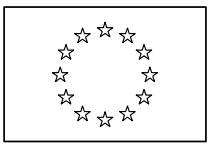

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 23.7.2004
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COMMISSION STAFF WORKING DOCUMENT

Proposal for a Directive of the European Parliament and of the Council

establishing an infrastructure for spatial information in the Community (INSPIRE)

EXTENDED IMPACT ASSESSMENT

{COM(2004)516 final}

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EXECUTIVE SUMMARY

All public sector organisations will face fundamental change over the next decade as they adapt to the *Information Age.* During this period there will be a move to almost total reliance on electronic media to store records, data and information. Principles of good governance can no longer allow islands of data and information to be created which are separate from other public-authority departments, or indeed from other public authorities, industry or members of the public.

Recent experience of the use of new media has exposed serious inefficiencies in the way data are acquired, handled and turned into information. It is accepted as 'normal' procedure to spend days seeking out data from other public sector organisations, to spend many hours checking the quality of the data or adapting the data to the specifications used in a report. However, this needs not be the case and current practice is therefore a considerable waste of public sector resources. By adopting good data and information management techniques, common specifications and common systems, these inefficiencies can be eliminated.

The Infrastructure for Spatial Information in Europe (INSPIRE) is intended to provide a common Europe-wide framework to eliminate a number of these chronic inefficiencies in the sector of spatial information. This infrastructure will provide the context within which spatial information can be analysed, overlaid, and integrated to support public policy formulation, implementation and evaluation, in particular in relation to sustainable development. When such a context is lacking, parts of it are created over and over again for every application where spatial data is needed.

Establishing such a common Europe-wide framework will require legislation at European level. The overall objective of the INSPIRE legislation will be to make harmonised and high-quality spatial (geographic) information readily available across public sector bodies in the European Union at local, regional, national and European level in order to support policies with a strong territorial dimension. INSPIRE will begin with information needed for environmental policy, but will be defined in an open way so that it can be extended in the future to agricultural, transport and other sectoral requirements. It also has the objective of facilitating access by citizens and business to spatial information anywhere across the European Union.

When developing the INSPIRE proposal, the following six policy options were considered:

(1) Do nothing.

(2) Voluntary cooperation among Member States.

(3) *A broad framework* backed by an EU framework Directive based on the subsidiarity principle of management devolved to Member State level. Obstacles addressed within a broad framework in a progressive manner.

(4) *A focused framework* backed by an EU framework Directive based on the subsidiarity principle of management devolved to Member State level, to constitute a first step focusing on priority data for environmental policies in a context of progressive implementation of a multi-sectoral spatial data infrastructure.

(5) *A comprehensive framework* backed by an EU framework Directive addressing all obstacles in a comprehensive manner.

(6) *EU Regulation* stipulating how Member States should implement INSPIRE specifications and infrastructure.

Option 1 is the baseline against which the other options were assessed. Analysis of past progress and current trends suggested that, under this option, policy-making would still strive to be more integrated and sustainable but that, without INSPIRE, the underpinning information base would remain patchy in coverage, variable in quality and difficult to access or use in a cross-boundary context. Islands of interoperability would be established. It would remain difficult to find the requisite data for lack of an organised structure in which to search for information and because the metadata (information on the available data sets) would be variable. Moreover, even when users found data, they would be unable to access or integrate them easily because the overarching architecture at the technological, organisational and procedural levels would be missing or have been applied inconsistently.

Option 2 was discarded at an early stage, as policy measures on awareness raising and voluntary coordination have been tried before (GI2000[1]), but have proved incapable of overcoming the obstacles to be addressed.

Option 3 is a coherent set of measures which are consistent with measures taken elsewhere in the world where infrastructures for spatial information have been set up and which address some of the key obstacles to the use of spatial data in Europe. Option 3 covers a broad range of data themes described in the INSPIRE Internet consultation document.[2] The impact of option 3 has been assessed and is presented below.

Option 4 differs from option 3 in that it limits the scope of INSPIRE to the spatial data all users need in order to place their information in a spatial context and the thematic spatial data needed across a large number of environmental policies. It also excludes the policy-specific spatial data covered by option 3. Furthermore, option 4 limits the harmonisation of certain spatial data to the definition and geo-referencing of spatial objects, whereas option 3 additionally deals with the harmonisation of data content. The impact of option 4 has been assessed and is presented below.

Option 5, the comprehensive legal framework, goes beyond option 3 by including additional measures in order to address all the obstacles to accessing and using spatial data for governance across Europe, particularly in relation to data gaps and harmonisation of historical data. At this stage, it is impossible to assess what the additional costs and benefits would be compared with option 3 as there is no overview of the availability and quality of existing spatial information. Furthermore, the structures needed to assess the needs and priorities of spatial data collection across the relevant policy sectors are not in place. It was therefore decided not to proceed with this more ambitious option, as it cannot be justified on cost/benefit grounds.

Option 6, the EU Regulation, might produce greater benefits than option 3 as it would allow for a higher degree of harmonisation of spatial data infrastructures across the Member States.

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1 http://www.ec-gis.org/copygi2000/

2 http://inspire.jrc.it/

However, this option might have significantly higher costs in certain Member States with established spatial data infrastructures that would need to be adapted to the harmonised approach set out in the Regulation. Therefore, a progressive approach is preferred, first bringing together existing initiatives in the Member States in one common framework and only then considering what the additional benefits would be of further harmonisation.

Approach to the extended impact assessment

The extended impact assessment was carried out in two steps. Firstly, the impact of option 3 was fully assessed with the support of a dedicated INSPIRE working group. This analysis and the feedback received from the consultation process resulted in the consideration of an additional option (option 4), for which the impact was then assessed. In addition, the assessment of option 3 was revised in view of the new information that became available during the second half of 2003 and the first quarter of 2004.

The extended impact assessment was based on information that was available to two working groups made up of Member State experts involved in the production and handling of spatial data and in environment-related policies, industry experts and a Commission contractor who provided support. A particular challenge was the almost complete absence of previous studies containing quantitative information on the costs and benefits of introducing infrastructures for spatial data. The chosen approach was therefore to determine the impact by referring to the expert knowledge available in the working group and to existing and new case studies of the introduction of components of spatial information infrastructures. When quantifying the impact of INSPIRE, the working groups tried to make generous assumptions regarding costs and conservative assumptions regarding benefits. The expertise available in the working groups meant that the impact in terms of investment requirements for INSPIRE could be covered fairly comprehensively.

The benefits for the user, however, have been described and quantified mainly for the environmental sector, this being the only sector for which information was available to the group. Consequently, the wider benefits of INSPIRE to other public sectors and to the private sector have only been briefly described and have not been quantified. The existence of these gaps in the description of benefits was confirmed by feedback received at the public hearing on INSPIRE. In spite of this, the quantified benefits described already justify INSPIRE and the existence of additional benefits in other sectors only strengthens this justification.

Investment requirements for INSPIRE (all figures in €m per annum)

The two tables below summarise the investment needed to set up and run INSPIRE for both option 3 and option 4 for 10 years as from the date of adoption of the proposal by the Commission. It is assumed that INSPIRE activities are additional to what would be in place at EU, national and sub-national level. The added value of INSPIRE is to create the synergy necessary to connect all the separate parts of the infrastructures being created across Europe and to fill gaps where they exist, thus delivering a fully integrated service. The available evidence indicates that, without INSPIRE, Europe will only have isolated pockets of working infrastructures that will fail to support the knowledge base needed for good governance and the sustainable development and innovation goals set by the Union.

OPTION 3

Blocks of INSPIRE policy measures	**EU**	**National Organisations**	**Regional/local**
Harmonisation	2.7	1.9	0.8
Metadata	0.2	2.7-3	46
Data Policy Framework		0.47	
Coordination and implementation including outreach	2.2	12	57-115
Total investment per annum over 10 years (€m) (rounded)	**5.1**	**17**	**104-161**

For option 3, the required investment is estimated at an average of €4.8-7m per annum per EU Member State (EU25). At regional/local level, the average investment needed represents €60,000-94,000 per annum per region of 250 000– 350 000 inhabitants.

OPTION 4

Blocks of INSPIRE policy measures	**EU**	**National Organisations**	**Regional/local**
Harmonisation	.6	1.2	0.5
Metadata	.16	1.9-2.2	33
Data Policy Framework		0.47	
Coordination and implementation including outreach	2.2	9.6	44-88
Total investment per annum over 10 years (€m) (rounded)	**3**	**13**	**77-122**

For option 4, the required investment is estimated at an average of €3.6–5.4m per annum per EU Member State (EU25). At regional/local level, the average investment needed represents €45,000-70,000 per annum per region of 250 000– 350 000 inhabitants.

These estimates represent an average over a 10 year period from the start of the adoption by the Commission of the INSPIRE proposal and will to a large extent be borne by the public sector. After this 10 year period, the required investment will drop considerably.

The investment needs of INSPIRE may be compared with a base expenditure on INSPIRE-related data which have been roughly estimated at about €10bn. **This suggests that investment needs of INSPIRE would only represent 2% (option 3) or 1% (option 4) of the total expenditure on geographical information over the period as a whole.**

Qualitative benefits

The qualitative benefits are similar for option 3 and for option 4, although they are expected to be more pervasive for option 3 than for option 4.

The policy benefits associated with greater availability of harmonised data sets across Europe centre on improvements in pan-European policy formulation, analysis, implementation and evaluation that was previously very costly, time consuming or simply impossible. The wider **environmental gains** include:

- support of a wide range of activities related to environment policy implementation, such as:
  - environmental reporting,
  - environmental and other impact assessments,[3]
  - establishment of management plans for specific sites or areas,
  - implementation of registration requirements related to territorial factors,
  - establishment of permits that need to take into account territorial factors,
  - notification requirements and public information,
  - establishment of monitoring networks;
- easier participation by NGOs and members of the public in public debates and decision making – in line with the UNECE Aarhus Convention principles on access to environmental information, access to decision-making and access to environmental justice;
- easier ex-ante evaluation of environmental policy, now an established practice for major Community policy initiatives;
- better monitoring and evaluation of environmental policies and their effectiveness, e.g. through the establishment of indicators that take into account the territorial dimension of the state of the environment or of the factors affecting it;
- support for more integrated policy approaches and policy coordination over different environmental themes and across sectors, as advocated by the 6th EAP[4];
- more effective implementation of the policy on Trans European Networks by allowing more detailed spatial analysis that combines information on transport more effectively with the other spatial information within the scope of this Directive, leading to increased understanding of the spatial context in which the Trans European Networks are built.
- better integration of environmental protection objectives into other policies, through the use of information common to various sectors.

The same kinds of benefits as listed above for environmental policy will also occur for other Community policies with a strong territorial dimension. Thus wider **social benefits** will result from overall improvements in the quality of policy and decision-making across Europe at local, regional, national and international level, such as:

- management and provision of information on property ownership, tenure and mortgage,
- monitoring and management of agriculture, such as crop planning and crop growth monitoring,

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[3] EIA and SEA, but also other assessment requirements in the context of numerous environmental legislative acts, e.g. risk assessments, effectiveness assessments.

[4] Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme, OJ L 242, 10.09.2002, p. 1.

– management of public utilities such as water, gas and electricity networks,

– planning and management of transport and logistics,

– operation of emergency services,

– spatial planning.

Furthermore, the impact on commerce (see below) will undoubtedly lead to the creation of new high-quality employment, as has happened in the US.

There is a tendency to focus on the benefits of INSPIRE to the public sector. Yet there are good prospects for **gains by the private sector**. Mention could be made of possible efficiency savings for industries that are for instance active in the utilities, oil and gas, communications, fishing, farming and forestry, mining, drilling, dredging and quarrying, in tourism, property development; surveying, insurance, cable laying, architecture and engineering sectors. Equally important are opportunities (combined with the GMES initiative[5] and the PSI Directive[6]), including:

- better and more accurate analysis of different European markets by commercial data users, leading to greater competition, and

- the creation of new products and services by commercial value added information providers, such as in the sectors of travel, logistics, telecommunications and tourism.

Experience elsewhere in the world has shown that a thriving market for added value services can develop on top of public sector spatial data. It is reasonable to assume that the implementation of INSPIRE would contribute to more vibrant economic activity in this area. This assumption is supported by the private sector's positive reaction to the INSPIRE initiative.[7]

Quantified benefits of INSPIRE

Quantification of the benefits of introducing INSPIRE has proved a difficult challenge, as the benefits of more information being available only become apparent after a certain period of time and because they also depend on many factors coming into play. The tables below summarise for options 3 and 4 the evidence found in relation to activities in which the availability of spatial information is a decisive factor for achieving the anticipated savings.

OPTION 3

Type of benefit	**Quantitative estimates** (all figures €m per annum)
More efficient EIAs and SEAs[8]	100-200

5 Global Monitoring for Environment and Security (GMES), Establishing a GMES capacity by 2008 (Action plan 2004-2008) COM(2004) 65 final, 3 February 2004.

6 Directive 2003/98/EC of the European Parliament and of the Council on the re-use of public sector information, OJ L 345, 31/12/2003, p. 90.

7 Cf. results of the INSPIRE Internet consultation and public hearing.

8 Environmental Impact Assessments and Strategic Environmental Assessments as required by Directive 85/337/EEC and Directive 2002/41/EC, respectively.

More efficient environmental monitoring and assessment	100
More cost-effective expenditure on environmental protection	300
More cost-effective implementation of the environmental *acquis*	50
More effective implementation of EC projects	5-15
Reduced duplication of spatial data collection	25-250
Improved delivery of risk prevention policies	120-400
Improved delivery of health and environment policies	350
Total	**1 050–1 660**

For option 3, adding together the quantified elements gives a **total of €1.2 to €1.8 billion annual benefits or an average of 48-72 m € per Member State (EU25)**.

OPTION 4

Type of benefit	**Quantitative estimates** (all figures €m per annum)
More efficient EIAs and SEAs[9]	60-121
More efficient environmental monitoring and assessment	64
More cost-effective expenditure on environmental protection	192
More cost-effective implementation of the environmental *acquis*	32
More effective implementation of EC projects	3-8
Reduced duplication of spatial data collection	25-160
Improved delivery of risk prevention policies	77-256
Improved delivery of health and environment policies	224
Total	**680-1060**

For option 4, the sum of the quantified elements gives **a total of €820 to 1200 million annual benefits or an average of €30-46 million per Member State (EU25)**.

For both options, the benefits are expected to accrue gradually as the implementation of INSPIRE progresses, reaching their full effect when INSPIRE is fully implemented. **Knowing that these elements only represent a partial view of the whole picture, the conclusion is that for both options the benefits outweigh the investment requirements by a considerable amount**.

The benefits in terms of efficiency gains accrue both to the public sector and to the private sector, as well as to the general public, NGOs, research institutions, etc. However, the benefits to business are particularly difficult to quantify because the costs of poor data and poor access are usually hidden within organisations and because the benefits will accrue in terms of new services. The distribution of the benefits between public and private sector bodies is therefore difficult to establish. As regards public sector bodies, a distribution of benefits between

[9] Environmental Impact Assessments and Strategic Environmental Assessments as required by Directive 85/337/EEC and Directive 2002/41/EC, respectively.

national and regional/local level of 1:15 can be assumed.[10] This is roughly the same as the distribution of INSPIRE's costs between national and regional/local level.

Risks

The implementation of INSPIRE has inherent business risks, which need to be managed carefully in order to optimise INSPIRE's benefits. Important challenges will be the achievement of a shared understanding of the mutual benefits of harmonised policy frameworks, the organisation of funding for the INSPIRE initiative, the consistent implementation of INSPIRE across the Member States, the engagement of the thematic stakeholders, and capacity-building at the local level. Stakeholders at all levels, including the Commission, should therefore support and contribute to the coordination of INSPIRE's implementation. The risks can also be limited by adopting a more progressive approach to INSPIRE.

Stakeholder consultation

The extended impact assessment was carried out by closely involving key stakeholders through a working group set up by the INSPIRE expert group. These stakeholders brought together a wealth of case studies and expert views on the basis of which the extended impact assessment was drawn up.

In addition to the Internet consultation on the proposed INSPIRE policy measures and in addition to the regular consultation of the INSPIRE expert group, the contribution of the dedicated INSPIRE working group was made available as input to a public hearing in which 39 persons took part. This contribution covered assessment of the impact of establishing a broad framework for INSPIRE.

Most of the comments made at the public hearing related to the INSPIRE proposal or its implementation and have been taken into account by the Commission in the current proposal. However, the following comments related specifically to the extended impact assessment of INSPIRE, of which the methodology and quality were otherwise supported: the costs of metadata collection were over-estimated, the significant benefits of INSPIRE for the property market had not been analysed, there was too much focus on public sector data and there was no breakdown of the benefits across the different levels of government.

The remarks on the over-estimation of certain costs have been taken into account by considering the new information that became available in the context of the SDI State of play study[11] and the results of the GINIE project.[12] The remarks on the partial assessment of the benefits have been addressed by emphasising more clearly that the quantitative assessment of benefits does not present the whole picture. The remark on the focus on public sector data has been taken into account in the formulation of the INSPIRE proposal for a Directive. The remark on the lack of breakdown of benefits across the different levels of government has also been addressed.

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10 This assumption is based on a comparison of the amounts of data available in maps at national and regional/local level respectively and on the assumption that the benefits of INSPIRE are proportionate to the volume of spatial data available to the user.

