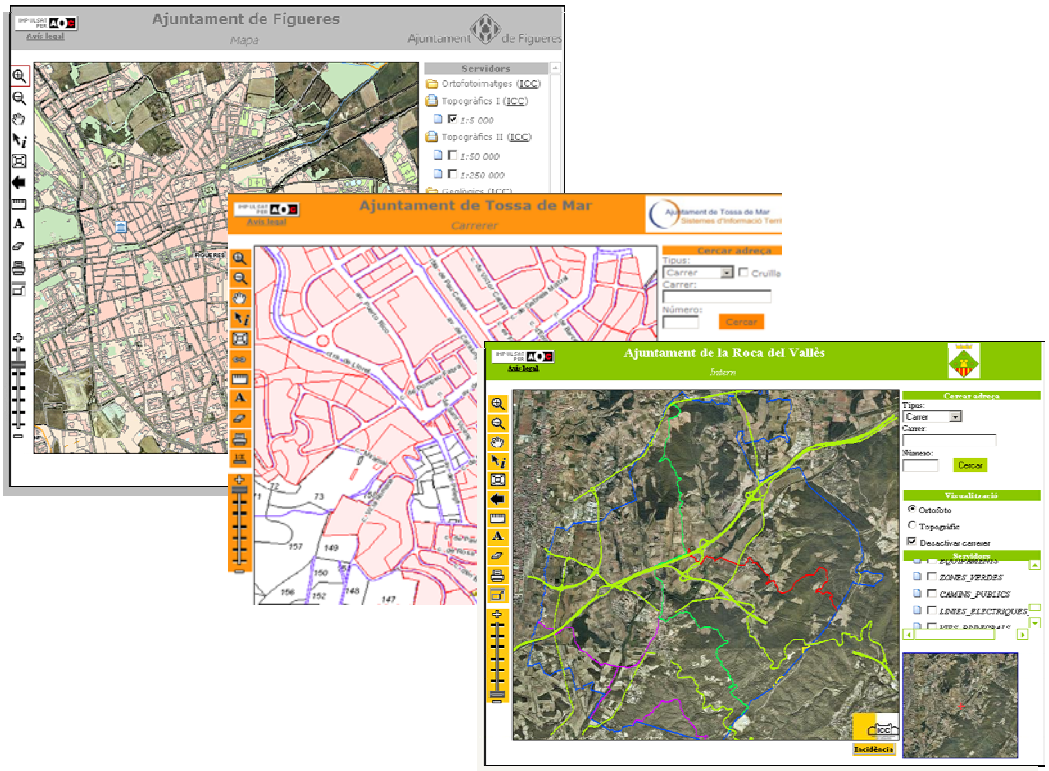


3.4 The municipal context of IDEC

From the onset of the Catalan SDI initiative, the approach adopted has been to maximise the creation of thematic SDIs geared to the specific needs of concrete domains such as coastal management, or the research and university sector (IDE.UNIVERS). Of particular importance to deliver the benefits of the IDEC is the project to engage local authorities fully in the Catalan SDI (IDE.LOCAL). IDE.LOCAL encourages local authorities to document their information resources with metadata, publish this information in catalogues and enable access and sharing through web services. This is supported by regional e-government funds that give incentives for the creation of metadata (30 € per metadata record), the publication of data in OGC-compliant services (€2,000 subsidy to each participating authority), and also support GIS projects closely related with the IDEC.

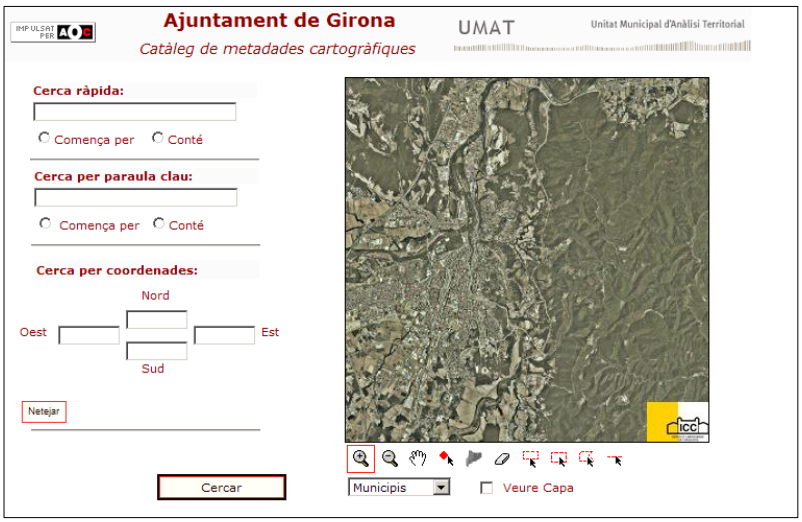
From its part, the IDEC Support Centre offers to local authorities several reusable and customisable components based on the resources of the IDEC platform to help them understand the benefits of a collaborative framework in which different providers share their data to provide *geo-knowledge* to public administrations and citizens. Among the applications developed for local authorities are customised map viewers enabling users to create mashups from the municipal web page (Figure 8), customised catalogues (Figure 9), and object editors (Figure 10).

Figure 8: Customised Viewers for Local Authorities



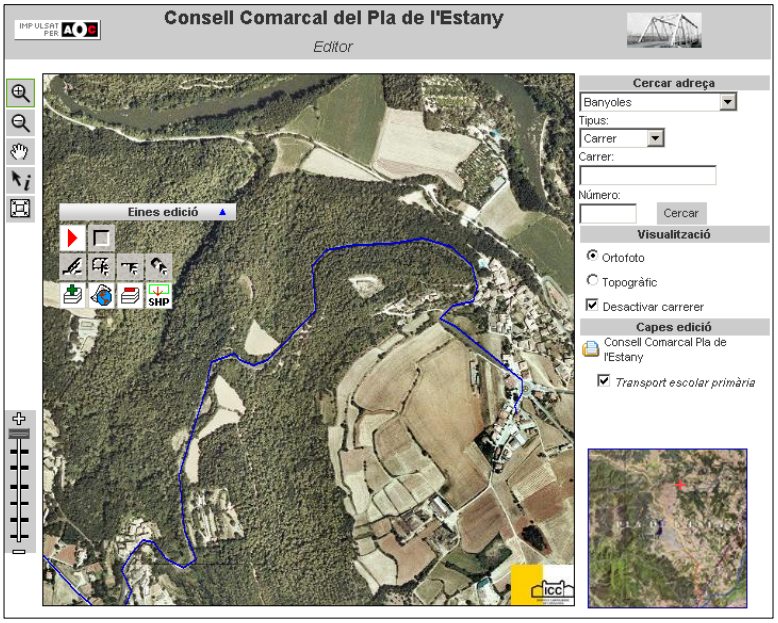
- A fully customisable component that operates through a form allows a user to select the WMS to be accessed and from the municipal web page, link to this viewer as a mashup.
- Another component is a street viewer, which can also be customised by every organisation. Additionally, a viewer can be configured with different layers of data for internal use only.

Figure 9: Customised Metadata Catalogue



The local authority can configure an interface to access the IDEC Catalogue, using a customised view providing exclusive access to metadata of the municipality. Alternatively, for those municipalities with little metadata, instructions have been issued to allow delivery of a list of municipal metadata from a request button on the municipal website.

Figure 10: Geospatial Object Editor



Employing only the browser, it enables access to the WMSClient. It uses elements including any kind of background cartography (*e.g.* orthophotomaps, topographic maps or street maps), edit points, lines and polygons of geographic features (including their attributes), links and images. These are saved in a dedicated WMS, or the IDEC WMS, or on a GIS desktop.

By the end of 2006, i.e. less than one year of operation, the IDE.LOCAL project had achieved the following results: f

- 80 local authorities were using the viewers integrated in their web pages;
- Online Municipal Street Maps were registering 15,000 monthly visitors;
- 20 local authorities were using publication tools and were publishing new layers;
- 25 municipalities had their WMS (4 to 6 layers) connected to the IDE.LOCAL network;
- 60 municipalities had published their geodata metadata in the Catalogue service (3,000 new records);
- New projects using WFS transaction technology were being planned.

Table 5: Number of access to the services

Application	October 2006	November 2006	December 2006	January 2007
Layers viewer	3,802	4,006	3,668	4,959
Street viewer	8,710	8,691	7,139	10,575
Internal viewer	86	65	25	99
Catalogue client	256	267	230	301
Object editor	150	162	160	159
WS Geocoder	10,973	10,969	9,596	13,173

Local authorities represent a very important user group because apart from internal purposes, they also use IDEC resources to offer new and improved information services to their citizens. Therefore, they are contributing to a wider use of IDEC resources and to extending the impact of these resources on society as discussed in Chapter 8.

4 The wider GI context in Catalonia

4.1 Overview

The Catalan GIS sector represents approximately 20% of the total activity of the Spanish GIS sector—a similar proportion to that of the industrial and services sectors. However, Catalan GIS companies are smaller than those which are headquartered in Madrid, mainly due to centralisation of the biggest contracts managed by Spanish public bodies (e.g. IGN, ministries, public utilities). Nonetheless, it should be noted that *use* of GIS is generally higher in Catalonia than in the rest of the country.

This section reviews the results of the three studies performed in 2006 and the first semester of 2007, to provide a context to understand IDEC. Firstly, the results of the GIS Sector study carried out by AESIG are summarised and evaluated. Secondly, some of the conclusions from the GI status study carried out by the University of Lovain (per request of the ICC) are

extracted and highlighted, primarily those related to theIDEC. Lastly, some initial conclusions are drawn from the on-going AESIG survey of end users (e.g. architects, geographers, environmental engineering companies, and real estate agents).

4.2 Study of the GIS/GI sector

In 2006, the Catalan division of AESIG (*AESIG-CAT*, in Catalan) began a study on the GIS sector in Catalonia (both public and private). Its objectives were:

- To quantify changes in the sector;
- To assess the job market for GI technicians and evaluate GIS education;
- To study market trends for products and technologies;
- To compare the current situation with that found in a study performed in 2002;
- To analyse the impact of new regulations on the sector, as well as new active elements (*e.g.* Google, Microsoft Live and SDIs).

The study was based on a survey distributed to 110 organisations, of which 45 responded. Of these, 58% said that they offer services, and 51% said that they were developing software. Of the participating entities, 67% came from the public sector, and 33%, from the private sector.

The key findings on the use of standards, usefulness of IDEC, and the level of knowledge about interoperability technologies are listed below.

- 70% of the organisations use geoservices from ICC, IDEC and the Cadastre;
- 18% of the organisations are interested in using them within one year.

Percentage of companies offering OGC compliant software products:

48% WMS
22% WFS
15% WFS-T, WCS
10% Catalogue CWS
5% Location Based Services

The business volume of the sector can be estimated based on the total sales for 2006 declared by the private and public organisations surveyed, which totals €41 million (€25 m. from the public sector plus €16 million from the private sector). Considering the proportion of public organisations and private companies surveyed to those that exist in the sector (there are approximately 35 companies dealing in GIS and/or cartography in Catalonia), the total business volume of the sector can be estimated by multiplying the values above by 1.5 for the public sector, and by 3 for the private sector respectively, to obtain a total value of roughly €80 million.

General conclusions of the Survey:

- There was a major increase in sales (+17% in 2006) in a favourable environment for the sector.
- Services provisions grew 110% from 2004 to 2006, primarily due to customised applications and services.

- The sector is maturing, as reflected in greater effort in marketing and commercial activities.
- Private companies have expanded their R&D programmes.
- There has been a major increase in the number of courses offered, number of students and researchers, and number of partnerships between academic organisations and private companies.
- Mobile tools, GPS and aerial and satellite orthophotomaps are being increasingly used.
- The GML format is just starting to be used.
- In contrast to their non-use or non-existence in 2004, WFS and WMS have since been adopted by 45% of the added-value services companies.
- Web technologies are experiencing clear and continuous growth.
- 66% of organisations use OGC standards when designing and developing applications.
- The sharing of data among public organisations remains very low.

4.3 The ICC study

The Cartographic Institute of Catalonia (ICC) is the most important GI organisation in the region, responsible for the production and maintenance of the topographic databases and for supporting the IDEC.

As indicted in Section 3.2, the legal framework for the IDEC is contained in the regional law on GI and the ICC (Law #16/2005; 27 December 2005). With this law, the Catalan Government aimed to exploit new opportunities and prepare stakeholders by stimulating and streamlining further GI products, the Catalan SDI, and its major organisational component, the ICC. The Law foresees creation of a Cartographic Plan to define the future strategy. To prepare the ground for this new strategy, the ICC commissioned a study to the Spatial Applications division of K.U. Leuven Research & Development (Vandenbroucke, 2007) to get an impartial and independent view on the current situation in Catalonia, and obtain the views of the GI stakeholders in the region.

A series of 45 interviews with 130 individuals from 70 organisations was carried out to obtain a broad perspective of the scenario and to provide the basis for the report which will be used as input for development of the Cartographic Plan. In addition to the interviews, two workshops were organised to mobilise the stakeholders and get feedback from them. The study tackles the Catalan GI sector from a global perspective, and addresses technical issues related to spatial data, metadata, services and applications, as well as institutional aspects (e.g. legal, financial and organisational).

The results of the interviews clearly indicate that the GI sector is very important in Catalonia, in terms of both economic impact and human resources employed. Its importance may even be greater than it appears as the effects of recent changes in policy at the ICC, which now makes the majority of its datasets available free of charge, are giving a boost to the wider use of GI. This boost is also compounded by the *Google Earth effect* which has contributed considerably to raising the awareness of GI in the region and beyond.

The study identified several areas in which the Catalan GI sector can be improved, and makes 42 recommendations. The most important of these relate to data and data-sharing among stakeholders; the use of metadata; increasing participation of the private sector; clarification of the official status of spatial data and the register of cartographic products; the

frequency of updating; integration of GIS and CAD systems; harmonisation of data models; missing data (e.g. important large-scale data, transport networks, thematic data) and the flexible integration of these data into the GI infrastructure; more advanced applications; network infrastructure performance; the amount and quality of GI training and education; and long-term funding. These recommendations will be taken into account for the future Cartographic Plan by the ICC.

4.4 AESIG end users survey

The AESIG End Users Survey is taken via the Association website and draws on the collaboration of professional organisations. The aim of the survey is to collect information on how online GIS applications for end-users are used (*e.g.* Google and IDEC); predict future trends; and determine the opinion of end users on services offered by IDEC (*e.g.* the Catalogue and the Client) or by other institutional providers, especially the ICC. The Survey is ongoing, hence the following conclusions are only based on the preliminary results:

- All of the participants are familiar with the major geoservices (e.g. ICC and Cadastre).
- 50% of the participants are satisfied with these services, whereas the remainder consider that the services are insufficient due to the fact that data are only available for viewing.
- 50% use direct WMS web access to ICC and Cadastre (*i.e.* without the IDEC Client), but 20% eventually use the IDEC Client.
- 66% consider that the Catalogue will be more useful in the future (one year or more) than it is now.
- The main benefits of using geoservices are reported as: being able to perform rapid queries in various subject areas (50%), obtaining graphical information that complements the applications (50%), and saving time (30%).
- The major drawbacks of the geoservices are reported as: lack of information (60%), and restrictions on downloading data (50%).
- The most popular requests are: rapid access to a list of what data is available (50%), and the ability to download data (50%).

4.5 Summary of Section I

Catalonia is a prosperous region with a high degree of autonomy. Its spatial data infrastructure was the first to be established in Spain, setting a model that other regions have followed since, and setting the base for a distributed approach to the national SDI. Throughout the region, the GI sector has expanded considerably over the last few years but particularly so since 2004-05 undergoing a 17% increase in economic volume and a 110% increase in billing for services in 2006 as indicated by the AESIG-CAT survey (Section 4.2). This growth has been supported by the policy adopted by the ICC in 2004 to allow free and open access to its basic cartography, the development of the IDEC initiative since 2002, but also the so-called *Google effect*, which has raised users' expectations and awareness of the value of GI across various sectors. In addition, the policy of the Spanish cadastre to make its reference data freely available on the internet through Web Map Services[4], has provided

[4] http://www.catastro.minhac.es/

users in the private and public sector with a foundation layer that is critical for many applications, particularly when combined with the topographic layers available from the ICC.

eGovenment funding by the Catalan government (*Generalitat*) has supported the development of the IDEC directly but also through almost €1.5 million made available to local government for GI projects linked to the development of the IDEC such as creation of metadata and geo services. This has raised awareness with public administration of the opportunities offered by GI to support the delivery and planning of services and has reduced the digital divide between large organisations and the small and medium-sized municipalities, who normally lack the financial and human resources to undertake GI technology projects.

As indicated in Chapter 3, the IDEC has gone from being an initiative or project to being a legally recognised and established entity, including a legally created support centre which is responsible for its maintenance and operations. It took two years to set up the initial operating capacity of the IDEC, and since 2004 it has expanded significantly its portfolio of services, reaching a mature base by 2006. The overall investment of €1.5 million over a five year period is relatively small compared to the annual GI turnover in Catalonia of some €80 millions as estimate by the AESIG/CAT survey. Most of this investment is in local human resources (over 76% on the launch period, and over 90% during operations). This is also a positive feature because it is investment in people and knowledge that remains in the region and supports the further development of the GI sector in Catalonia. As shown from the GI market studies in Chapter 4, most GI companies in the region are familiar with the IDEC and the interoperability technologies and protocols that underpin it. Indeed, many already use IDEC services, or are planning to equip their products with the standard connexions required to build a network of SDI map servers. In this respect a synergy is being achieved between public investment, and private sector initiative and innovation.

Notwithstanding the very significant progress made, there is still more to do to provide better and more updated information, broader use of metadata and better means to create them, integration of thematic cartography into the IDEC, and development of services and applications across the public administration, particularly at the local level.

This Section has provided the overall context for this study of the social and economic benefits of the IDEC, and detailed the direct costs incurred in setting up and maintaining this spatial data infrastructure. The next Section details the methodology deployed and the findings in relation to the benefits achieved.

SECTION II – USER SURVEY

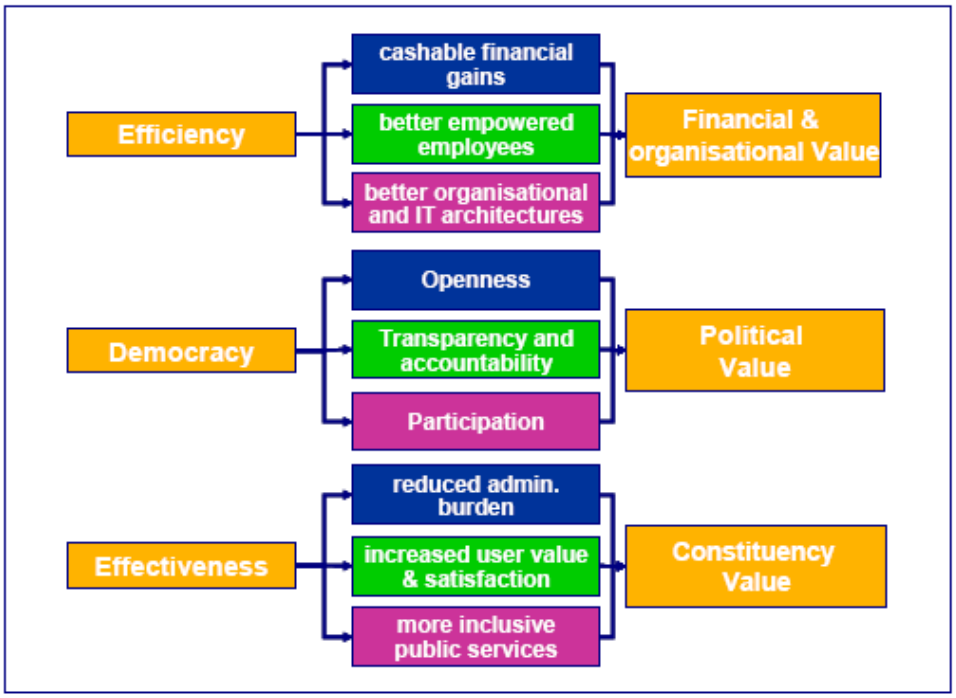
5 Methodology

5.1 Overview

To evaluate the benefits of the IDEC, this study focused on two main groups of users: institutional users and value-added private sector companies using the main IDEC services, and local authorities using the IDE.LOCAL applications.