11 Spatial Data Infrastructures in Europe, State of Play Spring 2003, August 2003, http://inspire.jrc.it

12 GINIE: Geographic Information Network in the wider Europe (IST-2000-29493), October 2003. http://www.ec-gis.org/ginie/

Conclusions

There are clear conclusions to be reached from this extended impact assessment of the proposed INSPIRE Directive. In particular, INSPIRE would provide:

- more Europe-wide spatial data of greater consistency;
- consistent Europe-wide documentation of data and data quality;
- direct and free access to services to find and view available public sector spatial data sets;
- access to and delivery of spatial data, meeting the needs of users ranging from members of the public and academics to policy-makers and commercial users;
- an incentive for breaking down barriers to the sharing of spatial data required for good governance;
- a framework for coordination between spatial data users and suppliers;
- a platform for building public-private partnerships for producing and using spatial data.

By putting the proposed measures in place, INSPIRE would yield the following key benefits:

1. For both options 3 and 4, the economic benefits far outweigh the cost of setting up and operating INSPIRE;

2. INSPIRE would help eliminate chronic deficiencies in spatial data from across the public sector in the European Union and contribute to providing the knowledge base to support sustainable development, especially when complemented with the GMES initiative;

3. Given the persuasiveness of spatial data for many uses, INSPIRE would produce significant social benefits by contributing to increased transparency in environmental decision-making as required by the UNECE Aarhus Convention and through its potential to support the implementation of social policies in the EU; and

4. INSPIRE would bring major benefits to the commercial sector, especially when allied to the complementary PSI Directive,[13] by making spatial data sets held by public sector organisations accessible and usable and by providing a common platform for both public and private sector spatial data.

Comparing option 3, the broad framework, and option 4, the focused framework, in both cases the benefits considerably outweigh the investment requirements. For option 3, the benefits but also the investment requirements are significantly higher, and option 3 would require significantly more coordination efforts between INSPIRE and the thematic policies than option 4. Option 4 represents the more progressive approach to the implementation of

[13] Directive 2003/98/EC of the European Parliament and of the Council on the re-use of public sector information, OJ L 345, 31/12/2003, p. 90.

INSPIRE, with a review clause allowing next steps to be taken by building upon the experience of the previous steps. In particular, Option 4 involves lower costs up-front at the regional level, and so should allow for an easier implementation. Option 4, the focused framework, is therefore recommended.

FOREWORD

This document represents the Extended Impact Assessment of the INSPIRE initiative as referred to in **Communication COM (2002)276.** The document is based upon the contributions of the INSPIRE Framework Definition Support (FDS) Working Group, the INSPIRE Extended impact assessment task force, a contractor to the Commission as well as those of EC officials.

1. WHAT IS THE PROBLEM?

Chapter summary: Detailed geographical information is available in Europe but activities are fragmented and the information is therefore difficult to use to support the policies that need this information. The following key challenges should therefore be addressed through the establishment of a spatial data infrastructure: gaps in spatial data, lacking documentation, spatial data sets not compatible, incompatible geographic information systems, barriers to sharing and reuse.

The growing complexity and interconnectedness of issues that affect the quality of life today is increasingly recognized by the policy-makers and influences the way new policies are being prepared today. Many such policies need to be underpinned by information on spaces and places, i.e. geographic information (GI) to assess needs, inform policy, and evaluate impacts. However, the current situation of GI in Europe is one of fragmentation, gaps in availability, duplication of information collection and problems of identifying, accessing or using data that is available. In addition, much of the quality spatial information is available at local and regional level, but is difficult to exploit in a broader context for a variety of reasons, which are largely institutional, organisational, and legal in nature rather than technical.

Europe has a long tradition in cartography. Many individual policy actions, including at the Community level, contribute to this tradition by requiring or supporting the gathering of specific geo-referenced information. As a result, detailed geographical information is available in Europe to support a broad range of policies. Indeed, map-based information is used in many reporting, analysis, evaluation and forecasting tools and activities. In addition, the emergence of the Internet allows for widespread and low-cost distribution of this type of information and could contribute to better understanding and awareness of the broad public for various policy issues[14].

Despite these many initiatives, widespread access and use of geographical information is still a problem in Europe. The existing activities - all very laudable individually - are fragmented and poorly co-ordinated at European level. Although a lot of the geographical information collected could potentially be useful for a wide range of purposes, the wider needs are rarely taken into account.

Traditionally, geographical information has been a specialised activity organised by individual national states and professions in different ways. European specifications for data definition and exchange are only now emerging, but are complex to use. Provisions for

[14] Examples: http://www.europa.eu.int/water/cgi-bin/bw.pl, http://www.europa.eu.int/cornet/environment/nature/natura.htm,

making available basic European geographical information, supporting technology and knowledge infrastructure have not been well co-ordinated across disciplines or national boundaries, making it difficult and expensive to fit data together from many different sources in a seamless way. In spite of the potential for the creation of a market of added-value services on geographical information, a dynamic commercial market for geographical information fails at present to take off in Europe [15], contrary to what happens in the US.

The main problems can be summarised as follows:

- Difficulties of access to information (insufficient metadata at all levels);
- Different projections and scales, making existing information difficult to integrate;
- Unclear status of the information as to its currency;
- Prohibitive cost of geographical data;
- Lack of interoperability between data sets, and among web-enabled services;
- Lack of harmonisation in the codes used to represent the objects described;
- Varying data quality from one country to another within the same layer of geographical information;
- Lack of long-term solutions (instead: supply of snapshots, absence of information on changes), resulting in information that becomes quickly outdated and hence the need for duplication of data collection efforts.

These obstacles lead to fragmentation, gaps in availability of geographical information[16] duplication of information collection and to problems of identifying, accessing or using data that is available. In this environment, no economies of scale can take place. As a result of these problems, effective Community policy actions suffers because of lack of monitoring and assessment capabilities that take into account the spatial dimension[17].

The problem of having different baseline data sets which make existing information difficult to integrate, is illustrated in the box (right) which shows differences between the European and various nationals measurements for heights.

Another good example, which demonstrates

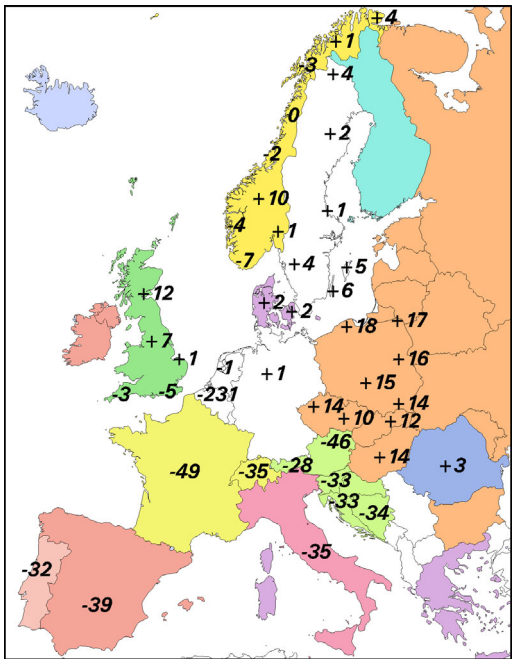

Figure 1: GI standardization: Need of a European Vertical Reference System
Differences between UELN heights and national heights in Europe (in cm)

15 For example, a market survey dating from March 200[illegible] in North Rhine-Westphalia in Germany suggests that only 15% of the market potential is realised.

16 For example, only a few pan-European geographical information layers exist, often designed for specific purposes that limit the possibilities of their wider use e.g. CORINE Land Cover and the SABE data set (Seamless Administrative Boundaries of Europe) from EuroGeographics.

17 For example: insufficient monitoring capabilities are key obstacles to the further development of a range of priority *themes of* the 6th Environmental action programme, such as soil, bio-diversity, health and environment and marine policy.

several of the difficulties in the list above, can be seen in the case of the EUROSION project which aims to provide the EC with recommendations on policy and management to address coastal erosion in the EU.[18]

As an additional indication, a survey of 50 organisations across Europe[19] engaged in the preparation of EIAs and SEAs confirmed the above obstacles and indicated that their impact on their work included:

- Lower level of accuracy of description of impacts,
- Higher uncertainty of extent of impacts identified,
- Higher cost of EIA/SEA studies.

The following key challenges to achieve the widespread use of spatial information to support governance in Europe should therefore be addressed through the establishment of a spatial data infrastructure. These challenges can be summarised into the following five main obstacles:

- **gaps in Spatial data**: spatial data is often missing or incomplete,
- **lacking documentation:** description of available spatial data is often incomplete,
- **spatial data sets not compatible**: spatial data sets can often not be combined with other spatial data sets,
- **incompatible geographic information systems**: the systems to find, access and use spatial data often function in isolation only,
- **barriers to sharing and re-use:** cultural, institutional, financial and legal barriers prevent or delay the use of existing spatial data.

The widespread presence of these barriers have been confirmed by the INSPIRE Internet consultation and public hearing.

2. WHAT ARE THE MAIN OBJECTIVES OF THE INSPIRE INITIATIVE?

The overall objective of INSPIRE is to make harmonised and high quality spatial (geographic) information readily available for formulating, implementing, monitoring and evaluating European policy, beginning with environmental policy and later extending to agriculture, transport, and other sectors, as well as facilitating access by citizens and business to spatial information, whether at local, regional, national or international levels.

INSPIRE will contribute to sustainable development by supporting the integration of the environment into other policies and the integration of social and economic considerations into environmental policies. For this purpose, spatial data common to several sectors and needed for environmental policies will be organised and co-ordinated by involving the sectors concerned.

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[18] First interim report of the EUROSION project presented at the Expert group meeting of Member States ICZM contact points of October 2002 Brussels)

[19] Internal research of the European Commission services, publication forthcoming (Environmental Impact Assessment Review)

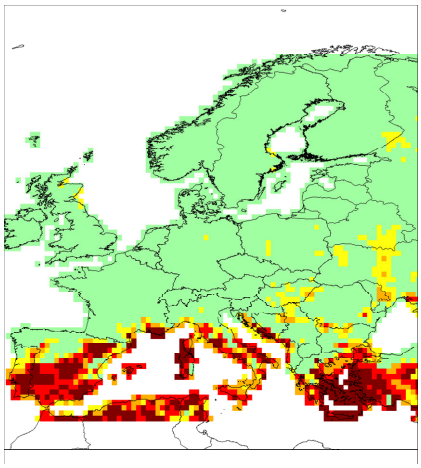
The broader goals are also to contribute to good governance through more and better-informed public participation in decision making by policy makers and environmental improvement resulting from better-informed decisions by individuals and businesses.

The specific objectives of INSPIRE are:

- to increase the accessibility of quality geographical information
- to increase the usability of existing geographical information, in particular for supporting good governance of Europe's environment,
- to reduce inefficiencies in the collection, handling, storing and distribution of geographical information, and
- to eliminate institutional and data policy barriers to the use of geographical information.

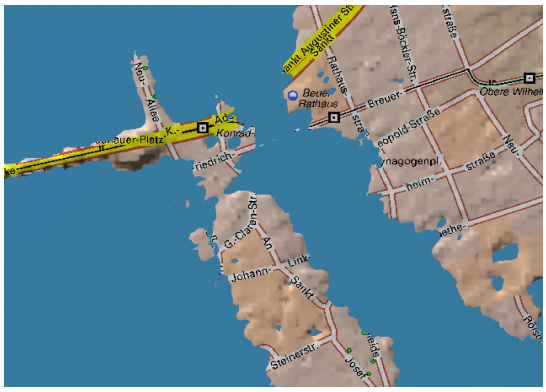
Some examples of the types of application that would be supported by INSPIRE are presented below.

Forest fire risks at EU level are currently determined using a low-spatial-resolution meteorological model that produces the weather forecast for the whole EU territory. The low-resolution meteorological data this generates are used for the fire risk models in conjunction with other data sets to provide the European forest fire risk maps. Although higher-resolution national and regional meteorological data exist, they are not available for use in a European context. Harmonised regional/national data would help improve the spatial resolution and accuracy of forest fire hazard maps, in turn producing a uniform level of information to the public and more effective fire prevention and mitigation measures.



Fire Risks 2003-07-29 - JRC Natural Hazards project

River flooding is often a transnational or interregional problem. Many institutions are involved in issues related to river and water management, all of them with different approaches to collecting and storing spatial data. This creates problems in cases where integrated river basin studies need to be carried out. Simulation tools such as those used for the flooding process in the Rhine valley near Bonn[20] based on harmonised spatial data can help to take account of risks to people and property in a transboundary context. They can also provide guidance on using Community funds with a view to flood prevention and recovery.



This report assesses the options for, and costs and benefits of establishing INSPIRE to achieve these objectives.

[20] Simulation provided by the Surveying and Mapping Agency of North-Rhine Westphalia.

3. INTERRELATIONSHIP WITH OTHER COMMUNITY INSTRUMENTS

Access to environmental information

Directive 2003/4/EC updated the requirements regarding public access to environmental information introduced by Directive 90/313/EEC. In addition to taking account of the experience gained in applying the old Directive, it also reflects, as regards public access to environmental information, the terms of the 1998 Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.

Some of the information covered by the public access to environmental information Directive is also covered by INSPIRE. Hence the INSPIRE policy measures will both support and complement the implementation of Directive 2003/4/EC's requirements regarding the dissemination of environmental information. In other areas, such as charging provisions, there is little overlap between the two initiatives. Directive 2003/4/EC includes provisions on charging for access to environmental information, whereas this proposal only addresses the barriers to the use and harmonisation of spatial information.

The re-use of Public Sector Information (PSI)

Directive 2003/98/EC on the re-use of public sector information[21] is of considerable importance to the development of the Infrastructure for Spatial Information in Europe. It aims at ensuring, amongst other things, fair, transparent, proportionate and non-discriminating conditions for the reuse of public sector information.

The INSPIRE proposal and the PSI Directive are complementary in scope. Some information covered by the INSPIRE proposal is also covered by the PSI Directive, with policy measures complementing each other. Indeed, the INSPIRE proposal will make more information available for re-use in a harmonised format and therefore broaden the positive impact of the PSI Directive. Conversely, the provisions of the PSI Directive are complementary to the INSPIRE measures in that they enhance the potential re-use and commercial exploitation of data covered by this proposal.

Global Monitoring for Environment and Security (GMES)

The Communication on GMES[22] sets out an action plan to establish a capacity for global monitoring for environment and security by 2008. This monitoring capacity should address all obstacles to gathering, interpreting and using data and information in support of sustainable development policies. These obstacles include gaps in information, problems with data quality, inadequate monitoring infrastructure (both in situ, airborne and from space), deficiencies in data integration and information management capacity and the lack of services and applications to bring the information to the user.

INSPIRE will address only one subset of the obstacles to data integration and information management, namely the absence of a European Spatial Data Infrastructure. It will deal with

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21 Directive 2003/98/EC of the European Parliament and of the Council on the re-use of public sector information, OJ L 345, 31/12/2003, p. 90.

22 Global Monitoring for Environment and Security (GMES): Establishing a GMES capacity by 2008 (Action plan 2004-2008) COM(2004) 65 final.

issues of data policy, coordination, documentation and harmonisation and it will establish the services of a Community clearinghouse network. GMES will benefit from such an infrastructure and may deliver through it spatial data resulting from the new monitoring capacity and services to bring the information to the user. The success of GMES therefore depends on the implementation of INSPIRE and the two initiatives will work in a complementary fashion.

GALILEO: the European Satellite Navigation System

The European awareness of the importance of navigation by satellite led to the GALILEO programme of positioning and dating of civil infrastructure. INSPIRE, which will partly rely on satellite positioning services, will take into account the technical characteristics of GALILEO in order to ensure that the synergies can be fully exploited to the mutual benefits of the users of GALILEO and INSPIRE.

4. WHAT ARE THE MAIN POLICY OPTIONS?

Chapter summary:The extended impact assessment describes six policy options: the do-nothing option, the option of voluntary cooperation between Member States and four approaches to establishing a legislative framework with varying degree of ambition. Two of the latter options are subjected to an extended impact assessment. For this purpose, the measures of INSPIRE are regrouped into four components: INSPIRE data and data harmonisation, Metadata and catalogues, Data policy framework and Coordination and implementation.

4.1. The INSPIRE policy options

The table below sets out the six policy options that were considered when developing the INSPIRE proposal, along with the pros and cons of each option:

Table 3.1 The Main Policy Options for Managing and sharing Geospatial Data

Option	Pros	Cons
1. ***Do nothing***		Current data and information problems continue
2. ***Voluntary co-operation*** among Member States supported by EU projects.	Maximum flexibility for Member States	High risk that current problems continue with patchy spatial data infrastructures, poorly supported due to lack of funding and political support
3. A ***broad framework,*** backed by an EU Framework Directive, that focuses on a broad range of public sector spatial data, that requires harmonisation only as far as new data or newly updated data is concerned, that does not include new data collection requirements and that establishes a licensing framework that can be adhered to by third parties on a voluntary basis.	Addresses issues and meets objectives in flexible way	Risk that some important obstacles will not be addressed in time

Option	Pros	Cons
4. A ***focussed framework,*** backed by an EU Framework Directive, that compares to option 3 by leaving out of the legal framework those data[23] that are not widely used across a broad range of environmental policies and by limiting the harmonization requirements for theme-specific spatial data.	Lower budgetary impact on the Member States, more progressive approach, more favourable cost/benefit ratio than option 3	Less benefits, need for revision, higher risk that some important obstacles will not be addressed in time
5. *A* ***comprehensive framework*** backed by an EU Framework Directive that addresses and harmonises all existing spatial data needed for the environment, that establishes a mandatory licensing framework for third party data and that includes new data collection requirements.	Certainty that all obstacles will be addressed	Member States will resist agreeing on a package of measures that is open-ended
6. An ***EU Regulation*** that lays down detailed provisions on how INSPIRE is to be implemented in the Member States.	Prescriptive approach with maximum guarantees of harmonisation	Difficulty to take into account the diversity of situations regarding Geographical Information in Member States

The INSPIRE options have evolved out of many discussions within the INSPIRE Expert group and out of the work[24] of the INSPIRE Working Groups on:

- Common Reference Data and Metadata,
- Environmental Data,
- Data Policy and Legal Aspects,
- Architecture and Standards,
- Funding and Implementation Structures,
- Impact Analysis.