The study utilised the methodological framework developed by the e-Government Economics Project (eGEP)[5], funded by the European Commission DG INFSO. The use of this framework was recommended as one of the possible ways forward after comparing the methodologies and findings of SDI-related studies in the workshop organised by the JRC in 2006 (Craglia and Nowak, 2006). What makes the eGEP framework interesting is that it is underpinned by a theoretical model of the expected benefits of e-government services, it attempts to capture both economic and social/political values, and puts forward a set of measurable indicators together with a methodology to undertake the measurements. The overall framework of impacts proposed by eGEP is shown below.

Figure 11: eGEP Measurement Framework Benefits



Source: Codagnone, Boccardelli and Leone, 2006, pg. 15

5 http://82.187.13.175/egep/asp/E_Home.asp

eGEP proposed some 90 indicators to measure the impacts of e-government based on a range of available data sources, including official statistics, administrative records, user surveys, and web crawlers. From this starting point, this study selected a range of indicators that would be relevant in the context of the IDEC, and then convened a meeting with a panel of local authorities and representatives of the user community to discuss the proposed methodology and indicators.

The feedback from the panel introduced some modifications to the indicators proposed and crucially indicated to the study team that it was necessary to collect the information needed through face to face interviews rather than surveys. This change to the methodology proposed by eGEP was necessary because the concept of an SDI is still rather fuzzy in the mind of local government officials. Therefore, relying on surveys directly filled by the users would run the risk of misinterpretation of many of the questions leading to results of unverified quality. Face-to face interviews make it possible to provide the necessary context to the respondent, and ensure higher quality of outcome. On the down side, they are more time consuming and therefore the number of users that can be reached within a given time and budget is reduced.

Having finalised the indicators (see Annex 2 and 3), the following methodological steps were undertaken:

- Separate questionnaires were prepared for the institutional users, the private sector, and local authorities.
- The questionnaires were piloted and modified as needed, and then the field work was conducted in the Spring of 2006.
- The results of the interviews were sent back to the interviewees for validation, and then compiled to produce an intermediate report.
- The results of the field work were analysed in respect to the three categories of potential benefits, and any negative effect or problem area reported during the interviews.
- The economic benefits were quantified.
- A workshop was organised to discuss the results with the Local Public Administrations and the End Users (private companies and institutional users).
- On the basis of the feedback received, this final report was prepared, including a discussion of the lessons learned in using the indicators proposed (Chapter 8).

5.2 Selection of the sample population

5.2.1. Local Public Administrations

The criteria for selecting the sample of local administrations were:

- Territorial distribution;
- Municipal population;
- Level of SDI resource usage.

Although Catalonia contains 946 municipalities, the total population of IDEC users at the time of the study was 101 municipalities. From these, 20 candidates were chosen based on the criteria above to represent the total population of users. In addition, three other local

authorities which are NOT users of the SDI resources were selected to compare their results with the rest. The list of authorities visited is included in Annex 4, while Table 6 gives the population distribution of the sample.

Table 6: Distribution of the sample population

Municipalities (Users)

	Sample			Included in IDEC.LOCAL			All Catalonia		
Pop. Ranges	Number	Total pop. group	% of total pop.	Number	Total pop. group	% of total pop.	Number	Total pop. group	% of total pop.
< 10.000	5	30,826	6.85%	65	186,324	17.61%	835	1,367,302	19.16%
10.001-20.000	5	70,300	15.64%	13	198,286	18.74%	51	715,701	10.03%
20.001-50.000	5	134,800	29.99%	9	242,960	22.96%	37	1,094,217	15.34%
50.001-100.000	1	93,508	20.81%	1	89,890	8.50%	13	885,437	12.41%
> 100.000	1	120,000	26.70%	2	340,576	32.19%	10	3,072,040	43.06%
Total	17	449,434	100.00%	90	1,058,036	100.00%	946	7,134,697	100.00%

Counties (Users)

	sample			Included in IDEC.LOCAL			All Catalonia		
Pop. Ranges	Number	Total pop. group	% of total pop.	Number	Total pop. group	% of total pop.	Number	Total pop. group	% of total pop.
< 10.000				1	9,796	0.65%	4	30,491	0.43%
10.001-20.000				2	25,363	1.69%	4	55,648	0.78%
20.001-50.000	1	29,000	3.05%	2	49,814	3.32%	12	349,775	4.90%
50.001-100.000	1	52,190	5.49%	2	118,167	7.87%	5	377,070	5.29%
> 100.000	1	870,000	91.46%	4	1,298,935	86.48%	16	6,321,713	88.61%
Total	3	951,190	100.00%	11	1,502,075	100.00%	41	7,134,697	100.00%

Municipalities (Non Users)

	Non users			All Catalonia		
Pop. Ranges	Number	Total pop. group	% of total pop.	Number	Total pop. group	% of total pop.
< 10.000				835	1,367,302	19.16%
10.001-20.000	1	12,805	13.51%	51	715,701	10.03%
20.001-50.000	1	23,374	24.64%	37	1,094,217	15.34%
50.001-100.000	1	58,663	61.85%	13	885,437	12.41%
> 100.000				10	3,072,040	43.06%
Total	3	94,842	100.00%	946	7,134,697	100.00%

The data in the table above indicate the following:

- There are 111 municipalities in Catalonia with more than 10,000 inhabitants. 25 of these (22.5%) participate in the IDE.LOCAL project and use some or all of its tools. The sample selected among the municipalities with population greater than 10,000 inhabitants (12) represents 48% of those participating in IDE.LOCAL.

- There are 845 municipalities in Catalonia with fewer than 10,000 inhabitants. 65 of these (7.8%) participate in the IDE.LOCAL project. The same proportion (7.7%) was used to select a sample of 5 local authorities to represent this group.

- Three municipalities that do not use IDEC services were studied for comparison, in terms of work styles and operations.

5.2.2. Other Users

Private companies

Twelve private companies were selected for the study out of the approximately 35 Catalan companies dealing in GIS or cartography. Annex 4 lists the companies interviewed which were selected to represent different sizes as shown in Table 7.

Table 7: Distribution of companies selected by number of employees.

Employees	Companies	Percentage
0 to 5	1	8.33
6 to 20	3	25.00
21 to 50	5	41.67
51 to 100	1	8.33
101 to 200	2	16.67
Total	**12**	**100.00**

Institutional End Users

Three large institutional users were selected to contribute to the assessment of the impacts of the IDEC.

- Palau Robert: This institution comprises the Catalonia Information Centre of the Generalitat of Catalonia. It aims to provide local citizens with information to know the region better. Among the services provided is the use of a visualiser to display over 700 themed routes in Catalonia. It has 80,000 visits daily.

- The Barcelona Port Authority: This institution is the managing body of the Barcelona Port. Its various responsibilities include management of Port cartography and GIS.

- The AOC Consortium: The Electronic Open Administrative Consortium of Catalonia is a public body formed for the implementation and use of new IT and communications technologies within the Catalan public administration. It uses IDEC resources to track its activities.

The following section reports the key findings of the surveys undertaken

6 Survey results in public administrations

6.1 Institutional and technological context

To provide context to the survey results it is important to notice that the 20 local authorities analysed vary considerably in size, human and technical capacities, structure, and IT context.

In terms of departmental structure, almost all of them have a department in charge of Planning and the Environment and 13 of 20 have a Cartography/GIS/IT department. Eleven of 20 have a department in charge of Economy/Treasury, while departments dealing with Tourism, Public Works, Public Transport, and Personal/Social services exist only in 4 or 5 of the authorities analysed. Clearly, the size of the municipality conditions the complexity of its organic structure. In many cases this structure and its complexity can help to explain some of the results achieved in the survey. Similarly, in terms of technology, only 13 of 20 have a "GIS" environment, which in most instances is in fact a CAD, while 7 do not have any of these technologies but plan to adopt in future. 10 of the 13 that have "GIS" have it through an external contract. The Planning and Environment Department is generally the greater user of these technologies.

Against this variable GI technologies context, all the authorities have web sites and use the Map Viewer provided by the IDE.LOCAL, 16 out of 20 use also the Street Viewer and half of the authorities use the Geospatial Object Editor. These figures already demonstrate how the availability of free to use web tools is important in local contexts that would otherwise have difficulty in adopting and using desk-top tools. Another important finding is that three quarters of the authorities interviewed declared that there was a positive institutional support for the adoption of new technologies in their administration.

6.2 Quantifiable Economic Benefit

Seventy percent of the local authorities interviewed reported savings in time through the use of IDE.LOCAL, and 60% a perceived reduction in costs. When it came to quantify these savings however, only a smaller number of local authorities were able to make an estimate. Table 8 summarises the time savings identified. As shown only between 30% and 45% of the local authorities surveyed were able to quantify such savings although twice as many declared that they were experiencing some.