Option 1 describes the baseline against which the other options were assessed. Option 2 has been discarded at an early stage. Options 3 was assessed extensively and the findings of option 3 together with the results of the consultation led to its fine-tuning which is presented as an additional option which has also been subject to an extended impact assessment. The impacts of options 5 and 6 are briefly described by comparing them to those of option 3.

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[23] Noise and radiation zones, Human health and safety, Forest resources, Fisheries resources, Water resources, Agricultural land and soil resources, Geological resources, Renewable energy resources, Settlements, Polluted areas, Climate zones, Vegetation, Technological risk zones, Technological accidents and natural disasters, Natural amenities, Oceanographic spatial features, Areas of intensive exploitation, Transport services, Trade and services facilities, Cultural heritage. These data themes represent 35% of the total number of data themes identified as relevant to environmental policy in the INSPIRE Internet consultation document.

[24] See position papers of the working groups in http://inspire.jrc.it/

4.2. Option 1: The Do-nothing Option

Without the adoption of INSPIRE, Europe would no doubt make progress in respect to increased quantity, quality, and general availability of data relevant for policy, good governance and business. The capability to frame and build interoperable geo-processing networks already exists now to a certain extent, and some organisations would over the coming years recast their business around a network-centred approach thus enabling users to address more quickly questions that demand information in a spatial context. None the less, without INSPIRE, these improvements would have only established islands of interoperability and it would remain difficult to find the data needed because there would still be a lack of an organised structure in which to search information, and the documentation of data sets (metadata) would remain patchy. Moreover, even when users found data, they would be unable to access or integrate them easily because the overarching architecture at the technological, organisational, and procedural levels would be missing or have been applied inconsistently. Therefore, whilst there will be incremental improvements at all levels, European, National, and regional/local, some of the underlying difficulties would remain, including:

- the absence of agreed and transparent policies for access and reuse,
- a project-based approach to data that leaves gaps and at the same time wastes resources by duplicating data collections that cannot be fully re-used,
- no framework for regular updates,
- emphasis on voluntary agreements with missing coordination,
- patchy interoperability of geo-spatial data and services,
- poor return on investment because projects are one-off and not well integrated.

The vision of the common market with free movement of people, goods, and services would continue to be hampered by invisible barriers (information, rules, procedures, etc). Policy-making would still strive to be more integrated and sustainable, but the information base underpinning would remain patchy in coverage and variable in quality. Therefore, this option will not allow the INSPIRE objectives to be achieved and is not recommended.

This assessment has been confirmed by the results of the State of Play project[25] that assesses the situation in relation to Spatial Data Infrastructure in Europe, based upon in-depth interviews with a wide range of stakeholder in countries that have been actively pursuing the establishment of spatial data infrastructures. Furthermore, the broad support for INSPIRE by the INSPIRE Internet consultation respondents confirms that INSPIRE is needed to deal with the obstacles for the use of spatial data experienced in Europe.

4.3. Option 2: Voluntary co-operation between Member States

This option was discarded at an early stage, in view of previous experience in Europe and elsewhere. Indeed, previous experience with policy measures on raising awareness and co-

[25] Spatial Data Infrastructures in Europe, State of Play Spring 2003, August 2003, http://inspire.jrc.it

ordination have been tried before (GI2000[26]), but proved to be incapable of overcoming the obstacles to be addressed. The choice of this option would create high risks for the implementation of existing and forthcoming key Community legislative acts, such as the Water Framework Directive[27] and the implementation of the thematic strategies referred to in the 6th EAP.

4.4. Option 3, 4, 5 and 6: legislative framework

Options 3, 4, 5 and 6 have progressively narrowed down to options 3 and 4 during the policy formulation process. This section briefly describes the impacts of options 5 and 6 by comparing them with those of option 3, described in detail in section 3.5 below.

Option 5, the comprehensive legal framework, goes beyond option 3 by including additional measures in order to address all the obstacles to accessing and using spatial data for governance across Europe, particularly in relation to data gaps and to harmonisation of historical data. At this stage, it is impossible to assess what the additional costs and benefits would be compared with option 3 as there is currently no overview of the availability and quality of existing spatial information. Furthermore, the structures needed to assess the needs and priorities of spatial data collection across the relevant policy sectors are not in place. It was therefore decided not to proceed with this more ambitious option, as it cannot be justified on cost/benefit grounds.

Option 6, the EU Regulation, might produce greater benefits than option 3 as it would allow for a higher degree of harmonisation of spatial data infrastructures across the Member States. However, this option might have significantly higher costs in certain Member States with established spatial data infrastructures that would need to be adapted to the harmonised approach set out in the Regulation. Therefore, a progressive approach is preferred, first bringing together existing initiatives in the Member States in one common framework and only then considering what the additional benefits would be of further harmonisation.

4.5. Options 3 and 4

Having discounted the 'Do Nothing' option and after discarding option 2, 5 and 6 at an early stage, the remaining options are option 3 and 4 in Table 3.1 i.e. to introduce an EU Directive based on the subsidiarity principle to allow flexibility for Member States in implementing INSPIRE, respectively with a broad or with a more focussed scope. The policy measures related to these options and selected for impact assessment are broad-brush measures. Option 4 can be considered as a fine-tuning of option 3, taking into account the outcome of the impact assessment and the consultation with the stakeholders.

4.5.1. Overall scope

Following extensive analysis work, the potential scope of INSPIRE has been defined by a list of 60 spatial data components grouped together in 17 themes. These themes cover both information directly related to environment policy (e.g. noise, water quality, protected sites etc) and information of a cross-sectoral nature, often needed by several sectors (e.g. administrative boundaries, elevation, transport networks, land cover, etc). For the purpose of

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[26] http://www.ec-gis.org/copygi2000/

[27] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000 p. 1-73

this impact assessment, these 17 themes are divided into three annexes: Annex I, Annex II and Annex III. Option 3, the broad framework covers the full potential scope comprised of all the three annexes without differentiation. Option 4 only covers Annexes I and II and sets less stringent requirements for Annex II compared to Annex I. Throughout the impact assessment, we assume that the average number of data sets for annexes I, II and III spatial data components is within the same order of magnitude.

All spatial data sets corresponding to the themes of the scope that are held in an electronic form by public sector bodies at national and local level would be covered, with the exception of local level data of no relevance outside the local district in which they have been created.

4.5.2. The scope of INSPIRE- options 3 and 4

Building upon the work of several INSPIRE working groups, some 60 data components were identified as relevant for the INSPIRE framework, In the context of the finetuning of the INSPRIE policy measures after the consultation with the stakeholders, the potential scope of INSPIRE has, for the purpose of this impact assessment, been divided into three parts presented in annex I, annex II and annex III. Option 3 of INSPIRE covers all the spatial datasets that correspond to these three annexes. Option 4 only covers the spatial datasets that correspond to annexes I and II and requires less stringent harmonisations efforts for annex II spatial data.

4.5.3. The INSPIRE components and policy measures

In broad terms, the key components of INSPIRE are typical of any Spatial Data Infrastructure, as indicated for example by Rhind (2001), Masser (1998), and by Craglia et al. (2002), namely:

INSPIRE data and data harmonisation: this includes both reference and thematic data, at all levels (European, national, and regional/local). This component includes Policy measures covering the requirement to contribute to the definition of harmonised ways of exchanging and presenting spatial data sets – resulting in harmonised spatial data specifications - and the requirement to use these specifications for any new spatial data collection, or update of existing spatial data, within the scope of INSPIRE. For option 4, the harmonisation requirements are less stringent for annex II spatial data.

The elaboration of harmonized spatial data specifications should be an open and evolutionary process, building on a series of iterations that over time move from the general specifications for the more frequently used objects towards more detailed specifications responding to specific requirements (e.g. to satisfy particular applications or legislation demands). For simplicity, these will be referred to as ‘data harmonisation projects’ in the cost benefit analysis. In the course of each data harmonisation project, which may last in the region of 12 –18 months, the community of domain experts at European, national, and regional/local level will work closely with engineers and interoperability experts to define:

1. features and feature collections, the basic spatial “units of analysis" and link these together into higher-level units of analysis (e.g. different water bodies form together a river network);

2. the data’s geometry and topological relations and the types of associated geometric reference systems the data should be captured in or converted to via an on-the-fly

services. At a minimum the data model must specify the requirement that data to be objectified uses the agreed European conventional reference systems that include projections, horizontal, and vertical reference systems (such as ETRS89 and EVRF2000 respectively);

3. agreed-to terminology and definition of the key attributes of the spatial objects;

4. the necessary codes and unique identifiers and feature coding catalogue (if applicable) and encoding (for transfer data sets) to be used by the application schema;

5. the conceptual schema expressed in Universal Modeling Language (UML) to include the application and spatial schema, the metadata, quality information;

6. the feature types, attribute types, attribute domain, feature relationships, spatial representation, and data organisation, in terms suitable for transformation to electronic metadata;

7. a data content specification that is format-independent of a conceptual model that can be implemented with one or more logical and physical models;

8. implementation profiles derived from the conceptual schema as annexes; and

9. the multilingual thesauri for items 1, 3 and 8 to facilitate semantic interoperability.

As mentioned earlier, these requirements must be seen evolving over 10 years of implementation of INSPIRE starting from the more generic to more specific.

As the product specifications are developed in each data harmonisation project they will spawn access or exchange services that use common interoperable interfaces and encodings. At this stage, it is possible, already with exiting technology and methods, to build connectors (wrappers) to existing databases so that they can be registered with web-enabled services and become INSPIRE compliant. Over time, as operational and organisational capacity develops, and new data is collected to INSPIRE specifications, there may be benefits in upgrading national and local specifications to international best practice, thus saving resources and at the same time integrating further the different data sets across Europe.

Metadata and Catalogues: this component includes the policy measure requiring the Member States to document the spatial data sets corresponding to the scope of INSPIRE and according to common rules. The resulting metadata should allow discovering relevant spatial data, provide information on access and should be made available free of charge. It requires the definition of an INSPIRE profile based on ISO 19115, ideally cross referenced to e-government metadata formats based on the Dublin Core, the translation of existing metadata to such profile, the creation and regular maintenance of metadata for the many data sets particularly at regional and local levels that are not documented, building the institutional and professional capacity to do so, i.e. making it somebody's job to create and maintain metadata. As the harmonisation process develops, build the data and services catalogues as well as the content repositories necessary to deliver in operational settings the INSPIRE vision. .

Data Policy Framework: this component includes the establishment of sharing frameworks between public authorities that provides for exchange of spatial data that is free of barriers and of a more general framework for the reuse of spatial data by third parties. It also covers

the requirement to provide for free of charge viewing of spatial data covered by the scope of INSPIRE and to deal with any barrier for the use of the harmonised spatial data specifications. In line with the principle of subsidiarity, each Member State will have to develop its own way of putting these requirements into practice in accordance to its institutional and financial practices, whilst respecting also other relevant international and European legislation or agreements such as the Århus Convention, the Directives on Public Access to Environmental Information (2003/4/EC) and on the Reuse of Public Sector Information (2003/98/EC), and competition law requiring transparency and non distortion of the market.

Coordination and implementation: this component includes the establishment a distributed network of services that publish, discover, view, access and trade the spatial data sets covered by INSPIRE, in accordance with common specifications. These services should be open to non-public sector providers of spatial data sets. The component also covers the requirement to connect to an "EU-Portal" that would provide a multilingual point of access to the spatial data and services accessible through the network. Coordination includes both strategic and operational management of INSPIRE at EU and national levels. This would cover, inter alia management of the data harmonisation programme, development and maintenance of Internet portals and the technical infrastructure needed to search, discover, view, and download the data sets covered by INSPIRE.

5. ASSESSMENT OF IMPACTS

Chapter summary: The impact assessment is based on existing information and recognises that more information is available on quantitative costs than on quantitative benefits. Costs and benefits are incremental to the base expenditure on spatial data incurred in the absence of INSPIRE. Estimates for costs are generous, estimates on benefits are conservative. The key stakeholders are public authorities at all levels and citizens, private sector and research institutions. The impact assessment covers a time period of 10 years, from 2005 to 2014. Calculations of costs and benefits are based on a number of basic assumptions, on the link between number of data themes and the costs and benefits and on the average costs per person, fixed at 75 000 € per year.

5.1. Methodology

The extended impact assessment has been based on information that was available to a Commission contractor and to the INSPIRE Framework Definition Support (FDS) group and the INSPIRE Extended Impact Assessment task force, two working groups composed of Member State experts involved in the production and handling of spatial data and in policies related to the environment, industry experts

A particular challenge was the almost complete absence of previous studies containing quantitative information on the costs and benefits of introducing infrastructures for spatial data. The chosen approach was therefore to determine the impact by referring to the expert knowledge available in the working group and to existing and new case studies of introducing components of spatial information infrastructures brought together by the expert group (Annex V). Furthermore, when quantifying the impact, the working group tried to make generous assumptions regarding costs and conservative assumptions regarding benefits.

The impact in terms of investment requirements for INSPIRE was therefore covered fairly comprehensively. However, the benefits for the user have mainly been described and

quantified only for the environmental sector, as this was the only sector for which information was available to the group. Consequently, the probable wider benefits of INSPIRE to other public sectors and to the private sector could only be briefly described and have not been quantified. The existence of these gaps in the description of benefits was confirmed by feedback received at the public hearing on INSPIRE.

The key to the methodology is that throughout estimates are made of *incremental* costs/investment requirements and benefits of the proposed INSPIRE policy measures, i.e. over and above what would happen without INSPIRE. In each Member State there are existing costs and benefits associated with the production and use of the various data sets that will be covered by INSPIRE. Although some overall estimates of the cost of the current investments in public sector information are used in the analysis, no attempt has been made to derive a new estimate of this base. Rather the impact assessment concentrates on providing figures for the additions to these base expenditures from the INSPIRE initiative. In some cases INSPIRE will simply refocus expenditures that would have taken place in any case, so that there is no incremental cost. But in others new investment is needed as a result of the INSPIRE requirements—though equally there will be new benefits.

Two complementary approaches have been adopted, depending on what data is available.

- the first is to estimate the incremental costs and benefits as a proportion of the costs (or benefits) of related activities. The output of such an analysis takes the general form: incremental of cost of, say, the creation of metadata, is 10% of the data collection costs;

- the second attempts to quantify the costs and benefits in monetary terms, over a defined output. Here the output takes the general form: the costs of the creation of metadata for the complete INSPIRE data sets for all member and accession countries are X person-years, which is equivalent to € Y millions[28].

Within each approach there is a mixture of values with different degrees of precision. It is generally much easier to estimate both cost increases and cost savings (efficiency improvements)—the latter being included here as "benefits". There will be wider generic benefits, sometimes known as "macro-economic benefits"—in terms, for example, of the increases in private sector innovation—which can be associated with the INSPIRE initiative. These benefits can only be described in qualitative terms.

5.2. Stakeholders

For the purpose of this impact assessment it is assumed that the following user groups: citizens, NGOs, and research institutions, are unlikely to face significant additional costs from the adoption of INSPIRE, although they will reap benefits. This assumption is predicated on

[28] For the purpose of this impact assessment we assume a daily rate of € 375, and yearly costs of € 75,000 per full-time equivalent person including overheads, office and both software and hardware equipment, and social costs. These costs are assumed the same across EU25 and are not discounted by Purchase Parity Standards. These figures have been revised downwards from an earlier estimate of € 100,000 per full-time equivalent. The revision has been made on the basis of the results of the GINIE survey on the State of Play in Member States' Geographical Information Associations (www.ec-gis.org/ginie), where cost figures were collected for staff working in across the majority of Member States. However, these figures may still be an over-estimate compared to staff required to implement INSPIRE, many of whom will be employed at the regional level.

these groups not holding, or producing, any significant data sets to which the INSPIRE requirements would apply.

In respect to the private sector, which in some instances holds or produces important data sets that may be of relevance to INSPIRE, the following is assumed:

- INSPIRE only puts obligatory requirements for public sector data, i.e. data for which the public sector holds Intellectual Property Rights (even if collected by the private sector on commission by the public sector). Therefore, data that involves third party rights will only be affected by INSPIRE when the third party Intellectual Property Right holder agrees to participate on a voluntary basis.

- The data policy framework proposed by INSPIRE will not result in additional costs to the private sector in terms of more restrictive conditions for access, or market distortions as it will be fully in line with existing EU legislation including competition law.

Therefore, the main groups of stakeholders affected by INSPIRE are likely to be:

1. the European Commission - it is predominantly a user of spatial information and thus could be expected to reap mainly benefits. However, the Commission is likely to also share some of the burden of the INSPIRE costs by through its involvement in the coordination of INSPIRE at EU level and by making Research and Development funds available to those who incur costs as a result of INSPIRE. Its net position would therefore include – costs and benefits;

2. national data providers (such as mapping agencies) and related associations (e.g. Eurogeographics) – costs and benefits;

3. national government agencies and organisations such as environment agencies and geological surveys that are both producers and users of GI – costs and benefits;

4. regional and local authorities, that likewise are both producers and users of GI – costs and benefits; and

5. citizens, private sector data users, research institutes – benefits only.

For the purpose of number 4 above, it is assumed that the principal actors are unlikely to be the 90,000 or so local administrations in Europe, as the majority of these are very small. We therefore assume that the key actors are likely to be:

- Cities of over 100,000 inhabitants (approximately 450 units).
- Middle level local authorities (regions, counties, or provinces) in large countries, and central organisations in smaller countries. As a first approximation of the number of organisations involved we have considered that these would be equivalent to NUTS3 administrations in the larger countries, which number 1200 in the 25 Member States of the expanded EU.

The total number of regional/local authorities involved is therefore approximately 1700. This is equivalent to one organisation for every 250,000-300,000 people across Europe.

This is of course only an average and cannot reflect the situation of each individual country. In some countries the nature of the institutional and organisational framework will be such

that only agencies at national and regional levels (NUTS 1 and 2) will be involved while in others the responsibilities and hence data holdings are more decentralised. Whilst mindful of these variations, we feel these are at least a first approximation of the numbers involved in the implementation of INSPIRE.

5.3. Timing of requirements

The extended impact assessment will attempt to provide estimates of the plausible costs and benefits of the INSPIRE measures as grouped in the following four blocks, for each of the main groups of stakeholders:

- Data covered by INSPIRE and data harmonisation,
- Metadata and catalogues,
- Data Policy framework,
- Co-ordination and implementation.

The timing of the requirements will have a significant effect on the investments required. As often is the case for infrastructure projects in general and for SDI-related projects in particular, the investments are front-loaded while the benefits only start showing at a later stage. This is why every effort should be made to show some early results through an iterative process resulting in evolutionary acquisition and deployment.

For the purpose of this Impact Assessment the following is assumed:

During 2004 some preliminary work will take place while the INSPIRE proposal enters the legislative process. Such work may include the start of the development of implementation profiles for international standards, guidelines for harmonised discovery metadata, interoperability trials between existing SDIs, of discussions about specifications and licencing frameworks, awareness raising activities about INSPIRE, and discussion about coordinating frameworks. The preparation of these processes is very important but will be funded through existing budget lines and will not be considered as INSPIRE costs.

INSPIRE costs are assumed to start in 2005-06 after the adoption of the proposal by the Commission. The sequence of expenditure is assumed to include:

2005-06 Preparatory actions to:

- Establish coordinating and implementation support bodies at European and national level.
- Issue guidelines for implementation of metadata standards.
- Establish harmonised licencing frameworks for data access and sharing.
- Establish a clearinghouse network including services for discovery, query, view, download and trading.
- Initiate and develop IT services to facilitate the collection of stakeholder requirements and reporting support services.
- Raise the awareness and inform stakeholders on the implications and implementation strategy of INSPIRE.
- Initiate the first data harmonisation projects through research and development.

2007-2008 Actions to support the transposition

- Roll out of the coordination, licensing, and discovery metadata across EU25 and regional/local levels
- Establish and operate the organisational structure to manage the implementation support actions as a service to the Commission, Member States and stakeholders
- Further develop harmonised licensing frameworks.
- Testing and further development of Clearinghouse services.
- Consolidation of data harmonisation projects deliverables, and delivery of relevant services.
- Continuing awareness raising.

2009-14: Actions related to further implementation

- Operational support
- Further data harmonisation projects to extend capabilities and applications to achieve the desired level of interoperability.
- Monitoring and reporting.

This does not mean that full compliance and implementation will be achieved by 2014 but for the purpose of this assessment we assume that most of the costs and benefits will have come on stream by then and that INSPIRE will have achieved its main objectives. That will be the appropriate moment to revise the requirements of INSPIRE.

5.4. Basic assumptions for the impact assessment

The scope of INSPIRE is defined by annexes I, II and III that identify 60 data components relevant for environmental policies. All their corresponding data sets form together the scope of option 3 of INSPIRE (broad framework). For option 4 (focussed framework), we assume that the scope of INSPIRE is reduced with 34% compared to option 3; this corresponds to the proportion of the number of spatial data components that are brought outside the scope of INSPIRE (annex III). Annex I contains 29% of the total number of data components and annex II 36%.

For calculating the reduction of the costs of INSPIRE due to the reduction of the scope, we assume that 25% of the costs are fixed and 75% vary proportionally to the number of spatial data components in the scope. This means that implementation of annex I spatial data represents 22%, of annex II spatial data 27% and of annex III 26% of the variable costs.

For assessing the benefits, we assume that annex I contributes to 20% of the benefits and annex II together with annex I to 75% of the benefits. This is justified when considering that annex II spatial data is more frequently used than annex III spatial data.

The annual cost of one full time equivalent person is estimated to 75000€ including all overheads. This estimation is based on information from the GINIE project showing the total cost per full time equivalent in Europe for the coordination of spatial information, including all the costs of the working credits involved in the coordination tasks.

6. THE INVESTMENT COSTS OF INSPIRE

Chaper summary:

For option 3, the investment needed are estimated at an average of €4.8-7m per annum per EU Member State (EU 25). At regional/local level, the average investment needed represents €60,000-94,000 per region of 250 000– 350 000 inhabitants.

For option 4, the investments needed are estimated at an average of €3.6–5.4m per annum per EU Member State (EU 25). At regional/local level, the average investment needed represents €45,000-70,000 per region of 250 000– 350 000 inhabitants.

Investments will to a large extent be borne by the public sector.

6.1. Data Harmonisation

As discussed in Section 3, the process of harmonisation needs to be viewed as a series of data harmonisation projects that over time refine and extend the first round of generic specifications to suit specific policy and analytical requirements.

For option 3, the full harmonisation requirements apply to all the spatial data sets covered by annex I, II, III. The Environmental Thematic User Needs Position Paper[29] describes in pages 81 and onwards several of the data components and gives examples of some of the data sets that would fall in each component.

For option 4, the full harmonisation requirements only apply to the annex I spatial data. Annex II spatial data has reduced harmonisation requirements. Annex III falls outside the scope of INSPIRE.

The process of harmonisation, as envisaged by the Architecture and Standards Working Group, focuses on the object level, i.e. the abstract representation of individual geographic features. It would therefore be appropriate to start focusing on those objects that are most frequently used. In respect to timing, this activity would start with those objects and themes that are already at least partially specified at the European level, and then move outwards to fill the gaps.

With these considerations in mind, the following is assumed:

- In the INSPIRE Internet consultation document, the 60 data components have been grouped according to 17 spatial data themes. For the purpose of harmonisation, these 17 themes can be grouped in 6 main super themes with a view to working on the common objects that are in most frequent use across domain. Reducing the scope of INSPIRE (option 4) would not decrease the number of super themes, although the harmonisation projects would become less costly, in particular in view of the preparatory R&D work planned in the context of the GMES initiative and the e-Content programme which are expected to focus on the option 4 scope of INSPIRE.

- For option 3, each of these 6 super themes will require 6 iterations, or data harmonisations, over a 10 year period to complete the specifications of all the objects relevant to the

[29] ehttp://inspire.jrc.it/

INSPIRE framework. Each data harmonisation project would cost in the region of € 750,000[30] and last 12-18 months, amounting to a total investment of **27 m € spread over a 10 year period**.

- For option 4, it is assumed that data harmonisation can largely build upon existing or forthcoming R&D work carried out in the context of national and EU-funded research programmes. The consolidation of this work would cost **6 m € spread over a 10 year period**.

This harmonisation work includes data modelling and applications schemas and the encodings necessary to ensure that data coming from different databases across Europe are displayed with common legends (portrayal). Furthermore, several existing data sets will have been part of the process of testing the specifications as they are developed and will therefore be already "INSPIRE compatible". We assume that these investments will be funded by the EC.

Member States and their organisations at national/regional/ and local level will be required to adopt these specifications for new data collections and updates. It is also expected that they will start encoding their existing databases to enable requests from web-enabled services to link to the INSPIRE specifications. This does not require changes in the existing database structures, but only adding a layer of encoding to increase the level of interoperability, thus capitalizing on past investment.

For option 3, the additional investment of such operations is estimated at 10% of the investments in the data harmonisation project or **€ 2.7 m p.a.** of which 70% is funded nationally, and 30% regionally/locally. For option 4, we reduce these investment needs with 26% for the spatial data that fall out of the scope of INSPIRE and with 21.6% for the reduced harmonisation requirements for annex II spatial data This yields **€ 1.7 m p.a** to be divided over the national and the regional level.

6.2. Metadata and catalogues

The standard to which metadata will need to be generated already exists, i.e. ISO 19115. Thus there are no additional INSPIRE costs to create the metadata standard, although an INSPIRE profile will need to be developed and cross-referenced to ISO 15836 (Dublin Core) which is widely use in e-government portals.

INSPIRE will require initially the creation of metadata to the INSPIRE guidelines for the data sets pertaining to the data falling within its scope. Some of these data sets already have relevant metadata associated with them. For the majority new metadata will need to be created. There will be a two-stage approach in most instances starting with discovery metadata first and moving then to fuller metadata in catalogues and services enabling interoperability. The creation of this latter type of metadata can also be embedded in the process of registering data sets to the INSPIRE services to enable interoperable network services.

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[30] These assumptions are based on experience collected in the US to specify the transport domain inclusive of some 20 data sets (US $500,000 over 12 months), and current experience in Europe based on OGC specifications. Given the multilingual and semantic complexity of Europe compared to the US, the costs have been increased by 50% to arrive at the sum above.

The SDI state of play project shows that across the EU, significant efforts have been and are undertaken to document spatial data, in particular for annex I spatial data. We therefore assume that 30% of the metadata for annex I data is already implemented and 10% of annex II data.

National agencies and organisations

The majority of the national data sets are held by four types of organisation:

- national mapping agencies:
- geological surveys;
- cadastral agencies; and
- environment agencies.

We assume that for INSPIRE with a broad scope (option 3), each organisation in each country needs 2-3 people full time equivalent for one year to document national data sets, to convert existing metadata, or to create new metadata. Taking into account the assumptions in relation to the metadata already in place, this brings the additional number of people needed for the metadata to 225-270 people across the EU 25. Assuming an annual cost of €75,000 per person, including overheads **this comes to a total one-off implementation cost of € 17-20m.**[31]

To determine the impact of a limited scope for INSPIRE (option 4), we first assume that part of the investment is fixed and relates for instance to the development of tools, to capacity building etc. The fixed cost is estimated at 25% of the total costs. Multiplying the variable costs with the proportion of the data that falls outside the scope of INSPIRE in option 4, the figures of option 3 need to be reduced with 25%, bringing the total one-off implementation cost to **of € 12-14.5m.**

Maintenance costs thereafter may be estimated at **€1m per annum** for option 3 and are reduced with the same proportion as above for option 4 (**€ 0.7m**). They include the translation of the metadata created into more than its native language.

Regional and local organisations

At regional and local level, where we assume that this documentation activity will be undertaken by 1700 or so organisations across Europe. We assume that for INSPIRE with a broad scope (option 3), 2 people full time will be required for a year in each organisation, giving a total of 3400 person years across the EU. Taking into account the assumptions in relation to the metadata already in place, this brings the additional number of people needed for the metadata at 3060 person years across the EU bringing the estimation of the one-off costs to **€ 230 m over a period of 10 years**.

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[31] These figures are consistent with those of the Environmental Agency in England and Wales who devotes already now € 1.5m per annum to data management, including 10 people full time on metadata, and another 20 on enforcing data standards, and managing the GIS data layers. This expenditure provides much more than discovery metadata. As an order of magnitude, this investment represent some 2% of the yearly expenditure by the Environment Agency on IT systems.

On the basis of the same assumptions for option 4 as for the national level, the one-off costs for option 4 amount to **€ 165 m over a period of 10 years**.

Given the lack of a culture of data documentation at the local level, INSPIRE ought to be considered to give rise to a share of the on-going maintenance costs, at least in the short-to medium run. We estimate these costs to be in the order of 10% of the one-off costs, i.e. some **€ 23m and € 16m per annum** respectively options 3 and 4, which is on average respectively €1m and €0.6m per Member State.

European Commission

For the European Commission, the estimated cost to develop the EU portal is estimated to a **€ 100,000 one off cost with another € 200,000 respectively € 150,000 per annum for maintenance and translation for option 3 and option 4**.

6.3. Data Policy framework

Given the framework outlined in Section 5 on what is involved under this heading, it is assumed that there will be no significant additional costs coming out of INSPIRE beyond the one-off costs of developing a shared understanding of the mutual value of agreed policy frameworks, and the technical instruments such as licensing that implement such frameworks in line with current EU legislation. This one off cost is assumed to be same for option 3 and option 4 and of the order of 2 full-time equivalent persons for 1 year per Member State i.e. € 150,000 X 25 = €3.7 m plus €1m for dealing with any barrier for harmonisation, bringing us to **€4.7 m.**

6.4. Coordination and implementation

Coordination and implementation require that a technical and administrative support is in place to ensure adequate support to the Member States, the stakeholders and the Commission to meet the INSPIRE requirements. In particular, this will need a coordinating and monitoring function to report on implementation, ensure that metadata is created, that data harmonisation projects are well managed and delivered, and that the translation, and clearinghouse services are developed and implemented. Coordination between stakeholders working together to achieve the set objectives, and a dissemination function are needed to ensure that the means are available to implement the data policy framework with respect to awareness, capacity building and demonstration of results. This function also includes the setting up and maintenance of web services and portals at EU and national levels. As the scope of INSPIRE will cover metadata, specifications, and application of data sets currently held nationally, locally and regionally, the coordination function will interact with the 1700 organisations identified above in addition to the national and EU levels.

From the state of play project, it becomes evident that across the EU a capacity for the coordination and implementation of national spatial data infrastructures starts to be put in place. It is assumed that this capacity will be used for the implementation of INSPIRE and will also serve the national needs. This capacity should be taken into account when considering the marginal cost of implementing INSPIRE in the Member States. It is assumed that 20% of the required capacity at national and EU level is already in place or would become available over the next decade without INSPIRE. At the local and regional level, relatively more efforts are needed and the capacity in place is assumed to be 10%.

For option 3, the following distribution of costs is therefore assumed:

- For the European Commission: the **annual cost is estimated to €2.2m**. These costs include the co-ordination of the data harmonisation process, the monitoring and evaluation of INSPIRE, the maintenance of the geoportal the co-ordination across the different policy sectors, and outreach measures to raise awareness and support capacity building.
- National coordinating structures and clearinghouses, including outreach: 2-5 people for small countries, up to 10 people for large countries, giving a total of 150 people. Adding the 50 people for outreach and support to regional/local levels gives a total of 200 people, of which 40 are assumed to be in place. This brings us to a total **annual cost of €12m**.
- Local structures and clearinghouses: assuming 1700 organisations and an expenditure of €37,000-75,000 (between 0.5 and 1 full time equivalent staff each) per annum each, gives an **annual investment of €57-115m,** assuming that 10% of the organisations have already this capacity in place.

For option 4, it is assumed that the variable part of the coordination and implementation costs (75%) decreases proportionally with the decrease of the number of data components. For the three levels referred to above, this yields:

- European Commission: the annual cost for coordination attributed to INSPIRE has been revised in the light of the consideration that at EU level the variable part will be a much more smaller proportion of the total costs. Therefore, the costs for option 4 are estimated at **€ 2.2 m. per annum**.
- National coordinating structures and clearinghouses, including outreach: taking into account that 25% are fixed costs and assuming similar coordination and implementation costs for annex I and annex II spatial data, the decrease of the scope will bring the **yearly investment down to €9.6m**.
- Local structures and clearinghouses: on the basis of the same assumptions as for the national structures, the annual investments are brought to **€ 44 – 88m**.

6.5. INSPIRE Summary of investment requirements

All investments are averages **on a per annum basis**. Where one off costs are considered they have been annualised over 10 years at 2003 costs i.e. without discounting.

Table 6.5: The Costs of Implementing INSPIRE (in million €)

OPTION 3

Blocks of INSPIRE policy measures	**EU**	**National Organisations**	**Regional/local**
Harmonisation	2.7	1.9	0.8
Metadata (including portal)	0.2	2.7-3	46
Data Policy Framework		0.47	
Coordination and implementation including outreach	2.2	12	57-115
Total investment per annum over 10 years (€m) (rounded)	**5.1**	**17**	**104-161**

For option 3, the investment needed are estimated at an average of €4.8-7m per annum per EU Member State (EU 25). At regional/local level, the average investment needed represents €60,000-94,000 per region of 250 000– 350 000 inhabitants.

OPTION 4

Blocks of INSPIRE policy measures	**EU**	**National Organisations**	**Regional/local**
Harmonisation	.6	1.2	0.5
Metadata (including portal)	.16	1.9-2.2	33
Data Policy Framework		0.47	
Coordination and implementation including outreach	2.2	9.6	44-88
Total investment per annum over 10 years (€m) (rounded)	**3**	**13**	**77-122**

For option 4, the investments needed are estimated at an average of €3.6–5.4m per annum per EU Member State (EU 25). At regional/local level, the average investment needed represents €45,000-70,000 per region of 250 000– 350 000 inhabitants.