Table 8: Economic benefits from the IDEC

	Average Monthly Hours	% of Organisations
Internal time savings		
in internal queries	141	45
in internal processes	62	45
in serving the public	81	30
Time saved by citizens	201	35
Time saved by companies	177	30

NOTE: Time saved by citizens and companies is measured by analysing the reduction in the number of requests for geographic information made by individuals in person to the local authority since making the same material available through web services or analysing the reduction in the time necessary to solve questions asked from individuals in the local offices.

The key element is time saved in responding to information requests related to land use planning, cadastre, building permissions, environmental issues, tourist information and so on. These requests are either internal to the organisation, or are coming from citizens and companies, and require an articulated information flow across more than one department to be answered.

Table 9 below provides an estimate of the number of such requests by size of population based on the information provided by the local authorities involved.

Table 9: Typical number of geographic information requests by population size

< 5,000 inhabit. = 25 requests/month

5,001 – 10,000 inhabit. = 50 requests / month

10,001 – 20,000 inhabit. = 100 requests / month

20,001 – 50,000 inhabit. = 250 requests /month

50,001 – 100,000 inhabit. = 500 requests /month

Given the large number of requests which are land-related or geographically tagged, even the saving of 1 hour to address a request can total significant savings when multiplied over the number of requests each month.

Because the complexity of the inter-departmental information flows needed to address a request varies considerably in local administrations, the survey addressed each main department in the local authority who uses geographic information. The Tables below report the findings by size of population served by the local administrations interviewed.

Table 10: Time savings in addressing internal requests

Ranges of population	Average hours / month	Num. of cases	Total hours / month
< 5.000	27	1	27
5.001 - 10.000	15	1	15
10.001 - 20.000	82	4	328
20.001 - 50.000	416	2	831
50.001 - 100.000	67	1	67
> 100.000	0	0	0
Total	141	9	1268

Table 11: Time savings through changes in internal procedures

Ranges of population	Average hours / month	Num. of cases	Total hours / month
< 5.000	38	1	38
5.001 - 10.000	75	2	150
10.001 - 20.000	24	3	72
20.001 - 50.000	100	1	100
50.001 - 100.000	99	2	197
> 100.000	0	0	0
Total	62	9	557

Table 12: Time savings in serving the public

Ranges of population	Average hours / month	Num. of cases	Total hours / month
< 5.000	48	1	48
5.001 - 10.000	0	0	0
10.001 - 20.000	107	2	213
20.001 - 50.000	83	2	165
50.001 - 100.000	63	1	63
> 100.000	0	0	0
Total	81	6	489

Table 13: Time saved by the public

Ranges of population	Average hours / month	Num. of cases	Total hours / month
< 5.000	0	0	0
5.001 - 10.000	165	1	165
10.001 - 20.000	243	5	1214
20.001 - 50.000	0	0	0
50.001 - 100.000	30	1	30
> 100.000	0	0	0
Total	201	7	1409

Table 14: Time saved by businesses

Ranges of population	Average hours / month	Num. of cases	Total hours / month
< 5.000	0	0	0
5.001 - 10.000	165	1	165
10.001 - 20.000	179	5	895
20.001 - 50.000	0	0	0
50.001 - 100.000	0	0	0
> 100.000	0	0	0
Total	177	6	1060

From the tables above, two main findings emerge:

1. Most of the savings are reported as benefitting citizens, followed by savings internal to the administrations to address inter-departmental requests. Savings to businesses are also significant.

2. Most of the savings take place among relatively small local administrations serving populations between 5,000 and 20,000 inhabitants. Smaller administrations are generally unable to quantify the savings made, while larger administrations do not generally experience any significant saving due to the IDE.LOCAL since they already have a stronger base of technologies and skills at their disposal.

The qualitative case-studies reported in the following section give a flavour of how the IDE.LOCAL can change processes and support the findings identified above.

6.3 Local Case-Studies

One of the more crucial spatial queries made by citizens relates to building plots, and permissible uses, i.e. is it possible to build on this parcel, what are the restrictions, what other uses are allowed on the plot and the immediate surroundings? These queries normally take two forms: a) the citizen is only interested in finding out what is possible; b) the citizen wants in addition a certificate from the local authority called “urban qualification” that says what kind of building is permissible.

This case study looked at this query as it is addressed in two different local authorities: Tossa de Mar, which is a user of the IDE.LOCAL, and Begues that is not.

Tossa de Mar
In this municipality, the citizen can check from home the municipal website, go to the planning section, look up the local plan in digital form, click on the parcel of interest, and obtain the information required on the urban zone and all related norms and regulations, thus being able to know what is possible to build.

If the citizen needs also an “urban qualification” document, then he can e-mail the technical office of the local authority giving the address and ID of the parcel obtained through the previous step.

In the technical office, the following happens:

a. After having received the request, the technical officer from the municipality locates the parcel on the map of municipality through the web application “street map” viewer;
b. Second, according to the location, the zoning map is reviewed to verify in which zone is the parcel, and what are the parameters allowed.
c. Third, the technical officer analyses any additional constraints that may affect the parcel by consulting other relevant information sources (municipal networks, proposed road plans and so on);
d. Fourth, the technical report called “urban qualification” is prepared with an extract of the map of the parcel, relevant zoning regulations, urban legislation of relevance and so on, and is validated;
e. Finally, the report is given to the Citizen Service Office and then transmitted to the citizen who had requested it. If the request was made by e-mail the report can also be sent by the same way.

Assembling the information necessary takes only a few hours, and the whole report, including validation from the authority, takes only a few days.

Begues

In Begues the process requires a personal visit to the local planning office. This needs in the first place an appointment to be made with the technical officer. This step alone could take about one hour, and the appointment fixed for a few days later.

When the municipality receives the request for an “urban qualification” report, it has to follow the same general process described for Tossa de Mar, except that all the information is in paper format, at different scales, filed in different locations, and compiling the report thus requires the best part of one month.

From these two case-studies, which are typical of what happens in many European countries, the added value of a spatial data infrastructure is immediately clear:

- Citizens have direct and simpler access to the information needed so this means greater transparency in the administrative processes and democracy accountability.
- The support of IDEC tools means for the municipality a very important saving of time both for internals searches of information and to attend to the citizens.
- The time and cost saved by citizens is also significant as they do not have to go in person to the municipality to obtain the information. It is here worth noting that in many instances, local offices might only be open to the public a few hours per week, requiring not only long delays in getting an appointment, but also the need for citizens to take time off work to attend to these queries.
- The availability through the municipal web site of maps, plans, and activities taking place in the town hall, makes it possible for citizens to be more informed about what goes on in their town, which is a fundamental base for increased participation in the democratic process.

6.4 Other key findings

6.4.1 Capital savings

These savings can be divided into savings in consumables and in IT investment. In respect to the former, 60% of the authorities indicated perceived savings in consumables, such as paper and ink in map production now that the maps are available on line. In some cases, they were very definite about the savings reporting for example:

> "Due to IDEC tools we are saving the 50% of material, we have grown in sustainability"

In many instances however they could not quantify such savings. A typical answer was:

> "It is impossible to calculate the saved material for some reasons, for example, the printer is used by a lot of people from other departments so we don't know how much ink we could save now that we don't print maps".

Overall, 25% of the authorities were unable to indicate if there were savings in consumables, and 15% indicated that there were no savings.

In respect to savings in IT, just over half of the authorities indicated that they had planned to invest in a web viewer for geospatial data prior to the introduction of the IDE.LOCAL project. As a result of this project, they were able to obtain the viewer at no cost, and thus save capital investment. Twelve authorities indicated that they would have been willing to invest up to €50,000 to have technology and applications equivalent to what was provided by the IDE.LOCAL, two that they would have been willing to spend more, and three would have invested less than €20,000. For all these authorities therefore, the IDE.LOCAL was a clear benefit.

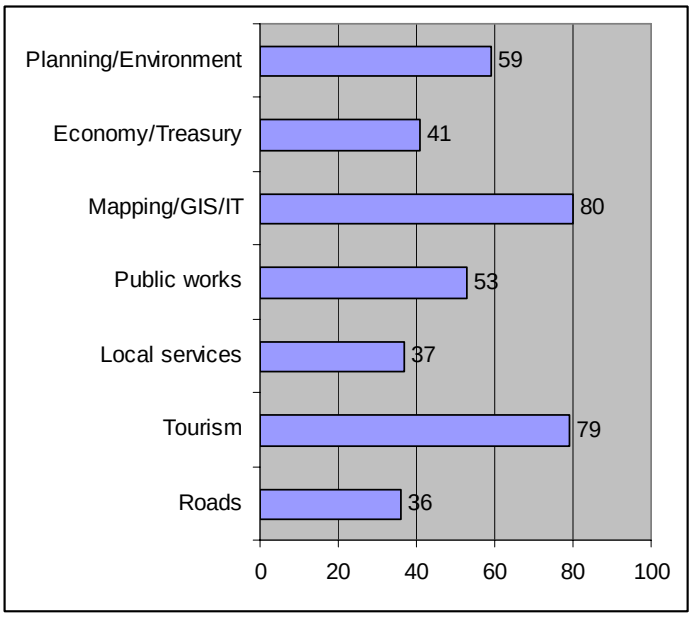
In respect to the costs borne by the authorities to implement the IDEC applications, i.e. number of hours necessary for configuration and set up, 13 authorities (65%) spent less than 5 hours for configuration, and 7 (35%) more than 5, and up to 20 hours. The average was just a little more than 8 hours, which at an hourly rate of €30[6] represents a fraction of the cost that the authorities were willing to pay to have similar levels of capabilities.

6.4.2 Departmental use of the IDEC

All the departments analysed were keen users of the tools made available through the IDEC and IDE.LOCAL, particularly in the Mapping/GIS department as expected, and Tourism, to respond to local queries by tourists as shown in Figure 12.

[6] The annual cost of a senior staff member is €50,000 (€38,000 salary plus €12,000 employer's contribution), as calculated for 11 working months per year at 147 hours per month.