It is important to clearly separate the impact of costs on different categories of stakeholders and the sources of funding for bearing these costs. This impact assessment does not prejudge the possibility that significant parts of the costs of implementing spatial data infrastructures at national or at regional/local level could be co-financed with EU budgets.

The order of magnitude of these investment needs is in line with recent experience in Italy with the implementation of spatial data infrastructures.

7. THE BENEFITS OF INSPIRE

Chapter summary: There are environmental, economic and social benefits of INSPIRE, ranging from efficiency gains, better policy-making and implementation, innovation, new products and services and social benefits. Only the environmental benefits have been quantified and amount to € 1 050–1 660 m for option 3 and € 680-1060 m for option 4. The beneficiaries from INSPIRE range from public authorities, to citizens, the private sector and research institutes.

7.1. Introduction

It is widely recognised in the few cost-benefit analyses undertaken of Spatial Data Infrastructure policies that the quantification of the benefits is particularly challenging. In particular, the following analysis of the benefits, whilst it is complete as was practical, is still only partial because:

1. Whilst some impacts are readily identifiable and monetisable (such as reduction in duplication of collection costs), often the provision of information is simply a means to different ends and those ends are often the result of many factors. In these cases, a complete identification and valuation of the benefits is impossible.

2. The following sections focus primarily on the potential benefits to the environmental sector. This does not mean that only this sector would benefit from INSPIRE. This initiative is cross-sectoral and will potentially benefit all the sectors with a strong spatial dimension, including agriculture, regional policy, transport, and spatial planning. (As an illustration, annex IV indicates a range of policies at the European level, which would be affected by INSPIRE, which then translate into national, regional, and local commitments.)

7.2. Qualitative description of the benefits

The qualitative benefits are similar for option 3 and for option 4, although they are expected to be more pervasive for option 3 than for option 4.

Two different sorts of benefits are identified: (a) benefits in terms of cost savings i.e. efficiency gains, enabling existing needs to be met more cheaply (these benefits accrue to both data producers and data users); and (b) benefits in terms of the ability of users to access and to use data in new and innovative ways increasing productive potential or improving the efficiency and effectiveness of policy responses.

7.2.1. Efficiency gains

Efficiency is seen both in respect of reductions in the cost of existing activities and the ability to do new things because costs are now lower. Since most existing activity is likely to be done within organisations, the visibility of the current costs of non-compatibility and non-availability is low. Secondary benefits may arise from the harmonisation of data sets in so far as less training etc is required to enable users to access and understand a wide range of data. There may also be improvements in quality.

Benefits arise separately from each of the different aspects of INSPIRE: interoperable specifications; access to metadata; data policy framework, and co-ordination. However, it is often difficult to split the benefits accurately between these different components.

1. Efficiency gains from data harmonisation

Interoperable specifications reduce the costs of combining data sets. The conversion of the data sets result in benefits accruing mainly to data users, not data providers. In the *absence* of harmonisation: some projects will require the expenditure of time and money in order to secure the one off conversion of one or more data sets; in other cases, work will not be done because the cost of data conversion is considered to be excessive.

2. Efficiency gains from harmonised metadata

Metadata produces more widespread knowledge of the existence of available data sets, so that:

a) some users are saved the cost of collecting data which they would otherwise have had to obtain anew (reduced duplication);

b) others find themselves able to pursue activities which would not otherwise have been worthwhile—in some cases wholly new outputs may be involved;

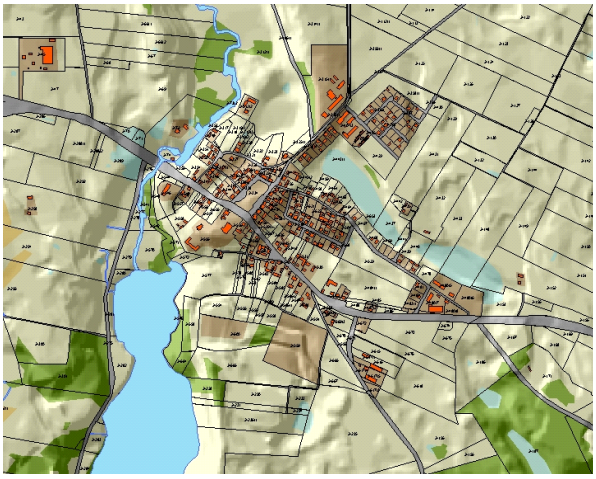
c) the collection of *new* data may now be viable since it can be combined with existing data to create an expanded set of services;

d) The ability to *discover* existing data sets reduces the barriers to entry in markets where "local knowledge" is a necessary condition for entry, which is a contribution to the single market (though this constitutes a wider benefit rather than an efficiency saving).

An example of the benefits of investing in metadata comes from a study by EuroGeoSurveys. The study found that the development of harmonised metadata and catalogues that required a total investment of some €7 m is benefiting the 22 organisations involved to the tune of some €7 m per annum in terms of better internal data management.

A further example of the type of savings that could be generated at the local level comes from Poland[32] is shown below, and is probably similar to thousands of other similar cases across Europe.

Figure 2: Balarzewo: Parcels, buildings and DTM



An example of the benefits that can be expected from having accessible metadata at the local level, comes from the community of Balarzewo, Northeastern Poland, pop. 3400, 123 sq km. As every municipality on Poland, it is required to prepare a planning study (structure plan) setting out its development strategy. To do so it contacted the Institute of Spatial Economy and Housing, in Warsaw, which decided to start off by contacting all the regional and national organisations which might have some geographic data relevant to the locality. To the surprise of the local community, it was possible to find some parcel level data and contour lines held at the regional level in an old database in DOS operating system. By converting this data into a modern GIS database it was possible in a few days to assemble parcels maps and land-owners, land-use, soils, geology and DTM (processed from contour lines). Total cost of data conversion € 1000. Estimated costs or data capture from scratch €50,000. The most astonished at the results were the "owners" of the original data who did not realize what they had and how it could be re-used

[32] Pawel Decewicz, Institiue of Spatial Economy and Housing

3. Efficiency gains from the data policy framework

The benefits of having simple user licences and access free of barriers at the point of use means that regardless of the financial practices of different Member States, users no longer have to negotiate through the maze of access conditions on an individual basis. This is often identified as one of the biggest barriers to GI development and use, but is also a highly intangible barrier and therefore very difficult to attribute benefits to. There are already examples of the way in which the different practices in Member States are becoming harmonised at the point of use which indicate the benefits of such a data policy framework. INSPIRE would speed up and facilitate this process. The examples include:

- In the Walloon Region, were all public sector organisations have free of charge access to the INFRASIG spatial data infrastructure;
- In Italy, where all signatories to the State-Region Agreement have similar free access;
- In Britain a recently signed pan-government agreement means that all 450 central government organisations have free access to the whole range of Ordnance Survey Great Britain data through a financial settlement negotiated centrally. Local government, the utilities, and academia in Great Britain already had similar centrally negotiated service level agreements.

Also in Britain, the outcome of negotiations between the Ordnance Survey Great Britain (OSGB) and the University sector means that a centrally agreed 5 year licence now covers all government-funded Higher Education institutions. This licence covers access to a selection of OSGB maps and data for teaching and research, including academic publication. The fact that the licence fee does not depend on usage is promoting increased volume of use and the reduction in administration costs has fed into significantly lower charges than would otherwise be the case.

The uptake of the service has steadily increased between 1999 (43 subscriptions) and 2003 (74 subscription) out of a total of around 160 institutions eligible to subscribe and has reached 17192 registered users. The service is now being experimentally extended to further Education institutions.

4. Efficiency gains from co-ordination

These benefits are the most difficult to quantify, but all the recent studies of SDIs across the Europe and a comparison with other parts of the world indicate that effective SDIs need more than simply strong legislation. They require long and sustained commitment, vision, and support to all the stakeholders involved to keep the project focused and build on the achievements.[33]. With this in mind, we have not put an estimate benefit to the coordination

[33] For example the GINIE study of SDIs (www.ec-gis.org/ginie) confirmed the crucial role of coordination in developing and sustaining these infrastructures. Using the US as an example, the Federal Geographic Data Committee (FGDC) which coordinates the National SDI performs all of the functions above with a staff of 15 and a budget of $ 3.6 million per year, of which approximately half is spent as seed money to support the development of metadata and related services and portals at federal, state and local level. Of importance for INSPIRE, is that even with an Executive Order of the US President, without the constant activity of the FGDC much of what has been achieved would have been dissipated by the pull of different organisations and agencies. Of note, as well, that a recent testimony of to the General Accounting Office has argued that a much greater effort is still needed to ensure that all the stakeholders are involved and that the objectives of the a more efficient use of GI are achieved.

element, but we have plenty of evidence to suggest that without this measure INSPIRE will fail to deliver its objectives.

Who benefits from these efficiency gains?

Efficiency gains accrue both to the public sector and to the private sector including citizens, NGOs, private sector, and research institutions. However, the benefits to business are particularly difficult to quantify because either the costs of poor data and poor access is usually hidden within organisations or the benefits will accrue in terms of new services. Examples include:

a) An internal audit by Shell indicates that 53% of New Frontiers Areas staff time was spent in searching for data, so the scope for efficiency improvements is obvious.

b) There are prospects for greater efficiency in the property and insurance industries, which are big users of GI data.

c) In Canada, in 1990, a number of oil and gas companies determined that their exploration geologists and geophysics spent more than 60 percent of their time searching for information and only about 20 of their time doing something useful with it. They created the Canadian Oil and Gas GIS (Canoggis), in essence a SDI to help them know what information is where, who owns it, and at what price. Canoggis reduced access costs by a factor of about 10 within three years of its creation. After implementation, the searching time fell from 60% to 20% and the using time increased from 20% to 60%.

Based on the comparison of amounts of data available in maps at national and regional/local level respectively, and assuming that the benefits of INSPIRE are proportionate to the volume of spatial data available to the user, we could consider that the distribution of benefits between the national, regional and local level are 1:30:100. However, taking into account that coverage at regional/local is patchier than at national level, we assume a distribution of benefits between national and regional/local level of 1:15. This is roughly the same distribution of costs of INSPIRE between national and regional/local level. But it should be noted that the balance will shift in favour of the regional/local level as the gaps at this level are filled in the future through other policy measures.

7.2.2. Better policy-making, policy-implementation

The wider benefits associated with the greater accessibility to harmonised spatial data sets across Europe centre on improvements associated with the availability of more consistent data and the facilitation of pan-European analysis which was previously impossible. The wider gains include:

- support of a wide range of activities related to environment policy implementation, such as:
  - environmental reporting,

  - environmental and other impact assessments,[34]
  - site and area selection,
  - establishment of management plans for specific sites or areas,
  - implementation of registration requirements related to territorial factors,
  - establishment of permits that need to take into account territorial factors,
  - notification requirements and public information,
  - establishment of monitoring networks;
- easier participation by NGOs and members of the public in public debates and decision making – in line with the UNECE Aarhus Convention principles on access to environmental information, access to decision-making and access to environmental justice;
- easier ex-ante evaluation of environmental policy, now an established practise for major Community policy initiatives;
- better monitoring and evaluation of environmental policies and their effectiveness, e.g. through the establishment of indicators that take into account the territorial dimension of the state of the environment or of the factors affecting it;
- support for more integrated policy approaches and policy coordination over different environmental themes and across sectors, as advocated by the 6th EAP;
- better integration of environmental protection objectives into other policies, through the use of information common to various sectors.

Case studies (see annex V) indicate something of the potential:

- The project which gave rise to the Wilderness Map is a good example of the benefit of increased consistency of national data sets. The Map may be used to analyse land use and cover across Europe with the particular objective of identifying areas that may warrant designation as SSSI's or national parks. Once completed the project will allow cheaper and easier access to information sources.
- The GETIS project brings together a large variety of cross-EU data (about infrastructure and topography to provide the basis for disaster management, especially flooding, scenario analysis.
- The EUROSION project uses a variety of existing data sets to produce a better understanding of risk associated with erosion. The result would be that some regional authorities will use the database as a tool to prioritise investments on erosion defence. More generally, the project is expected to produce a better understanding of the process of erosion, which should feed through into more efficient land use expenditures that do not try to resist natural dynamics.
- Policies that rely on integrated assessment such as the Water Framework Directive, the Noise Directive, the EIA and SEA Directives, the Structural Funds regulation will

[34] EIA and SEA, but also other assessment requirements in the context of numerous environmental legislative acts, e.g. risk assessments, effectiveness assessments.

significantly benefit from INSPIRE. A survey carried out for EIA and SEA point to benefits of 5.4% of the costs of these assessments.

International examples that support the benefits of an infrastructure like INSPIRE include:

USA

Federal Emergency Management Agency (FEMA)

FEMA staff performed an assessment of the benefits and costs of implementing the Flood Hazard Mapping Program (2001). This visionary plan for the future of the flood mapping program included:

- Completing the conversion of the 100,000 map panel inventory to a digital format;
- Conducting flood data updates for all flood-prone communities with inadequate or no floodplain mapping;
- Integrating communities, States, and regional agencies into the mapping process;
- Converting the maps to metric; and
- Improving customer service to make the maps easier to obtain and use, including electronic and digital printing and distribution.

FEMA considered only those benefits for which reliable data could be obtained. Three primary benefits were quantified: reduced potential loss of new homes; reduced potential loss of new non-residential structures; and reduced cost of map reviews due to the improved digital format, improved distribution and more complete mapping of road. The total cost of the modernization plan is $847.6 million. The total discounted benefits of the modernization plan are $175 billion - a benefit to cost ratio of over 200 to 1.

Fish and Wildlife Services

The US Fish and Wildlife Services National Wetland Inventory (NWI) now disseminates its digital wetland map files via the Internet. Before NWI started using the Internet to distribute digital wetland map files, they sold approximately 38,000 map files. Now, with access to a GIS and the Internet users have the ability to download and use the digital files of the NSDI. Since map files were made available over the Internet, over 1.35 million map files have been downloaded. At the average cost of $9.20 per map file, Internet users have saved $12.4 million by accessing NWI wetland map files online.

New York State

Members of the Legal and Data Coordination Groups developed a data-sharing framework, which became known as the New York State GIS Data Sharing Cooperative. The cooperative provides an arena to share data at no cost. By signing standard data sharing agreements, every member has access to every other member's data. Participants, or cooperative members, do not require data to join. Prior to the establishment of the cooperative, best estimates indicated that 800 to 900 GIS data sets were exchanged each year between data holders. In 1998, when cooperative member data was placed online in the New York State Clearinghouse, it resulted in 8,500 data sets being downloaded, valued at $2 million. In 1999, more than 98,000 data sets were downloaded valued at $7.8 million. In 2000, 280,000 data sets were downloaded valued at more than $14 million. In 2001, downloads approached one million.

The Netherlands

An overview of the costs and effects of the implementation of national project 'Space for Geo-Information' was undertaken[35]. All activities needed to implement the 'Space for Geo-Information' programme were systematically determined and their costs estimated based on available information sources and expert knowledge. The following costs were identified: technical implementation, co-ordination, legal adaptation and the purchase of hardware and software. The direct benefits (for example efficiency improvements for government and industry) and the indirect and external effects were distinguished and, where possible, quantified. The total costs of the project to strengthen the Dutch Geo-Information will be 79.6 million Euro (period 2003-2010). In the long-term, the yearly economical benefits are estimated to be higher than 1 billion Euro.

Italy

The growth of the Internet is making information cheaper and easier to obtain and in so doing revolutionising stakeholder involvment in policy debates. As a result NGOs and members of the public are increasingly obtaining the information they need to engage with policy makers, at all levels of government. It is difficult to be specific about the gains which might flow from the implementation of INSPIRE but it is worth noticing that online maps are particularly popular with the public. As an example, Nielsen Netratings reported that in April 2003 in Italy, the web sites with maps have had double figure increases in the number of hits. Specifically, mappe.virgilio.it is the leader in the field (473,000 visitors, + 40% since January 2003) followed by mappe.libero.it (332 thousand users, + 64%) then www.viamichelin.it (270 thousand, + 41%) and www.maporama.com (250 thousand, + 35%). So the benefits of increased availability of GI on line is clear.

7.2.3. New products and services: competition and innovation

There is a tendency to focus on the benefits of INSPIRE to the public sector. Yet there are good possibilities for gains by the private sector. Mention has already been made of possible efficiency savings, but equally important are business opportunities:

- for better and more accurate analysis of different European markets by commercial data users, leading to greater competition; and

- for the creation of new products and services by value added data providers and others.

If cross-EU data is easier to identify and to obtain, private sector companies will find it easier to compete outside the boundaries of their home market. Thus INSPIRE is likely to make some contribution to improving competition within the EU single market.

The main sectors in the economy using the INSPIRE data sets seem likely to be the utilities; the oil and gas industry; cable laying; the communications industry; the fishing industry; farming and forestry; mining, drilling, dredging and quarrying; tourism; surveying; architecture; engineering; property development; insurance. Businesses should be able to increase their international activity if they find it easier to obtain and process data for other locations (e.g., cable laying; surveying; architecture; engineering; insurance.) This is in

[35] This report is considered as an Appendix to the Letter of Interest of this project, submitted by the Netherlands Council for Geo-Information (RAVI) in 2000.

addition to improved access within national boundaries, which will also increase business opportunities.

There is widespread recognition of the huge changes in applications and in functionality that can be achieved by the application of IT to various geographical and other data sources. Businesses and research institutes will be able to expand the range of their activities.

There are many examples of GI applications, which could hardly have been envisaged in the days before data was available in digital form. Thus, in the UK a commercial value added reseller (Upmystreet) has developed a product which beings together a variety of separate local data sources in order to provide users with a one-stop shop giving them ready access to a range of information about given geographical localities. As a result some people will make considerable savings in time and effort in obtaining the information they need; others will use data that they would not otherwise have taken the trouble to collect.

It is not possible to identify in advance what new products and services will be facilitated by INSPIRE, nor is it possible even to indicate how important such gains might be in quantitative terms (i.e., as additions to GDP). We note the fact that public data has for some time now been much more readily available to all users in the USA, and also that data is generally available at no more than marginal cost (which is generally very low). There is little doubt that the scale of activity in the GIS industry is significantly higher in the USA. Whether the establishment of INSPIRE would trigger the same level of activity in the EU cannot be established here as there might be other factors involved. **It is reasonable to assume that the implementation of INSPIRE would contribute to more vibrant economic activity in this area.** This assumption is supported by the private sector's positive reaction to the INSPIRE initiative through the INSPIRE Internet consultation and public hearing.

7.2.4. Social benefits

The European Union has the aim of making Europe the 'most competitive and knowledge-based economy' by 2010. This will depend amongst other issues on the uptake of access to the Internet, but this is already at 40% of households and most countries provide public access to the Internet, for example, via libraries, internet cafes or internet kiosks in supermarkets. This wider access to the Internet has led to new initiatives aimed at increasing public access to data and information. Notable among these is the UN-ECE 'Aarhus' Convention, which has strengthened the links between access to information, public participation in environmental decision-making and access to environmental justice.

INSPIRE will ensure overall coherence and ease of use of the spatial data underpinning the information made available to citizens under the UN/ECE Aarhus Convention. The resulting better information of the citizen will lead to increased confidence in the accuracy and relevance of public sector information, leading to more engagement in the democratic process of environmental protection and, eventually, in other areas of government action. More specifically, in the environment field, INSPIRE will benefit citizens across Europe by:

- providing access to operational data and information held by public sector organisations to enable people to reach their own judgements about environmental issues in line with the first principle of the Aarhus Convention (Article 5) (and eventually other thematic issues);

- facilitating participation in environmental decision-making in line with the provisions of the second principle of the Aarhus Convention (Articles 6,7 and 8) as adopted in the proposed new EU Environmental Information Regulations;

- assisting in providing access to environmental justice, in line with the third principle of the Aarhus Convention (Article 9) and the European Convention on Human Rights

INSPIRE will also benefit citizens in facilitating access to high accuracy information about the environment that assists in making key decisions, for example, by making information about the environment in the vicinity of a house to be purchased. Examples of the kind of information relevant to purchasing a house, include the likelihood of flooding, whether or not the house was built on contaminated land, the proximity to sources of noise, or if there is a polluting or noxious industrial process nearby. INSPIRE will enable such services to be provided by the public or private sector, so that decisions on whether or not to purchase can be made with full knowledge of the environmental risks. When extended to other sectors, INSPIRE will eventually help provide a range of information relevant to house purchases, such as transport, health care, education facilities, shops, etc that will directly help raise the quality of everyday life for the people of Europe.

INSPIRE will also enable public sector information to be exploited by the private sector, in line with, and complementing the provisions of the Directive on the Re-use of Public Sector Information. INSPIRE will enable the private sector to 'discover' public sector data, thereby stimulating the creation of added value services useful to the public. INSPIRE will furthermore allow the private sector to publish their data along with the public sector data, provide to public and private organisations a wider choice of data to underpin their activities.

Furthermore, these impacts will undoubtedly lead to the creation of new high-quality employment, as has happened in the US[36].

7.3. Quantitative assessment of the benefits

Whilst previous examples have illustrated the benefits from INSPIRE like initiatives, the following sections try to quantify and monetise the additional benefits of INSPIRE compared to the 'do-nothing' baseline. It is recognised that many of the qualitative benefits set out above cannot be described in quantified terms. Whilst all impacts are ultimately tangible, the improved provision of information often results in those impacts to manifest themselves in unforeseeable ways.

Differentiating between option 3 and option 4 for the benefits is more tricky than for the costs. For most of the benefits quantified below, we have used for this purpose the following assumptions.

Most of the benefits accrue by combining annex I data with annex II data. We assume that Annex I in isolation of annex II data contribute to 20% of the total benefits. Annex II in isolation does not give rise to significant benefits, but combined with Annex I data would contribute to 75% of the total benefits, if both annex I and II data would be fully harmonised. As this is not the case for option 4, we reduce the contribution of Annex II benefits by 20%.

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[36] A study on the Commercial exploitation of Europe's public sector information (Pira International Ltd., 20 September 2000) suggests that the US information market is between two and five times that of the EU and that 35% of this EU market concerns geographical information.

These generic assumptions are used to calculate the reduction of the quantified benefits of option 4 compared to those of option 3, except for those benefits where it is obvious that they fully result from the availability of annex I and II spatial data only.

The section below quantifies the benefits for option 3 only. The results of applying the above assumptions for the quantitative benefits for option 4 are presented in chapter 8.

7.3.1. Efficiency gains

Environmental impact assessment

INSPIRE is likely to be of particular use to organisations, both in the public and the private sectors, which carry out Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs).

Recordings of the number of EIA and SEA's of Member State expert suggest that 10,000-19,000 EIAs and 3000-5000 SEAs are carried out every year in the EU-15. A questionnaire of the Commission's services of EIA and SEA experts operating in the EU-25 suggests that the average cost of preparing EIA and SEA reports is €73,000. Thus the total cost for carrying out these environmental assessments in the Member States ranges between €950-1,750m. The same survey reveals that problems related to the access and use of spatial data increase the costs of EIA and SEA studies by, on average, 5.4%. If these costs could be removed savings of €50-95 m per annum could be achieved.

The survey suggests that problems related to the availability, quality and use of spatial data increase the time needed to produce EIA and SEA reports on average by 8%. Since the average time for preparing these reports is six months, this would save on average two weeks per EIA or SEA. In order to provide a conservative response, we assume that all these time savings have been included in the overall savings given above. The benefits which are expected to result from the INSPIRE initiative are, therefore, very likely to represent an underestimation and to become more important in the future. For this reason, we work with figures taken from the top end of the above range, given a rounded saving of **€100 m per annum.** These savings represent an underestimation as they do not take into account the increase of SEA's due to the entry into force of the SEA Directive in 2004 and only take very partial account of the EIA's that take place at regional and local level. For a number of countries, it is judged that the estimates of the number of EIA's should at least be doubled. Therefore, the total savings could run **up to € 200 m per annum**.

Environmental monitoring and assessment

The costs of monitoring and assessment of the environment in the pursuit of environmental policy are in the UK some €160m a year. If this expenditure us grossed up over the EU-15 as a whole (pro-rata to GDP), the total is some €1bn. Without INSPIRE much of the monitoring data collected for the primary purpose of monitoring compliance against discharge limits or environmental quality standards would remain costly or impossible to combine for secondary environmental assessment purposes, largely due to inconsistent specifications of data or systems. It would also remain difficult to combine different data for reporting on the state of the environment at a regional, national or international level. Based on similar experience from many organisations, the estimated efficiency improvements arising from harmonisation, consistent metadata, more efficient data handling, and increased quality would lead to efficiency gains of at least 10%, which would be worth **€100 m per annum**.

Environmental protection

Industry across the European Union spends an estimated €33bn per annum on environmental protection measures[37]. A reasonable estimate is that 10% of this total spending relates to data handling, primary and secondary use. The need for investment in mitigation or prevention measures are often based on the results of environmental risk assessments (ERAs) of the discharges arising from industrial installations to air, water and/or land. Data required to carry out ERAs of discharges is often lacking, requiring very expensive data collection campaigns. Assuming a 5% efficiency gain from INSPIRE being in place by making environmental data of known location, quality and specifications readily accessible, that would be worth €150 m a year.

Also the public sector makes significant expenditure on environmental protection measures. As an example of this expenditure, it is estimated that the cost of implementing the Directive 2002/49/EC, relating to the assessment and management of environmental noise, is of the order of € 10-15 million per annum for conurbations and € 15 m per annum for the 150 airports in Europe, totalling € 25-30 million (Cost study on noise mapping and action planning", COWI report P-44581-W, 1999). Another example relates to reporting. The cost of the administration and reporting of the implementation of the Water Framework Directive in England and Wales alone in the order of € 15 m per annum with similar costs pro rata for other European countries. A conservative estimate that another € 150 m a year can be saved due to improved reporting and monitoring, leading to **€ 300 m a year total savings**.

EC projects

Estimates from EUROSION suggest that additional costs of €285,000 have been incurred because of the lack of good metadata, dissemination mechanisms, and restrictive access conditions, which have caused delays in the project and required the ultimately that downgraded data had to be used so that it could be released by the project owners. The economic costs of this represents some 13% of the database costs of the project, but there are also potentially negative policy implications by the use of downgraded data. In addition, lack of provision for continued data curation and preservation often means that data produced during a project is lost to future projects in the same work area. This experience is common among EC (and national) projects. It would be reasonable to consider that the EC would save between 5-10% of its project costs through better data management, and by not funding parts of projects that require the collection of data already existing.

A list of other projects that would benefit from INSPIRE includes: GMES (€380m); Forest Focus (€90m); Land Parcel Identification system (€300-500m); ESPON (€12m); and CLC/IMAGE 2000 (€10m) (the figures in brackets represent the expenditure on each). This gives a total expenditure of €800m-1.3bn. Data harmonisation would significantly increase the efficiency of these investments. Even assuming a low 5-10% savings, this would be worth **€40-130m or (rounded) €5-15m per annum over 10 years.**

It is important to note that there are many more projects across the EC that would benefit from INSPIRE. For example the GALILEO programme which represents an investment by the Member States, and industry of several billion Euros will need the terrestrial infrastructure

[37] Environmental protection expenditure by industry in the European Union", Eurostat, Statistics in Focus Series, Theme 8 14/2002

provided by INSPIRE to deliver the benefits expected. While the economic assessment of these benefits has yet to be developed, it is worth nonetheless bearing in mind that the ones identified above are only a very small part of the total across all thematic sectors. The potential efficiency savings would be **many millions € per annum.**

Adoption of the environmental acquis

EU accession countries are undertaking at the present time major efforts to align their legal framework to the Community *Acquis*, of which environmental legislation is one of the most difficult areas. The estimated cost of adopting the Environmental *Acquis* is €80-110 bn over the next 10 years, or €8-11 bn per annum[38]. A reduction in these costs of 5% would be a reasonable assumption. Taking a conservative approach, 0.5% savings, would be worth **€50m a year**. The anticipated benefits should come from efficiency gains when implementing environmental management, monitoring and reporting in the accession countries. Some accession countries like Poland and Hungary recognise this and are planning or preparing the implementation of components of spatial data infrastructures.

Benefits from Extension of INSPIRE to other Sector Themes

Although the emphasis throughout this assessment is on the environmental sector, it may be useful just to give an example of another sector that could benefit from INSPIRE. Network investments make considerable use of GIS. Thus if an improvement in information reduces the costs of the EU programmes there could be significant efficiency savings, e.g. between 1993 and 2000, the European Investment Bank has financed TENs transport projects with a total cost of € 144 bn, approving loans for € 43.6 bn of which € 30.5 bn have already been signed. In the Accession Countries, the EIB has signed transport infrastructure loans for € 5.8 bn (source EIB, 2001). If even only 1% of these investments could be saved for example in the analysis stage of evaluating the environmental and economic impacts of these projects, that alone would be worth **€1.4 bn, or € 140 m per annum.**

Duplication of data collection

Data collected for environmental purposes can be useful both for the environment and for other sectors. For example[39] the first CORINE Land Cover inventory for EU15 and AC10 is made available at marginal costs for non-commercial use by the EEA at small scale, but the larger scale data is only made available by each contributing institution at national or regional level with widely different conditions. As a result, an industrial user in Germany who needed land cover data for Germany and for all its neighbouring countries to develop a mobile phone network was obliged to address each neighbouring country individually and start negotiations for access to the data. Because of difficulties caused by the lack of a spatial data infrastructure, the user eventually decided that it would be more cost/time effective to simply duplicate the work already done at national level by the different countries. Costs of CORINE land cover mapping for Germany are estimated around 2m €.

Approximately 5- 10 % of > 500 requests per year received by the EEA for the reuse of CORINE data could not be solved and are potential cases for duplication of work similar as described above. The cost for producing CORINE land cover for EU25 is 25m €. **25m €**

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38 COM(2001)304 Final

39 based on information from the EEA Information Centre

therefore represents a reasonable estimate of annual duplication cost for land cover data. The SDI State of Play project conducted by the Commission reveals that similar duplication also occurs for other spatial data sets[40] and for other sectors in most of the EU 25 countries[41]. Given the huge costs of spatial data collection, potential saving are very important and **assuming that 250m € per annum can be saved in the EU25 due to reduction of data duplication is rather conservative (see also section 6.2.1. part 3).**

7.3.2. Better policy-making, policy- implementation and innovation

A central hope for INSPIRE, focusing as it does on spatial and environmental information, must be that, as a result, policy making in the EU as a whole will be improved. The main policy areas seem likely to be—the environment; water resources; transport; communications; and (possibly) waste; agriculture; energy; public safety. Better information and sharing of information is recognised as central to the delivery of the 6th Environmental Action Programme (6th EAP) and in particular to the thematic strategies that have been launched by the 6th EAP.

There are two ways to approach the quantification of benefits: either we can start with a measure of the total current expenditure within the EU on the policy-area in question; or, where this is possible, we can look at estimates of external damage costs, on the European society, economy or the environment which policy making seeks to address, e.g., the cost of residual damage to the environment or to health from harmful emissions to air; the costs of water resources mismanagement (droughts and floods).

Annual expenditure of consumers of environmental goods and services within the EU25 - i.e., on environmental goods and services whose purpose is to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems - totals about € 200 billion.[42] We may assume that the environmental improvement achieved is at least as large as the expenditure. Any improvement in the delivery of environmental policy could therefore be extremely valuable.

Risk prevention

A major area that would benefit from the implementation of INSPIRE relates to the prevention, preparedness and response to natural, man-made and other risks and the improved prevention of natural disasters, many of which have social underpinnings (e.g. development in flood-prone areas, deforestation, and so on). Within the EU-15 the relative importance of a number of most frequent types of natural disasters is illustrated by Figure 7.1.

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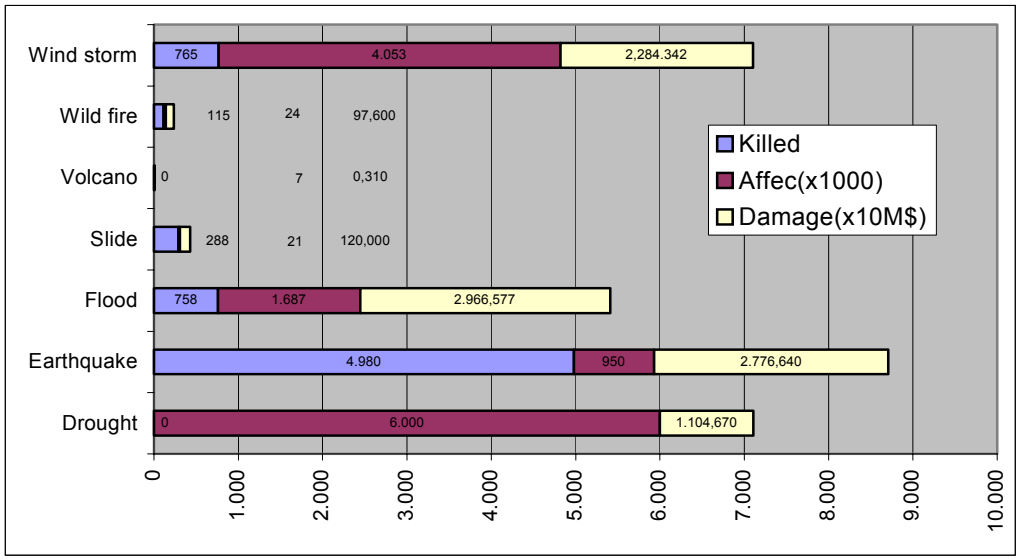
40 Examples are spatial data sets related the data components Addresses, Terrestrial Elevation, Orthophoto-imagery and data, Transport networks, Transmission lines and pipelines, Government service facilities, Trade and service facilities, Settlements, Human health and safety, Surface water bodies/ Hydrography networks, Habitats and biotopes, Species distribution, Water resources and Forest resources

41 In almost all of the 8 countries where a detailed examination of the situation with SDI took place, duplication of data collection has been reported.

42 Source: **Analysis of the EU Eco-industries, their employment and export potential**, a study by Ecotec Consulting Ltd. Available in the Industry/Employment section of http://europa.eu.int/comm/envionment/enveco/studies2.htm. Figure updated to 2003 prices.

Figure 7.1:Relative Impact of Natural Hazards in EU 15 – 1980-2001 (OFDA/CRED)



Source: The OFDA/CRED International Disaster Database (**EM-DAT: The OFDA/CRED International Disaster Database - www.cred.be/emdat - Université Catholique de Louvain - Brussels - Belgium-)**

The figure indicates damage costs of the order of magnitude of $ 80-100 bn over a 20 year period with over 5000 deaths and some 12 million people affected. Development pressures in Europe, combined with the effects of global warming, are poised to increase the extent of effects in the future. As an example, some very preliminary estimates indicate damage amounting to € 15 bn in Germany, €2 bn in Austria, € 2-3 bn in the Czech Republic and up to € 35 m in Slovakia due to the 2002 flooding (EC internal document).