Figure 12: Departmental use of IDEC tools (%)



6.4.3 Increased motivation by employees

The findings of this indicator were split. 40% indicated an increased motivation as a result of the new tools and ways of doing their work, 30% had a “medium” level of motivation, and 30% were not particularly interested, indicating that the process of diffusion and awareness raising within local authorities still has some way to go.

6.4.4 Introduction of new processes

The findings of this indicator were also split almost half way. 55% indicated no significant change or new process introduced, while 45% indicated that indeed the IDEC had made it possible to do things in new ways, particularly in the departments having direct contact with citizens.

6.4.5 Increased data sharing and improved decision-making

In respect to the contribution of the IDEC to increased data sharing across departments, 25% of the respondents indicated a very significant contribution, 40% some contribution, and the remaining 35% no contribution.

This finding is interesting in that it reflects the difficulty to introduce tools and processes in local contexts which are often quite reluctant to change, particularly when it comes to sharing information. The IDEC is clearly making a contribution, but the process is long.

Similarly, only a small group of 3 authorities indicated that they were already incorporating the IDEC into decision making processes related to land use and the environment. The vast

majority were not at that stage, and were mainly using the tools to retrieve information and to provide it to citizens.

6.4.6 Indicators of new interactive services and accesses

The majority (60%) had incorporated new geo-services in their web sites through the IDEC. These services also complement other forms of interaction with citizens and business, for example through e-mails, making it possible to provide a more efficient service to the community.

The more significant increases in data accesses of the geo-services made available by the municipalities, in particular the Map Viewer and Street Viewer, have taken place in the authorities serving populations of 10,000-20,000 inhabitants. In larger authorities, the change in number of accesses per 1000 inhabitants is not significant.

6.4.7 User satisfaction

Local authorities could not provide any measure of satisfaction from external users of the new web services they provide, except in a qualitative and anecdotal way as illustrated by the case studies in Section 6.3. In respect to the satisfaction levels of the internal users of the administration, 50% reported a high degree of satisfaction, 15% a medium level of satisfaction, and 35% were either not satisfied or would not be drawn to comment.

6.4.8 Analysis of local authorities not users of the IDE.LOCAL

The analysis of the three municipal governments interviewed that do not use IDEC tools revealed that, to date, these organisations already posses tools similar to those offered by IDEC, and hence do not consider implementation of IDEC to be necessary. For them, the benefits obtained through these tools are identical to those offered by IDEC tools. An analogous comparison was not performed for those municipalities that do not use any resources of this type because it is very difficult to compare the procedures of so different organisations. Nevertheless, the qualitative case study reported in Section 6.3 gave a sense of the major benefits.

6.4.9 Problems identified

No problems caused by the use of IDEC resources were detected at any of the Local Public Administrations, nor was there any observed reticence to the sharing of information. Nonetheless, there are issues which, in certain cases, can retard the development of IDEC or the integration of entities into IDEC. These were either observed directly or communicated by the interviewees, and are outlined below.

i) Metadata

This is a critical issue for nearly all of the entities studied. The Users expect that other entities will produce metadata, and recognise its importance, but they have difficulties in inventorying available information and, above all, in using the complex and extensive ISO format to do so. Even some of those that have received a subsidy from IDE.LOCAL for this task have difficulty in performing this work. This is down to many reasons, not least of which is the fact that the costs implied (*i.e.* training, etc.) in creating twelve to twenty metadata

records is excessive. One implication is that maybe the IDEC Support Centre should consider expanding the help it offers to small data providers for the creation of metadata, and taking on this task itself.

ii) Lack of human resources
When it comes to an organisation's use of IDEC resources and its participation in regional SDI programmes, the will, enthusiasm and dedication of its personnel—even of just one individual—strongly influences the results that it obtains. There were general complaints of a lack of human resources in IT departments, which normally encompass GIS in the case of those organisations that use it. This shortage limits the efficacy of initiatives to encourage participation in IDE.LOCAL, since the organisation spends all of its available resources on routine daily operations.

iii) Unmotivated personnel
There were some cases in which the main problem was the passivity of staff. This is not the result of a lack of personnel, but rather to a particular mindset and work style of certain civil servants whose initiative operates solely in function of the objectives that their superiors establish for them. These individuals do not take on any complementary tasks, which would imply more work without additional compensation. Nevertheless, this was not observed frequently.

iv) Huge gaps among municipalities
The size of a municipality is not a determinant factor in the extent to which it uses IT or GIS. Large municipalities may spend relatively little on these areas, whereas small ones may earmark greater resources or express greater interest in IT or GIS and thus obtain better results than the former. Indeed, the most important factors for a given organisation are its strategic plans, its culture, the coherency of its plans, and, above all, the interest demonstrated by its leaders, rather than the power that they possess. Every municipality is a world unto its own; hence, it is difficult to generalise or to predict results. As such, individualised solutions are required to motivate, and offer incentives to different municipalities since general proposals would not be very effective once a determinant number of positive responses was obtained.

v) Personnel confused by initiatives that appear similar to IDEC
Certain employees of the interviewed city halls appeared to be confused by initiatives which, at first glance, resemble IDEC. This stems from the fact that not everyone can tell the difference between a simple cartography visualiser from a local server, a geobrowser like Google Earth, and an SDI, leading to the perception that there is an excess of similar resources.

6.5 Summary of findings in local administrations

The overall finding of this survey is that at the present stage of development, the main contribution of the IDEC is to increase the efficiency of service, and improve transparency of administrative processes, particularly in the small-medium sized municipalities. The more significant benefits occur as time savings by citizens and companies, and as internal queries to look for information. The majority of local authorities reported savings in these three areas, although less than half of the authorities were able to quantify them. The economic quantification of these savings is reported in Chapter 8.

There are some capital savings both in terms of consumables, which are difficult to quantify, and in terms of foregone expenditure expressed as “willingness to pay” for the same level of capabilities provided by the IDEC.

Within the administrations, the IDEC tools are well used across multiple departments, and this has lead to new procedures and services in slightly less than half of the cases. Although the IDEC appears therefore to contribute to some process redesign and increased data sharing, the results of the survey also indicate that the process of diffusion, and awareness raising takes time to overcome resistance to change in established procedures. This can also be seen for the perceived motivation of the employees. Whilst 40% are highly motivated, and 50% indicate a high level of satisfaction with the new tools deployed, which very good news, more time and effort is needed to affect also the remaining staff, bearing in mind that the IDE.LOCAL project had only been in operation for just over 1 year at the time of the survey.

This time dimension is very important to contextualise the findings. Considering the short time since deployment, it is remarkable how swiftly most local authorities have used the opportunity provided by the IDE.LOCAL to add new services to their web sites, and achieve significant results. The results of the survey indicate that there is no significant correlation between the organisational complexity or technological advancement of the administrations analysed and the extent to which they use IDEC tools. Instead, the results obtained by these organisations seem to be related to the presence and enthusiasm of a few key individuals, able to exploit the opportunities offered by the IDEC. Nevertheless, additional support may be needed to support local authorities and their key staff so that greater awareness is raised and the benefits are more widely spread.

Looking at the benefits outside the local administrations, it is also important to note that facilitating the use, reuse and sharing of resources within an SDI helps to close the digital gap between small and large municipalities, which is a major social benefit. Thanks to the availability of IDEC resources, many small municipalities—whether directly or with the help of supra-municipal authorities—are now able to offer to their residents services that were only recently unimaginable. This provides the basis for greater transparency, more informed citizens, and increased participation in the democratic process. These benefits may not be quantifiable in economic terms but are socially and politically very important.

7 Summary of findings for other end users

7.1 Private companies

The survey of the 12 private companies operating in Catalonia in the GI sector (Annex 4) focused on their use of the IDEC and of the geo-services it offers, among which the ones utilised by most companies (84%) are the following:

- Ortho: Offers access to the orthoimages without toponomy of the Cartographic Institute of Catalonia, providing single images without any subdivisions into layers;
- Topo: Provides the ICC topographic base in raster format base. It covers the subject areas of cultivated land, communications, hydrography, population, toponomy and vegetation, each of which is subdivided into layers;

The key findings of the interviews are reported below.

The size of the company is a key to the extent to which it uses and values IDEC Geoservices. The largest companies use the Geoservices to obtain added value in their projects, rather than as a basis for the projects. In contrast, the smaller the company, the greater the extent to which it uses IDEC Geoservices. For companies of less than five employees, the Geoservices are fundamental.

For half of the cases, use of IDEC Geoservices translated in increased sales volume, which ranged from 5% to 20%, and in reductions in programming time. Nonetheless, these companies did not see any major change in profits directly linked to the IDEC, as they offered the services as added value at no extra cost.

The technological impact of IDEC Geoservices on the companies interviewed has been highly favourable; three quarters of the companies indicated that the architecture governed by OGC standards incorporated in the Geoservices has enabled projects which are more complete and better structured. Although this technological advancement requires that the companies, in varying levels, spend more on employee training, the relatively small investment needed (on average 28 hours per employee per year) will guarantee future rewards.

The impact of the Geoservices on marketing is positive. Almost 60% of the companies reported increased demand for IDEC services or projects incorporating such services, and predicted increases in sales for 2008 to 2010 range between 20% and 30%

In respect to problems, the two more frequently mentioned were:

- Problems with the updating and maintenance of data from IDEC Geoservices. Indeed, this was indicated by 30% of the studied population, who requested that the available information be updated more frequently.

- Problems with data access as Web Map Services only allow visualisation of data and use as backdrop for other data.

7.2 Institutional Users

Three large institutional users (see 5.2.2) were interviewed to identify any additional perspective and feedback. The key findings are:

The use of IDEC Geoservices has enabled these institutional users to take on projects that were previously too expensive to be feasible.

Savings were difficult to quantify but there was a consensus that the use of the Geoservices had lead to a reduction in data updating time estimated at 70% on average. Views on any reduction on project management time were divided.

The quality of the projects undertaken has improved as a result of using IDEC Geoservices. Two users identified this as High, and one as Medium.