While much work is needed to integrate risk prevention, mitigation and preparedness throughout the environmental management and planning process, it is important to recognize the potential contribution of early warning and rapid response information systems to this area.

If GMES and INSPIRE had been in place in 2002, it is likely that:

- impact scenarios, using modelling based on the various INSPIRE components could have been developed, and mitigation measures taken well in advance, hence, strengthening prevention;
- the preparedness of the civil protection and other competent authorities would have been better, potentially resulting in less loss of life and less deployment costs, i.e. there would have been a more efficient emergency response;
- the costs for recovery/reconstruction could have been reduced or at least the rebuilding would take into account the scenario outputs, hence, avoiding the extensive use of the precautionary principle.

A reasonable estimate of the savings possible would be 2-4%. Combining this with a conservative estimate of € 6-10 bn per annum of potential damage across Europe due to natural hazards, would result in savings of **€120-400 m per annum** and, crucially, lives saved.

Health and environment policy

Better information is at the basis of the approach advocated by the European Health and Environment Strategy[43], allowing the development of new policies that reduce the impact of environmental pollution on health.

Such new policies could, for example, improve the identification of those at risk of asthma and target measures to reduce those risks or 'hot spots'. Across Europe, it is estimated that 10% of children have asthma, with an annual welfare cost, in terms of discomfort, lost schooldays, inconvenience to parents, estimated to cost €5 bn for the UK alone. If this figure is grossed up across the EU-15 (pro-rata to GDP), the total annual cost might be € 35 bn. Even a 1% improvement in policy delivery due to INSPIRE would be worth **€350m a year.**

A study by ECOTEC[44] of the benefits of compliance with the Environmental Acquis in the Accession countries indicated that fully implementing the EU Directives on air quality can lead to 15,000-34,000 fewer cases per year of premature death from exposure to air pollution and between 43,000-180,000 fewer cases of chronic bronchitis. When taken all together the annual benefits of implementing EU environmental legislation range between € 12 and 69 bn. Again if INSPIRE can contribute to the more efficient achievement of a small portion of these benefits, or an increase in them, it will be extremely significant. These are over and above the efficiency savings.

8. BRINGING THE INVESTMENT COSTS AND BENEFITS TOGETHER

Chapter summary: INSPIRE would only represent to 1% or 2% of the total expenditure on geographical information over the period as a whole, depending on the option chosen. Costs would be front-loaded, and for both options, the benefits outweigh the investment requirements by a considerable amount. Public authorities will bear both costs and benefits whereas the citizens and the private sector will be mainly beneficiaries.

8.1. Comparing quantitative costs and benefits

The sections above have identified three elements in a cost-benefit calculation: the investment needed by data providers and data users in meeting the requirements of INSPIRE; benefits in the form of increases in the efficiency with which data is either produced or used as a result of INSPIRE; and the benefits related to better policy-making and innovation. These elements are brought together in the following table.

[43] COM (2003) 338

[44] ECOTEC 2001: the Benefits of Compliance with the Environmental Acquis, Service Contract for DG ENV B7-8119/2000/159960/MAR/H1

Table 8.1: Summary—investment requirements for INSPIRE (all figures €m)

OPTIONS 3 and 4

Blocks of INSPIRE policy measures	**EU**		**National Organisations**		**Regional/local**	
Options	**3**	**4**	**3**	**4**	**3**	**4**
Harmonisation	2.7	.6	1.9	1.2	0.8	0.5
Metadata	0.2	.16	2.7-3	1.9-2.2	46	33
Data Policy Framework			0.47	0.47		
Coordination and implementation including outreach	2.2	2.2	12	9.6	57-115	44-88
Total investment per annum over 10 years (€m) (rounded)	**5.1**	**3**	**17**	**13**	**104-161**	**77-122**

No attempt has been made to make any precise allocation of investment between Member States or between regions, but, taking the higher estimates of €160m and €122m per annum for the regional level and dividing it equally between 1700 local/regional entities, gives an average annual cost of respectively € 94,000 and € 70,000 per region over 10 years for options 3 and 4 of INSPIRE.

The cost of INSPIRE may be compared with a base expenditure on INSPIRE-related data which may be roughly estimated at about €5bn a year. (A study by PIRA[45] gives an estimate of total annual investment in all Public Service Information of nearly € 9.5 billion. This includes financial and business information and other non-INSPIRE information, but 40-60% of the total seems to be GI. It is clear, however, that the PIRA coverage of environmental data is incomplete covering, for example, only government expenditure and excluding organisations such as the England and Wales Environment Agency.) The figure of 5bn. may in fact be an underestimate as figures quoted by Rhind (2001) indicates that the expenditure for GI in the US was in the region of $ 4 bn per annum at federal level and $ 6 bn per annum at State and local level, hence a total of $ 10 bn per annum. Given that European data is by an large of higher detail and quality, it is not unreasonable to assume that the European expenditure maybe no less than what is spent in the US. **This would suggests that INSPIRE would only represent to 1% or 2% of the total expenditure on geographical information over the period as a whole, depending on the option chosen.**

These costs may then be compared with efficiency improvements; reductions in waste due to unnecessary duplication; and wider benefits. It is suggested that savings equal to the necessary €120-160m a year could quite easily be achieved—the cost savings and duplication savings would need to equal, or exceed 1% or 2 %, of the current base expenditure on INSPIRE-related data. Equally, the effectiveness of environmental policy would have to improve by only 0.1% to produce a reduction in environmental damage broadly equivalent to the €120m or €160m.

[45] Commercial **Exploitation of Europe's Public Sector Information**, Final Report for the European Commission Directorate General for the Information Society, PIRA 2000

The section on benefits includes a number of estimates, though many of the benefits remain to be quantified. Table 8.2 summarises the quantified benefits (i.e. the figures in **bold and underlined** in the benefits section) for both options 3 and 4.

Table 8.2: Quantified benefits (all figures €m per annum)

Type of benefit	**Quantitative estimate (option 3)**	**Quantiative estimate (option 4)**
More efficient EIAs and SEAs	90-190	60-121
More efficient environmental monitoring	100	64
More cost-effective expenditure on environmental protection	300	192
More cost-effective implementation of the environmental *acquis*	50	32
More effective implementation of EC projects	4-13	3-8
Reducing duplication of Land Cover Data collection	25-250	25-160
Improved delivery of risk prevention policies	120-400	77-256
Improved delivery of health and environment policies	350	224
Total	**1 050–1 660**	**680-1060**

Summing the elements quantified gives for option 3 a **total of €1.2 to €1.8bn annual benefits by 2014 against an average annual investment of €160m. Knowing that these elements only represent a partial view of the whole picture, the conclusion is that the benefits outweigh the investment requirements by a considerable amount**.

Option 4 yields a total of €70m to €1150m after 10 years against an average annual investment of €120m.

8.2. Phasing of costs and benefits

Like any infrastructure project, the costs will be front-loaded because they are needed to build the infrastructure, and connect those elements that already exist. Once the infrastructure is in place, the cost will diminish significantly because what is needed is maintenance and gradual expansion. In addition, there are specific costs relating to INSPIRE which are one-off with respect spatial data sets (e.g. producing harmonised spatial data specifications and translating existing data sets to the new specifications) which, once incurred, do not reoccur. However, the benefits, in terms of interoperability, continue for many years, if not for ever. As a result, although the investment in INSPIRE need to start straight away and the benefits only start to accrue during the implementation period, by the end of this period (2014) the savings generated by the use of the INSPIRE infrastructure will more than pay for the on-going maintenance costs.

It is likely that extending INSPIRE to other policy themes would require only a modest increased investment, but lead to equivalent benefits to those in the environment sector. This is because the INSPIRE infrastructure would already be in place. It would simply be a matter of extending the list of data themes to include additional types of spatial data.

8.3. Winners and losers

The investment needs of INSPIRE will to a large extent be borne by the public sector whereas most categories of stakeholders stand to gain as a result of the implementation of INSPIRE:

- *Regional and local authorities:* one of the largest impacts of INSPIRE will occur at the regional and local level, which is the level where many Community policies, in particular in relation to the environment, are implemented or having their effect. As INSPIRE will take into account the available information and needs at local and regional level, regional and local authorities *a*s a group will attract most of the benefits but will also need to make the largest investment in INSPIRE. However, the required investments at the regional and local will be lower than if INSPIRE would not be in place, due to increased funding opportunities, to the opportunity refer to established specifications and due to support that will be provided in the context of the implementation of INSPIRE. As users of data sets partly collected internally and partly provided by third parties, the benefits to regional and local authorities arise from avoiding duplication; increased efficiency of locating existing data; and increased efficiency by using data that is available when carrying out public tasks (in the absence of the metadata, such data would be not be used and the public tasks would be carried out without it). Moreover, the investment made to build the INSPIRE infrastructure will also support the delivery of e-government services, and therefore yield wider benefits.

- *National authorities and data providers* will be beneficiaries in terms of gains in efficiency and in terms of the potential for improvements in policy performance. They will however also have to attribute the necessary resources for making INSPIRE happen. Whether authorities or providers are net contributors or beneficiaries will depend on a number of factors, e.g. the extent to which the organisation is both user and producer, the degree of harmonisation already achieved etc.

- *Citizens, private sector data users, research institutes:* these stakeholders will be mainly beneficiaries of INSPIRE. The benefits for these organisations arise from having (potential) access to existing data. Private sector data users and research institutes will reduce their search costs and reduce costs of data collection, even if they do not expand their output. Private added value resellers will find it easier to develop new services, to the benefit of the society as a whole.

- *Also EC and international bodies* are likely beneficiaries since INSPIRE will reduce the costs of analysing pan-European information for policy making and policy implementation purposes, but will need to invest in the delivery of INSPIRE and in the support and monitoring of its implementation. Academic institutions (and similar) are also likely to be beneficiaries.

It should be noted that investment needed for INSPIRE will not be distributed evenly over the Member States. Some Member States, like the UK and the Netherlands, are further advanced in building their spatial data infrastructure than others and the same is truth for the accession countries.

9. POSSIBLE WIDER DISBENEFITS AND RISKS

Consideration needs to be given to whether there might be any possible adverse effects of INSPIRE. Such potential adverse impacts might include: confusion as a result of the imposition of external requirements; increased bureaucracy; market distortion, unfair competition, and so on.

No attempt has been made to assess the likelihood of these disbenefits. All that can be said is that policy-making and implementation should be conducted in the light of these possibilities, and so should seek to implement policy in ways which do not give rise to these costs.

Implementation of INSPIRE also has inherent business risks, which need to be managed carefully in order to optimize INSPIRE's benefits. Important challenges will be achieving a shared understanding of the mutual benefits of harmonised policy frameworks, the organisation of direct funding for the INSPIRE initiative, the consistent implementation of INSPIRE across the Member States, the engagement of the thematic stakeholders and the availability of skills at the local level. These and other risks to INSPIRE implementation are summarised in Table 9.1. They can be limited by adopting a more progressive approach to INSPIRE.

Table 9.1: Risk log for INSPIRE

Number	Risk	Probability	Impact	Counter Measure
1.	Finance not available to implement INSPIRE across all Member States	H	H	Binding legislation needed Make use of existing funding sources, e.g. GMES, Structural Funds Ensure that INSPIRE has sufficient funding, limit scope of INSPIRE. Option 4, as a more focussed version of Option 3 with lower up-front costs, was itself developed as a counter measure to reduce this risk of capital constraints not leading to INSPIRE being implemented.
2.	Emerging technology timescales not in line with proposals	L	M	Technology is already proven
3.	Other sectors ignore INSPIRE	H	M	Binding legislation needed, MOU between Directorates and adopt stepwise approach
4.	Unharmonised implementation of INSPIRE	M	H	Binding legislation needed, Closely monitor INSPIRE implementation and adopt corrective measures in case of problems
5	Only partial engagement of thematic stakeholders in INSPIRE	H	H	Binding legislation needed, Build up solid co-ordination and outreach measures
6	Lack of agreement on policy frameworks	H	H	Binding legislation needed
7	Lack of skilled personnel at regional and local level	H	H	Dedicated measures for education and training required. Option 4 was developed as a more focussed version of Option 3 to reduce the risk of such capacity constraints.

10. HOW TO MONITOR AND EVALUATE THE RESULTS AND IMPACTS OF THE PROPOSAL AFTER IMPLEMENTATION?

This is clearly a critical component that will be addressed by provisions for monitoring and reporting. Given however, the complexity of measuring the impacts of initiatives such as INSPIRE, and the dearth of reliable data on this subject across the world, it would be worth considering a specific INSPIRE accompanying measure, possibly to be funded through the Framework 6 R&D Programme, that brought together some of the key stakeholders with representatives from data producers, users, research, and a sample of national and regional governments, to monitor the incurred costs and benefits as they happen through the implementation of INSPIRE. This would provide a much-valued set of information and data to evaluate impacts, and support further impact assessments in related fields.

11. STAKEHOLDER CONSULTATION

The extended impact assessment was carried out by closely involving key stakeholders through the INSPIRE FDS working group and extended impact assessment task force. In addition to the information provided by the previously established working groups, the FDS working group has brought together a wealth of case studies and expert views on the basis of which the extended impact assessment was drawn up.

The INSPIRE FDS Working Group issued questionnaires with targeted questions on the impact of INSPIRE to specific user groups including the other INSPIRE Implementing strategy working group, the research community (AGILE), the private sector and local/regional administrations.

Furthermore, the INSPIRE State of Play project held face-to-face interviews with key stakeholders in 8 countries where impacts of INSPIRE have been discussed.

All this was taken into account in formulating the extended impact assessment.

INSPIRE Internet consultation

During 2002, the development of INSPIRE has been discussed in several INSPIRE working groups. Input from these groups[46] has been discussed by the INSPIRE Expert group and has been consolidated into an INSPIRE Internet consultation document[47].

The Internet consultation took place from the end of March 2003 until 6 June 2003. The INSPIRE Internet consultation document listed the issues that are addressed in the Extended Impact Assessment.

Public hearing

In addition to the Internet consultation on the proposed INSPIRE policy measures and in addition to the regular consultation of the INSPIRE expert group, the contribution of the dedicated INSPIRE working group was made available as input to a public hearing in which

[46] See Position papers in http://inspire.jrc.it/

[47] See Internet consultation in http://inspire.jrc.it/

39 persons took part. This contribution covered the assessment of the impact of the establishment of a broad framework for INSPIRE.

The following comments related specifically to the extended impact assessment of INSPIRE, of which the methodology and quality were otherwise supported: the costs of metadata collection are over-estimated, the significant benefits of INSPIRE for the property market have not been analysed, there is too much focus on public sector data and there is no breakdown of the benefits across the different levels of government.

The remarks on the over-estimation of certain costs have been taken into account by considering the new information that became available in the context of the SDI State of play study[48] and the results of the GINIE project[49]. The remarks on the partial assessment of the benefits are addressed by emphasising more clearly that the quantitative assessment of benefits does not present the whole picture. The remark on the focus on public sector data has been taken into account in the formulation of the INSPIRE proposal for a Directive. The remark on the lack of breakdown of benefits across the different levels of government has also been addressed.

12. COMMISSION DRAFT PROPOSAL AND JUSTIFICATION

What is the final policy choice and why?

Comparing option 3, the broad framework, to option 4, the focused framework, the benefits outweigh for both options the investment requirements by a considerable amount. For option 3, the benefits but also the investment needs are significantly higher and option 3 would require significant more coordination efforts between INSPIRE and the thematic policies than option 4. Option 4 represents therefore the more progressive approach to the implementation of INSPIRE with a review clause allowing to take the next steps by building upon the experience of the first and takes more into account budgetary issues. Moreover, the cost/benefits balance is more favourable for option 4 than for option 3, which is logical as option 4 covers the spatial data sets used most frequently. Option 4, the focused framework is therefore recommended.

The proposed policy, a proposal for an INSPIRE framework Directive follows the recommended option presented as option 4 in the extended impact assessment. It addresses four of the key obstacles that prevent the widespread use of spatial information for good governance: lacking documentation, spatial data sets not compatible, incompatible geographic information systems, barriers to sharing and use. The proposal is complementary with the GMES initiative that addresses the fifth obstacle and a number of other issues that deal with the use of the spatial data infrastructure to support environmental and security policies. The proposed policy takes into account the results of the impact assessment and the outcomes of the various consultations that have taken place.

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[48] Spatial Data Infrastructures in Europe, State of Play Spring 2003, August 2003, http://inspire.jrc.it

[49] GINIE: Geographic Information Network in the wider Europe (IST-2000-29493), October 2003. http://www.ec-gis.org/ginie/

Why was a more/less ambitious option not chosen?

Less ambitious options, such a voluntary approach or only implementing some of the proposed measures would not allow to achieve the objectives of widespread sharing and reuse of spatial data. For instance, a proposal that would only deal with the obstacle of lacking documentation by establishing a EU wide metadata catalogue network would have a high risk of not being sufficiently used because of the existence of other important obstacles that prevent the use of the data, such as the inability to view the data or prohibitive data policies.

The option of extending the scope beyond the priority data identified for option 4 has not been taken to limit the budgetary impact of the proposal on the Member States and to take a more progressive approach to the implementation of INSPIRE by considering further action only after experience has been gained with the first step.

Even more ambitious options that would for instance establish a framework that addresses the problems in a more comprehensive way and include requirements for data collection) or that would be more prescriptive when laying down how to implement infrastructures for spatial information can at this stage not be justified on cost/benefit grounds and are therefore not proposed.