Some concerns were expressed on the availability of data and inability to modify data layers accessed through the IDEC to suit project requirements. Nevertheless, the was a clear view that development of the IDEC had raised awareness within their organisations of the value of a geographic perspective, resulting in increased number of project requests, and use of GI technologies in their institution. One organisation went as far as suggest that the use of IDEC Geoservices should be made mandatory in the Catalan public administration.

SECTION III – ANALYSIS AND CONCLUSIONS

8 The socio-economic impact of the IDEC

8.1 Economic impact

This Chapter brings together the direct costs of the IDEC reported in Chapter 3.3, with the benefits identified in the local authorities survey and reported in Chapter 6. The survey of private companies and institutional users (Chapter 7) did not provide sufficient quantitative evidence to be included, largely due to issues related to commercial confidentiality. This however, dos not represent a major problem for the analysis of the economic impact of the IDEC. At most, it means that the benefits analysed are only partial and therefore underestimated, since neither companies nor institutional users reported significant additional costs due to the use of the IDEC but only benefits of varying degree.

The method used to monetize the benefits identified in public administrations, which were largely in the form of time savings, is as follows:

- The total number of estimated hours saved as reported from the authorities that had been able to quantify them was divided by all the authorities in the sample (20) stratified by population served.

- In this way a saving per authority was calculated and then multiplied across all 101 authorities participating in the IDE.LOCAL project from which the sample of 20 had been selected.

- The total number of hours saved was then multiplied by the rate of €30 per hour which represents the current rate of senior technical staff (see footnote 6 page 35) to monetize the benefits accrued.

Following the methodology described in Chapter 5, once this economic evaluation was completed, the results were presented at a special meeting to all the Local Public Administrations that had participated in the survey, and were validated by them.

As indicated in Chapter 6.2 five different types of savings were identified:

1. Time saved in internal queries executed by civil servants
2. Time saved in internal processes
3. Time saved in serving the public
4. Time saved by citizens
5. Time saved by companies

Table 15 calculates the total monthly time savings (in hours) by class of local authority.

Table 15: Total monthly time savings (in hours) by class of local authority.

		Internal Time Saved			External Time Saved	
Population	Tot. author in sample	Internal Queries	Internal Process	Serving Public	by Public	by Business
< 10,000	5	42	188	48	165	165
10,001 - 20,000	5	328	72	213	1214	895
20,001 - 50,000	6	831	100	165	0	0
50,001 - 100,000	2	67	197	63	30	0
> 100.000	2	0	0	0	0	0
Total	20					

From the table above, the average saving for each authority and population range is calculated, dividing the total hours for each group by the number of authorities in each class of the sample (second column).

Table 16: Average savings (hours) by public authority and population class

		Internal Time Saved			External Time Saved	
Population	Tot. author in sample	Internal Queries	Internal Process	Serving Public	by Public	by Business
< 10,000	5	8	38	10	33	33
10,001 - 20,000	5	66	14	43	243	179
20,001 - 50,000	6	139	17	28	0	0
50,001 - 100,000	2	33	99	31	15	0
> 100.000	2	0	0	0	0	0
Total	20					

Table 17 aggregates the internal and external savings per authority as hours/month, and calculates the monetary values of such savings by multiplying the savings accrued by the total number of authorities participating in the IDE.LOCAL and by €30 per hour. The yearly savings multiply the monthly savings by 11 working months.

As the Table shows the total internal savings to local authorities exceed €2.6 millions. If also the external savings are included (assuming for convenience the same hourly rate), then the savings would exceed €6 millions per year (based on 2006 reported values). The last column to the right in Table 17 averages the estimated internal savings by local authority.

Table 17: Total Savings of Local Administrations and using IDEC

Population	Tot. author in IDE.LOCAL	Int. Savings hours/month per authority	Ext.Savings hours/month per authority	Int. Savings €/year total	Tot. Savings €/year total	Int. Savings €/year per authority
< 10,000	66	56	66	1219680	2657160	18480
10,001 - 20,000	15	123	422	608850	2697750	40590
20,001 - 50,000	11	183	0	664290	664290	60390
50,001 - 100,000	3	163	15	161370	176220	53790
> 100.000	6	0	0	0	0	0
Total	101	525	503	2654190	6195420	

Having monetized the benefits accrued in 2006, it is possible now to assess the overall relation between direct set up and operations costs of the IDEC and the benefits accrued,

bearing in mind that these refer only to those at the local level, and not to any other benefit taking place in the public or private sector as a result of the IDEC.

As indicated in Table 4 (Chapter 3.3), the set up costs of the IDEC during 2002-03 (Launch Period) were: €650,000.

In the survey of local authorities, the average cost per authority to configure their services and incorporate the IDEC ones was of the order of €250 (8 hours on average), which across all 101 participating authorities gives a rounded figure of €25,000 as a one off expenditure.

Therefore the total set up costs can be estimated as being €685,000.

The operating costs, again from Table 4 are €283,000 per annum. Therefore over the 2004-05 period, they amount to €556,000.

On the benefit side, and only considering the internal benefits to local administrations in 2006, the net benefit is given by total benefit 2006 (Table 17) – operating cost for 2006.

Net benefit 2006 = €2,654,000 - € 283,000 = € 2,371,000

Table 18 below summarises the total costs and benefits accrued.

Table 18: Summary of Costs and Benefits IDEC

	Costs	Benefits
Set-up costs 2002-03	650,000	
Local costs	25,000	
Operating costs 2004-05	556,000	
Total costs	1,231,000	
Net benefits 2006		2,371,000

This means that the total investment for the IDEC (and not just for the IDE.LOCAL that represent only some 40% of the operations) over the period 2002-05 has been **recovered in just over 6 months**, considering only the benefit internal to local administrations, and only for 2006. Therefore any benefit that may have accrued in other users of the IDEC has not been considered, nor any additional benefit that may have accrued during 2004-05.

As shown in Table 17, if external benefits to businesses and citizens were considered, the overall benefit would almost double. Therefore, this is a very conservative estimate of the economic impact of the IDEC, taking into consideration all the (direct) costs of setting up and maintaining the SDI (not the costs of data production) but only a portion of the benefits and only for 1 year.

As the IDEC develops further and extends its user base, the benefits will continue to accrue at minimal operating costs.

8.2 Political and social impact

This Section outlines the areas in which IDEC has the clearest social and political impact. These are based primarily on the answers to the qualitative indicator questions, as well as on observations and commentaries made during the study. These impact areas are more apparent in the case of the local public administrations while the analysis for companies and institutional users did not reveal any clear trend.

The socio-political impact areas of IDEC, in line with the objectives of the INSPIRE programme, affect a broad array of users, especially those linked to the public sector and to serving the general public (*e.g.* public administration, public services, and universities), such that the entire community benefits from access to information and spatial data. Nevertheless, this is an ongoing process that demands a change in mentality towards a culture of shared data, in which the contributions of each party enrich the whole and can be shared by all. Freeing this information will ultimately enable everyone to prosper from general social and economic development.

Catalonia is beginning to make progress in this area: thanks to the ICC, it has opened up a large portion of its cartographic database and has passed laws which name IDEC as an official source of information. This could be considered an initial area of socio-political impact, since the availability of this information facilitates transparency, improves democratic actions, enables citizens to participate, and expands knowledge and training.

One of the major social effects observed in the study is that it mostly in the smaller municipalities between 10,000 and 20,000 inhabitants that the IDEC tools have contributed in reducing the digital divide, the effects of which are felt most acutely in rural areas and small towns. These municipalities can now provide easily a range of services that would have been unimaginable until recently given the financial and technical resources at their disposal. In this respect it is worth noting how the local authority with population greater than 100,000 did not report any significant savings from the use of the IDEC as the range of systems they have in place already provides a wide range of services, so that the addition of the IDEC ones is more difficult to single out as making a difference.

The importance of increase transparency, access to information and opportunity to participate in decisions that affect the local communities is likely to increase in the coming years as the *Generalitat* has introduced important changes in territorial policies that affect land use and housing, mobility infrastructures, architecture and landscape and urban regeneration. These include:

- Catalonia Law on Urbanism (reference: DL 1/2005, 26 July) and its Enactment (Decree 305/2006, 18 July)
- Land Law 8/2007 of 28 May (BOE 29 May 2007) outlines basic principles to protect the environment, impede speculation and protect the right to dignified and adequate housing. It includes a new regulation dealing with the reservation of land for government-subsidised housing.
- Legislative decree 1/2007, of 16 October, comprises urgent measures for urban action; It modifies the Catalonia Law on Urbanism by incorporating the stipulations of the Land Law.
- The National Housing Agreement for 2007-2016 was signed on 8 October 2007 by representative social bodies to ensure that residents received the housing they need in the form they need it (*i.e.* renting or buying).

The application of these new land policy, mobility, landscape, information, urban rehabilitation and territorial information, requires a shared work by local authorities, *Generalitat*, and new partnership organisations to make effective interventions on all these matters.

The Infrastructure of Spatial Data of Catalonia has an important role to play in this new context to support the relation and communication among the different actors involved in the territorial environment, and to underpin the shared intervention of the public authorities and partnerships. By increasing access and use of geographic information the IDEC makes government action more transparent and accountable, and thus reinforces the democratic process. In short, it supports the construction of a territory that will be more efficient and adjusted to social and environmental requirements.

8.3 Conclusions

This report has presented the key findings of the study on the social end economic impact of the spatial data infrastructure of Catalonia, the IDEC. The study was commissioned by the European Commission Joint Research Centre and performed by the Universitat Politècnica de Catalonia in 2007. The key findings of the study are:

1. It has taken four years since the launch of IDEC to determine the concrete results obtained by the application of its resources. From the third year onwards—at which point IDEC is considered to have entered its operative phase—its resources have been exploited for a wide range of uses, as reflected in the statistics on its Geoportal. However, the details of such uses are unknown and hence, cannot be measured. It was in 2006 that an array of applications and services could truly be observed among business, local public administration, and institutional levels. Significant activities in this period included the creation of services for visualisation of geoinformation for local authorities and for public bodies, as well as services based on existing IDEC resources.

2. The changes which IDEC underwent during the period analysed—especially in 2006—occurred against a backdrop of a growing GIS sector. This period was characterised by policies on free access to reference geodata, which certainly accelerated the growth and use of IDEC resources. The *Google effect* and the *cadastre effect* have largely contributed to a better and faster development of IDEC and the use of its resources.

3. A conservative estimate of the economic impact of the IDEC is that the total investment over 2002-05 has been paid back in less than 6 months based on the benefits identified for 2006 alone. The results of the economic study reveal therefore that investments in and expenditure on the development of IDEC are high yielding, despite the fact that the number of current users is relatively small compared to the potential user population. As the user population particularly in local government expands, so will the benefits.

4. The investments and expenses related to the launch and subsequent maintenance of IDEC represent a mere fraction (less than 0.5%) of the total economic volume of operations in the GIS sector.

5. IDE.LOCAL tools (viewers, editors, etc.) are the first material and concrete application of IDEC resources. IDE.LOCAL represents a turning point in the development of the IDEC and has enabled determination and measurement of specific uses of SDI resources. It boosts the utility of the IDEC by bringing local entities and citizens closer together. The web services offered by local entities (*e.g.* map viewers and street maps) to the citizens are highly appreciated and used.

6. Evaluating the socio-political impact of the IDEC is much more difficult than evaluating its economic impact, as the former involves contradictory data—which remain difficult to obtain—as well as the opinions and expectations of the other users of IDEC services. The fact that only a short amount of time has passed since the release of services based on IDEC resources means that collection of the data required for a full analysis—as defined in the theoretical framework—is either difficult or impossible.

7. Among the most important of the socio-political implications is that implementation of IDEC services at local entities in rural zones has helped reduce the digital divide between these often small municipalities and much larger ones. Also noteworthy are the effects that some of these services have had on interactions between administrations and citizens. On a negative note, these services have not yet had any influence on intra-actions (*i.e.* internal coordination within entities).

8. The new political framework in Catalan territorial planning includes an important role for local public administrations and other public bodies responsible for urban development. The availability of territorial information; corporate transparency; intercommunication among different players; democratisation; and public participation are among the values demanded of the new policies and provided by IDEC.

9. In the future, once the potential of IDEC has truly been realised (i.e. expanding to more municipalities, providing more and better information) it will be of notable importance to the distribution of territorial knowledge. This is critical for effective communication between the public (e.g. social organisations, professionals and public agents) and local institutions. This dialogue will provide citizens with a new role in territorial politics, making it more transparent, more participative and better suited to the needs of society.

10. Many public organisations are now interested in publishing their geodata and making it available through the IDEC network. Also, some private companies have expressed their interest in being listed in the IDEC metadata Catalogue server, and in providing access to some layers as well, since this could be a good way for them to advertise their products and services. These facts suggest that IDEC will play an important role in the future in education and training and the development of a geographically more conscious culture.

8.4 Final comments and lessons learned

1. The Survey Participants identified two issues which make it more difficult to assess the implications of recently applied SDI: a lack of experience in the field, and an absence of references. This analysis is further complicated by the fact that only a short period of time has passed since IDEC was launched. Despite these limitations, interesting results were still obtained. Thus, the study should prove an excellent baseline for future monitoring of IDEC. The activities carried out in the preliminary and preparatory phases were the most difficult because they required definition of and debate on what needed to be done and how to do it. Subsequent activities, though not free of difficulties, were not as complicated.

There is a general consensus that IDEC is still in the initial phases of its implementation and operation, and that people are just starting to become aware of it (IDE.LOCAL only started at the beginning of 2006). Therefore, if the Survey and the Study are performed again in a few years, the results obtained would probably be different and much more positive than those described here. Indeed, just in the months in which the Study was carried out, there have been several changes: the number of users of IDEC resources in local public administrations has gone from 100 to 150; users have expressed greater interest in asking for more and better services; there has been greater direct participation in divulgation of geoinformation by WMS, etc. Hence, the results at hand do not reflect a consolidated state, but rather an initial state which offers the opportunity to benchmark the future developments.

2. Considering the commentary above, an analysis of how IDEC has changed over time—using the results from the present study as baseline values—will prove interesting. The relative values derived from comparing a future period with the current situation would probably be more meaningful than the absolute values described in the present report.

3. Given the difficulty of interpreting accurately the results of the Survey, it is critical that the field work be performed directly at a personal level. This ensures that the interviewer can correctly explain the questions to the interviewee, and thereby obtain the desired information, as well as enabling the interviewer to gather opinions that would otherwise remain unknown.

4. Since a scientifically robust study is not yet possible, having consensus on the results of this study, in terms of both the intermediate information as well as the final conclusions, is essential for legitimatising this type of work. This was achieved through the workshops organised with all the participants and their feedback. It also helps the Survey participants (who are IDEC users) reflect on the results and increase their motivation.

5. In most cases, determining the real impact of IDEC resources requires asking the user. However, for external users such as citizens, regional initiatives, residents' associations, and companies, this can be very difficult or requiring dedicated surveys. One possible solution could be to add to the web pages offering the services analysed a short online questionnaire to be completed by the users.

6. For a number of indicators, either data could not be obtained or was severely incomplete, preventing their use in the Study or their analysis with sufficient statistical meaning. For example indicators 2, 3, 12, 15 and 16 (se Annex 2) were originally meant to be quantitative. However, it became clear during the survey that at the current state of development very few local authorities were able to make a quantitative assessment, and it was necessary

therefore to use more qualitative statements. Similarly, indicator 20: “Complaints, queries, suggestions, errors, etc. transmitted electronically”, which was meant to be measurable in number of interactions per month, was too premature, and could not be assessed at the present stage.

Hence, in the future, it might be better to decrease the number of indicators, minimising those which are known beforehand to be difficult, which include questions related to external users (e.g. level of satisfaction, usage) of the organisations surveyed, cultural changes within the organisation or other non-material features.

7. The study must be highly focused: the surveys should concentrate on specific known applications (*i.e.* services) and be performed directly by the interviewer. Otherwise, determining the impact of any SDI is nearly impossible.

8. The Survey, taken through direct personal contact did not allow the interviewees for any initial reflection on the questions asked or any time to prepare the quantitative data requested (e.g. savings in time or disposable materials). Perhaps it would have been beneficial to have included a pre-Survey period in order to provide the interviewees with time to prepare their answers, whether qualitative or, even more importantly, quantitative. This may have increased the ability to respond to some of the questions, although one also needs to be aware of potential pitfalls in pre-prepared answers, which need always to be verified.

9. Another way to evaluate better the socio-political impact of IDEC would be to have all members complete a very brief questionnaire upon entering the IDEC website. This would provide specific data on the user, including a broad overview of its objectives. Subsequently, upon closing the session, an interactive window for comments (e.g. level of satisfaction, requests and problems) would automatically appear on screen. This should be programmed such that the statistics are automatically collected for periodic analysis.

10 Future studies should include measures to provide clearer definitions of user profiles and impact types, and should enable a component-based analysis of social and political impact areas in relation to specific groups. By subdividing each of the groups analysed might provide a more accurate representation of the impact areas.

References

AESIG (2007): “Estudi del sector TIG a Catalonia (Study of the GI Sector in Catalonia). Published by the Catalan division of AESIG, Barcelona. http://www.aesig.org/cat/enquesta/enquesta.htm

Codagnone C., Boccardelli P. and M.I. Leone. (2006). *eGovernment Economics Project: Measurement Framework Final Version*. eGovernment Unit, DG Information Society, European Commission. http://217.59.60.50/eGEP/Static/Contents/final/D.2.4_Measurement_Framework_final_version.pdf

Craglia M and J. Nowak (2006): “*Assessing the Impacts of Spatial Data Infrastructures - Report of the International Workshop on the Cost to Benefit and Return on Investment Ratios of SDIs”***.** 2006, Ispra, Italy. http://www.ec-gis.org/sdi/ws/costbenefit2006/reports/report_sdi_crossbenefit%20.pdf

IDEC (2007): “2006 IDEC Annual Report”. Barcelona.

Pettit P. (1999): “Republicanismo. Una teoría de la libertad y el gobierno”. Ed. Paidos, Barcelona.

Pratt, J.W. y Zeckhauser, R.J. (1991): “Principals and agents: the structure of business”. Harvard Business School Press.

Vandenbroucke D. 2007, ”The Geographical Information sector in Catalonia: Strategic Study to support the Cartographic Plan of Catalonia” . ICC, Barcelona. Spatial Applications division, K.U. Leuven Research & Development http://www.cccartografica.cat/web/c4content/doc/extracte_estudi_sector_info_geografica_cat.pdf (in catalan)

Acronyms

AESIG	Spanish Association of Geographic Information Systems
CPSV	Centre of Land Policy and Valuations
CI	Cartographic Information
FTP	File Transfer Protocol
GI	Geographic Information
GIS	Geographic Information System(s)
GML	Geography Markup Language
GPS	Global Positioning System
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
ICC	Catalan Institute of Cartography
IDEC	Catalan Spatial Data Infrastructure
INSPIRE	Infrastructure for Spatial Information in Europe
JRC	Joint Research Centre
OGC	Open Geospatial Consortium
PHP	Server-side HTML embedded
SDI	Spatial Data Infrastructure
SMTP	Simple Mail Transfer Protocol
SOAP	Simple Object Access Protocol
SPSS	Statistical Product and Service Solutions
UDDI	Universal Description Discovery and Integration
UTM	Universal Transverse Mercator
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
WSC	Web Service Client
WSDL	Web Services Description Language
WSS	Web Service Server
XML	eXtensible Markup Language

Project team
This study was carried out by the Centre of Land Policy and Valuations (*CPSV).* Founded in 1986, CPSV is formally recognised as a 'specific research centre' of the Universitat Politècnica de Catalonia (UPC). It draws together researchers from a number of the University's departments who are interested in planning, Geographic Information Systems (GIS), urban and environmental land management, and urban economics and valuation. In 1997, the CPSV promoted the formation of a 'multi-disciplinary' research group in the field of *environmental quality of urban life* within the context of a sustainable city, under the auspices of the Research Commission of the Catalonian regional government (the *Generalitat*).

The following CPSV members directly participated in this project:

- Dr. Pilar Garcia Almirall, PhD in architecture, Vice-Director, CPSV
- Montserrat Moix Bergadà, IT Engineer, CPSV
- Joaquim Garcia Strino, Geographer, CPSV
- Pau Queraltó Ros, Geographer, CPSV

Acknowledgements
This study demanded exhaustive research, drawing on experts from various fields. We would like to thank all of them for their frequent contributions, without which this project could have never been realised, especially to Dr. Jordi Guimet, Director Centre of Support IDEC.

Social research experts:
Anna Alabart Vilà, full professor, Universitat de Barcelona, and head of the Research, Territory, Population and Citizens Group

Economics research experts:
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Annex 1: IDEC Legal Framework (Extracts)

Extracts from Law number 16/2005 (December 27th) on Geographic Information and the Cartographic Institute of Catalonia.

Generics

Art. 6

Functions

1. The Cartographic Institute of Catalonia is the competent organization within the Regional Government for Geodesy and Cartography and for the Spatial Data Infrastructure.
2. The competences of the ICC are:
   …….
   ……..
   e) To elaborate and to propose the Cartographic Plan and its modifications and update
   f) To promote the Cartographic Commission, give it support, and execute its decisions when necessary
   g) To collaborate with other public organizations specially with local administrations to coordinate and cooperate in this field
   …….
   …….
   j) To create, structure, disseminate and maintain the SDI of Catalonia, in accordance with the State and European laws

The Cartographic Coordination Commission of Catalonia (CCCC) and the Cartographic Plan

Art. 31

- The CCCC is the basic body for the coordination and collaboration between the regional administrations and the local entities in the area of the cartography and related geographic information.
- The CCCC gives advice to the Government, and assures the participation of the local entities in the coordination processes of cartography and related geoinformation
- The CCCC is presided by the Minister of Public Works of the Regional Government

The Cartographic Plan

Art 36.
Content

The Cartographic Plan will contain:

a) The analysis of the existing and available official cartographic products and their quality and update levels.
b) The basic characteristics about the organization, functions and use of the SDI of Catalonia.

The SDI of Catalonia

Art. 44
Principles

The Catalan SDI is based on the generic principles of no duplication, accessibility and sharing of geoinformation, in order to allow and assure the general use of the following information:

a) *Reference data*: Geodesic System, geographic names, administrative boundaries, real state, buildings and their cadastral references and postal addresses, transportation, utilities, infrastructures, hydrography, land cover, coastal zones.
b) *Thematic fundamental data*: society and demography, protected areas, ecosystems, biodiversity, natural hazards, urban land, new urban planned land
c) Other which can be considered basic for the management of the territory.

Art. 45
Interoperability

1.- All geographic systems integrated in the SDI have to be interoperable

2.- To assure interoperability……the technological development have to follow the specifications which will be determined according with international standards

Art 46
Centre of support of the SDI

1. The created SDI Support Centre will act as the basic and technical organization for the promotion, exploitation and maintenance of the SDI, in order to disseminate geoinformation and related services, and make them accessible to assure their shared use.

2. The Support Centre will be a Unit of the Cartographic Institute, which will manage it under the orientations defined in the Cartographic Plan.

Article 47
Organization and functions

1. The basic characteristics, especially those referred to organization, activities and use of the SDI will be contained and described in the Cartographic Plan.

2. The future development of the present law will establish the adequate procedures so that the Cartographic Commission of Catalonia can monitor the activities and solve any question related with the SDI development.

Annex 2: Indicators selected for Local Authorities

EFFICIENCY

Impact	Indicator
Monetary gains	Savings in time (hours/month)
	Expected or predicted savings in consumables (qualitative)*
Better prepared personnel	More motivated employees with new training (qualitative)*
Improvements in the organisation	Time saved in the redesigned processes (hours/month)
	New processes (*e.g.* cadastre maintenance, license teams) (list-qualitative)
	Interoperable services (*e.g.* public service, permits) (list-qualitative)
	Interdepartmental data sharing (list-qualitative)
	Better planning of actions and decisions (list-qualitative)
	GIS services accessible from municipal websites (list-qualitative)

EFFECTIVENESS

Impact	Indicator
Benefits for residents	Time saved by residents (hours/month)
	Time saved by companies (hours/month)
User satisfaction	Repeat users of services (qualitative)*
	Volume of data queries and downloads (number)
	User satisfaction (qualitative)
Extension of services	Use of new services by businesses (qualitative)*
	Use of new services by residents (qualitative)*
	Uses enabled exclusively by SDI (qualitative)

DEMOCRACY

Impact	Indicator
Openness and transparency	Interactive services and web access (number)
	Available metadata records (number)
Participation	Complaints, queries, suggestions, errors, etc. transmitted electronically (number/month)*

NOTE: The indicators marked with * were originally meant to be quantitative but during the survey it became clear that it was not possible to quantify them at the current state of development, and therefore were assessed in qualitative terms.

Annex 3: Indicators selected for private companies and institutional users

Private companies

Impact	Indicator
Monetary	Increase in sales (€/month)
	Reduction of programming time (hours/month)
	Increase in added value (qualitative)
	Savings in licenses (€/month)
	Reduction of maintenance time (qualitative)
	Increase in profitability of projects (qualitative)
Technological	More technologically advanced projects (qualitative)
	More-structured projects (qualitative)
	Better-prepared personnel (qualitative)
	Amount of training (hours/worker/year)
Marketing	Increased requests by clients for IDEC geoservices (qualitative)
	Increased awareness and interest in GIS (qualitative)
	Easier sales (qualitative)
	Increased business (qualitative)

Institutional Users

Impact	Indicator
Monetary	Reduction of the costs of projects and applications (hours or €/month)
	Reduction in data maintenance costs (€)
	Reduction of implementation costs (e.g. reduced licence fees) (€)
	Better quality of outputs (qualitative)
Technological	Reduction in data updating time (hours/month)
	Simplification of project management (hours saved/month)
	Problems in use of IDEC Geoservices (qualitative)
Strategic	Increased ability to undertake previously infeasible projects (qualitative)
	Increased ability to handle large data volumes (qualitative)
	Improved project management (qualitative)
	Increased awareness of and/or interest in GIS (qualitative)

Annex 4: List of Local Authorities and Private companies interviewed in the study

The list below includes municipalities (in Catalan, *Ajuntaments*) and supramunicipal authorities (in Catalan, *Consells Comarcals*), which are users of the IDEC.

Local Authority	Visit Date
Tossa de Mar	03/04/2007
Lloret de Mar	03/04/2007
Roca del Vallès	11/04/2007
Santa Perpètua de la Mogoda	16/04/2007
Malgrat de Mar	17/04/2007
Sant Feliu de Codines	18/04/2007
La Garrotxa Regional Authority	18/04/2007
El Pla de l'Estany Regional Authority	18/04/2007
Girona	20/04/2007
Sant Feliu de Guíxols	20/04/2007
Forallac	20/04/2007
La Seu d'Urgell	23/04/2007
El Vallès Occidental Regional Authority	24/04/2007
Cervera	25/04/2007
Tàrrega	25/04/2007
Sitges	26/04/2007
Sant Vicenç dels Horts	26/04/2007
Palamós	08/05/2007
Calonge	08/05/2007

The three local authorities interviewed that are NOT users of the IDEC were:

Local Authority	Visit Date
Molins de Rei City Hall	05/06/2007
Castelldefels City Hall	07/06/2007
Corbera de Llobregat City Hall	12/06/2007

Private Companies:	Visit Date
CONNECTA.....	02/05/2007
GEODATA.....	09/05/2007
INTERGRAPH.....	16/05/2007
IOGEO.....	18/05/2007
NEXUS GEOGRAFICS.....	18/05/2007
SIGTE.....	18/05/2007
CREAF.....	21/05/2007
SUMMA.....	28/05/2007
T-SYSTEMS	30/05/2007
AURENSIS.....	06/06/2007
ABSIS.....	11/06/2007
SITEP.....	15/06/2007

European Commission

EUR 23300 EN– Joint Research Centre – Institute for Environment and Sustainability
Title: The socio-Economic Impact of the Spatial Data Infrastructure of Catalonia
Authors: Pilar Garcia Almirall, Montse Moix Bergadà, Pau Queraltó Ros
Editor: Massimo Craglia
Luxembourg: Office for Official Publications of the European Communities
2008 – 62 pp. – 21 x 29.7 cm
EUR – Scientific and Technical Research series – ISSN 1018-5593
ISBN 978-92-79-08728-8

Abstract
This report presents the finding of a study 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 is based on a sample of 20 local authorities participating in the Catalan SDI, 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 study found that the total direct cost of establishing and operating the Catalan SDI (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. The economic benefits in terms of increased internal efficiency of local public administrations for 2006 alone exceed €2.6 million per year. Therefore the study concludes 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. The illustrative case-study of the difference between two local communes, one which enables citizens to query their cadastral parcels and get all the necessary planning and building permission on line, while the other requires the process to be done by hand after making an appointment with the local technician illustrates well the opportunities offered by the IDEC. In addition to evaluating the socio-economic impact of the SDI in Catalonia, the study reflects on the indicators used for the study and the limitations encountered in collecting the necessary information, with suggestions for future work in this important field of research.

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LB-NA-23300-EN-C