Which are the trade-offs associated to the chosen option?

The most important trade-off is (mainly) medium term public investment against longer term public sector and wider benefits, both in qualitative terms and in terms of savings.

If current data or knowledge are of poor quality, why should a decision be taken now rather than be put off until better information is available?

A lot of data and knowledge were gathered during the preparation of the proposal, through for instance the work of the INSPIRE working groups, the Internet consultation and the "State of play" project. Further delays would not lead to major new insights that would significantly affect the proposal. Building an infrastructure for spatial information is a long term initiative that anyhow need to be implemented in a step by step manner. Every step taken will provide new data and knowledge that will help the further steps.

Have any accompanying measures to maximise positive impacts and minimise negative impacts been taken?

The proposal itself establishes the frame for the adoption of further accompanying measures such as the adoption of guidelines or the establishment of coordinating structures, that will help the implementation of the infrastructures for spatial information.

Furthermore, provisions in the financial fiche accompanying the proposal should provide the Commission with the means necessary to ensure its contribution to the establishment of an infrastructure for spatial information in Europe. A significant part of this contribution will come from the Communities' 6th Reseach Framework programmes that will provide support R&D for the development of INSPIRE.

ANNEX I

Annex	Data Component	Description
Annex I	Geodetic reference systems	Includes levelling benchmarks, permanent satellite observation stations, tide gauges, marker id, access information, coordinates and system for defining and transforming the reference system data
Annex I	Geographical names	Names of areas, regions, localities, cities, suburbs, towns, or settlements, or any geographical or topographical feature of public or historical interest.
Annex I	Geographical grid systems	Harmonised multi-resolution grid net with a common point of origin and standardised location and size of grid cells. Examples of cell sizes include 10x10 m², 100x100 m², 1x1 km², 16x16 km².
Annex I	Administrative units	National territory divided into administrative units. The administrative units are separated by administrative boundaries. Also includes the boundaries of national territory.
Annex I	Transport networks	Transport networks and related features. Include topographic features related to transport by road, rail, water or air. Include links between different networks.
Annex I	Water bodies/hydrography	Hydrographic elements, both natural and artificial: rivers, lakes, transitional waters, reservoirs, aquifers, channels, where appropriate in the form of networks, and linked with other networks. Including areas with significant amounts of groundwater, for human consumption or anthropogenic production.
Annex I	Water catchment areas	River basins and sub-basins as defined in Directive 2000/60/EC.[50]
Annex I	Protected sites	Area designated or regulated and managed to achieve specific conservation objectives.
Annex I	Elevation	Digital elevation for land, ice and ocean surface. Includes bathymetry and coastline.
Annex I	Addresses including postal regions	Geographical location of addresses, entrance at ground level, also includes level/floor. Units for each postal region. Postal codes corresponding to a specific location.
Annex I	Cadastral parcels	Boundaries of properties.
Annex I	Land cover	Physical and biological cover of the earth's surface: e.g. artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands
Annex I	Orthophoto-image data	Spatially referenced image data of the Earth's surface, from either satellite or air-borne sensors, recordings of visible light, infrared bands, radar or other sensors

[50] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, OJ L 327, 22.12.2000, p. 1.

ANNEX II

Annex	Data Component	Description
Annex II	Statistical units	Blocks, census and statistical districts as well as blocks in urban areas, commonly used for collecting or deriving statistical information.
Annex II	Buildings	Geographical location of buildings
Annex II	Soil	Soils and subsoil categorised according to depth, texture, structure and content of particles and organic material, stoniness, where appropriate mean slope and anticipated water storage capacity.
Annex II	Geology	Geology classified according to composition and structure. Includes bedrock and geomorphology .
Annex II	Land use	Territory described according to its current and future functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational)
Annex II	Human health and safety	Spatial data on diseases, linked directly (epidemics, spread of diseases, health effects due to environmental stress, air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, stress, etc.) to the quality of the environment
Annex II	Government service and environmental monitoring facilities	Sites for governmental services, location of hospitals and medical treatment locations, schools, kindergartens, etc. Include sewage, waste and energy facilities, production sites and environmental monitoring facilities operated by or for public authorities.
Annex II	Production and industrial facilities	Industrial production sites. Include water abstraction facilities, mining, storage sites.
Annex II	Agricultural and aquaculture facilities	Farming equipment and production facilities (including irrigation systems, greenhouses and stables).
Annex II	Population distribution - demography	Population commonly aggregated, by municipalities, by blocks of houses or in grids.
Annex II	Area management/restriction/regulation zones & reporting units	Areas at European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitrate-vulnerable zones, regulated fairways at sea or large inland waters, OSPAR areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, OSPAR reporting units and coastal zone management areas
Annex II	Natural risk zones	Areas vulnerable categorised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides, avalanches, forest fires, earthquakes, volcanic eruptions
Annex II	Atmospheric conditions	Physical conditions in the atmosphere, represented as isolines, or using grids or according to another spatial organisation. Includes spatial data sets based on measurements, on models or on a combination thereof and includes measurement locations
Annex II	Meteorological spatial features	Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction.

Annex II	Sea regions	Seas and saline water bodies divided into regions and sub-regions with common characteristics.
Annex II	Bio-geographical regions	Areas of relatively homogeneous ecological conditions with common characteristics
Annex II	Habitats and biotopes	Geographical areas, characterised by specific ecological conditions, which physically supports the organisms that live there. Include terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features, whether entirely natural or semi-natural. Include small features of the rural landscape – hedgerows, creeks, etc.
Annex II	Species distribution	Species distribution, species-by-species or grouped, where appropriate recorded by grid cells

Annex III

	Data Component	Description
Annex III	Noise and radiation zones	Areas affected by noise, commonly appearing as zones with different levels of noise disturbance due to distance from source, such as roads, rail, airports, ports, air routes, sailing lanes/fairways, rifle courses, motocross courses, military training courses
Annex III	Transmission lines and pipelines	Pipelines include physical constructed pipelines for transport of defined products such as oil, gas, water, sewage or other products. Transmission lines include electrical, phone, cable TV or other networks.
Annex III	Forest resources	Location of forests, potential production and forest stand quality. Includes information on sustainable exploitation levels
Annex III	Fishery resources	Fishery resource description, includes stock distribution and characteristics (breeding, migration, and living areas). Includes information on carrying capacity/sustainable catch levels
Annex III	Geo-morphology	Geomorphological processes and results of processes, commonly monitored both as landscape changes and as potential risks. Includes information on loss/gain of land
Annex III	Settlements	Includes the physical distribution of cities, towns and villages, where appropriate classified according to the predominant economic activity (urban, rural, industrial, etc.)
Annex III	Water resources	Resources for consumption, processes, energy, or other uses of water
Annex III	Agricultural land and soil resources	Agricultural inventories, with mapping of existing and potential land for cultivation. Description of quality, production potential, suitable farming systems and crops, limiting factors under natural conditions. Includes categories such as irrigated areas and organic farming areas
Annex III	Polluted areas	Local contaminated sites, often sites near or at large industrial sites or at places of dumping of waste, mines and mine dump sites. Both land and sea
Annex III	Climate zones	Categorisation of past, present and future climatic conditions
Annex III	Vegetation	Structure and composition of the natural or near-natural vegetation
Annex III	Technological risk zones	Categorisation of areas vulnerable to technological hazards (all economic activities that because of their location, nature or scale have the potential to seriously affect society in the event of a major accident), e.g. release of chemicals into the atmosphere by explosion or fire, events leading to surface or groundwater contamination, releases of radionuclides into the environment, soil contamination, aircraft accidents
Annex III	Technological accidents and natural disasters	Location of actual events, site of occurrence, cause, effects, environmental impact
Annex III	Natural amenities	Natural qualities of areas and landscapes, used in recreation and for other activities. Includes bathing sites, local recreation sites, paths and vantage points, hunting areas and areas for use of other non-commercial resources in forests
Annex III	Oceanographic spatial	Measurable physical conditions of oceans, e.g. salinity, oxygen, other chemical components and currents, represented as isolines,

	features	or using grids or according to another spatial organisation, and based on measurements, on models or on a combination thereof. Includes measurement locations
Annex III	Geological resources	Geological resources, such as minerals, stone resources and deposits (sand/gravel), including hydrocarbons (oil, gas).
Annex III	Renewable energy resources	Energy resources excluding hydrocarbons: hydropower, biomass, solar, wind, etc. Where appropriate, e.g. for oil/gas and wind, includes information on the height/depth of the resource's location
Annex III	Areas of intensive exploitation	Areas of high economic interest and activity but also areas where high economic stress is possible. Covers both land and sea. Includes data about pressure zones such as coastal or urban regions, but also derelict land, mining areas, oil drilling areas
Annex III	Transport services	Services linked to transport networks
Annex III	Trade and services facilities	Sites for trade and public and private services, e.g. shopping centres, hotels and guest rooms, camping sites, sports facilities
Annex III	Cultural heritage	Areas or objects of cultural value, whether or not protected. Includes ancient and medieval remains, burial sites, and more recent artefacts, including valuable buildings and industrial constructions. Includes objects both on land and at sea

Annex IV: Examples of European policies that would benefit From INSPIRE

Legislation•*Council Directive 79/409/EEC on the conservation of wild birds*

•*Council Directive 90/313/EEC on the freedom of access to information on the environment*

•*Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources*

•*Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora*

•*Decision No 1692/96/EC on Community guidelines for the development of the trans-European transport network*

•*Council Regulation (EC) No 1638/98 amending Regulation No 136/66/EEC on the establishment of a common organisation of the market in oils and fats*

•*Council Regulation (EC) No 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF) and amending and repealing certain Regulations*

•*Commission Regulation (EC) No 1750/1999 laying down detailed rules for the application of Council Regulation (EC) No 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF)*

•*Regulation (EC) No 1783/1999 on the European Regional Development Fund*

•*Council Decision No 1999/126/EC on the Community statistical programme 1998 to 2002*

•*Decision No 1445/2000/EC on the application of aerial-survey and remote-sensing techniques to the agricultural statistics for 1999 to 2003*

•*Council Regulation (EC) No 1593/2000 amending Regulation (EEC) No 3508/92 establishing an integrated administration and control system for certain Community aid schemes*

•*Directive 2002/49/EC relating to the assessment and management of environmental noise*

•*Directive 2000/60/EC establishing a framework for Community action in the field of water policy*

•*Decision No 1600/2002/EC laying down the Sixth Community Environment Action Programme.*

Communications•*COM(1998) 605 Sustainable urban development in the European Union: a framework for action*

•*COM(1998) 806 Cohesion and transport*

•*COM(1999) 22 Directions towards sustainable agriculture*

•COM(2000) 20 Indicators for the integration of environmental concerns into the common agricultural policy

•COM(2000) 545 Recommendation concerning the implementation of Integrated Coastal Zone Management in Europe

•COM(2000) 547 on integrated coastal zone management: a strategy for Europe

•COM(2000) 597 Europe and Space Turning to a new chapter

•COM(2000) 855 amending Regulations No 136/66/EEC and (EC) No 1638/98 as regards the extension of the period of validity of the aid scheme and the quality strategy for olive oil

•COM(2000) 1100 laying down guidelines for a Community Initiative concerning economic and social regeneration of cities and of neighbourhoods in crisis in order to promote sustainable urban development (URBAN II)

•COM(2000) 1101 laying down guidelines for a Community Initiative concerning trans-European

•COM(2001) 144 Statistical Information needed for Indicators to monitor the Integration of Environmental concerns into the Common Agricultural Policy

•COM(2001) 264 A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development

•COM(2001) 609 Global Monitoring for Environment and Security (GMES) - Outline GMES EC Action Plan (Initial Period: 2001 – 2003)

•COM(2001) 718 Towards a European Space Policy

•COM(2002) 179 Towards a Thematic Strategy for Soil Protection

•COM(2002) 404 monitoring of forests and environmental interactions in the Community (Forest Focus)

Annex V: Case Studies

Case Studies

- ACACIA (UK)
- AIRPHOTO (Finland)
- Cable and Wireless Global Marine (UK)
- CORINE Land Cover
- Disaster Management – Flooding (Hungary)
- Disaster Management – Logwater (Hungary)
- Environment Agency Intranet (UK)
- Environmental Risk Assessment (UK)
- Eurogeosurveys Data Survey
- EUROSION
- Funding a Spatial Data Infrastructure (UK)
- Geospatial One Stop Shop
- GETIS
- GIS at the Environment Agency in Wales (UK)
- GISU (Bos)
- Green Flag (UK)
- Impact of INSPIRE on EIAs and SEAs
- Italian NSDI Experiences
- Joined-up Government in Scotland (UK)
- LabGIS
- MAGIC (UK)
- MIDAS
- Monitoring and Combating Noise Pollution (UK)
- National Cartographic Portal (IT)
- National Land Information System - NLIS (UK)
- NGII (Netherlands)
- NYMAP (US)
- OS MasterMap (UK)
- Piemonte (IT)
- Prague Environment Atlas (CZ)
- RSIP (Poland)
- Space for Geo-Information
- State of Maryland (US)
- TERRIS
- Tisza Basin
- Unemployment (CZ)
- UpMyStreet (UK)
- Water Supply Industry (UK)
- What's in Your Backyard ? (UK)
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Glossary

Aarhus Convention
UN ECE Convention on access to information and other rights in environmental matters adopted in 1998. The EU and all Member States have signed it.

Access / View / Download / Reuse
Access is the process of connecting a user with the data set to be used. *Viewing* is the ability to see, either in hard copy or onscreen, a portrayal of data and information which has been accessed in its original form but which may be presented differently (e.g. in map format). *Download* is the electronic transfer of data or information from a source computer to the user's computer so that they may be managed locally. *Re-use* implies the commercial or non-commercial utilisation of data or information for the benefit of third parties.

AGILE
The Association for Geographic Information Laboratories in Europe; the leading European academic body within the GI community.

Architecture
The models, standards, technologies, specifications and procedures used to represent, transform and generally accommodate the integration, maintenance and use of information in digital format.

Catalog, Catalogue
Structured information designed to locate geospatial data based on their characteristics expressed in metadata. Catalog services (also called *clearinghouse*) are services designed to help users of application software to find information that exists anywhere in a distributed computing environment.

Co-decision
The process by which the principal elements of EU government (Council, Parliament and Commission) agree on actions.

CORINE
A multi-national European land cover data set at scales from 1:100,000 to 1:1,000,000.

Coverage
The OGC defines coverage as a feature that associates positions within a bounded space to feature attribute values.

Data component, data set
Refers to the specific content subject definition of data; may consist of several data sets, but be a part of a database.

Directive / Regulation
In broad EU Framework Directiveation terms, a *Directive* sets out the objectives which it requires Member States to achieve, but leaves the detail of how this should be done to the Member States. A *Regulation* specifies both the objective and the means. (see also *Framework Directive*).

Do-Nothing Scenario
The situation visualised and projected ten years ahead if INSPIRE was not implemented.

Dublin Core
Widely used Metadata standard promoted by the Dublin Core Metadata Initiative.

Elevation
Vertical height above a theoretical earth's surface base. *Altitude* is the synonymous term used in the the US Federal Information Processing Standard 70.1.

ETRS89
European Terrestrial Reference System (1989). A geodetic reference system.

EU25
The fully enlarged European Union, i.e. the present fifteen Member States plus the ten so-called Accession Countries.

EVRF2000
European Vertical Reference Frame (2000)

Feature
The abstraction of a real-world phenomenon; a set of points, lines or polygons in a spatial database that represent a real-world entity.

Fitness-for-purpose
A measure of quality suitable and sufficient for the general purposes for which data and information are prepared. May be conceptually and legally synonymous with "satisfactory quality" and relate to issues of liability and certification.

Framework Directive
A legal instrument which describes broad objectives used as preparation for more specific and prescriptive follow-up legislation.

Gazetteer
A geographical index or look-up table which retrieves the geometries for one or more features. It may apply to a region, a country or some other specialised group of features.

GINIE
Geographic Information Network in Europe. An EC-funded project involving EUROGI, the umbrella organisation for GI organisations in Europe, the Open GIS Consortium and the EC's Joint Research Centre.

GMES
Global Monitoring for Environment and Security, an EC initiative associated both with INSPIRE and the European Space Agency.

Infrastructure for spatial information

See Spatial Data Infrastructure

Interoperability
The ability of two or more systems to operate in conjunction with each other; the coherent exchange of information and services between systems.

IPR
Intellectual Property Rights, of which copyright is one type.

ISO
The International Organisation for Standards. A world-wide federation of national standards bodies.

Licence, licensing
Agreement on the terms and conditions under which data and information that are the subject of IPR may be supplied and used. May be explicit and formal or implicit and informal.

Metadata
Data about data. Summary information or a description of the characteristics of a set of data; the information and documentation which makes data understandable and sharable for users over time.

NGO
Non-governmental organisation

NUTS
Nomenclature of Territorial Units for Statistics. The classification has five main divisions ranging from national to municipal in scope.

OGC
The Open GIS Consortium, comprising more than 250 organisations, agencies and universities worldwide dedicated to defining and developing standards to allow different GIS software components to work together (see also Interoperability)

Portal
A portal is a website that gives selected and evaluated links to other websites.

Portrayal
The presentation of information to humans, e.g. a map. A map is a two-dimensional visual portrayal of geospatial data, but it is not the data itself.

Schema
Common data definition which underpins transactions and processes that involve the interchange of data

Spatial Data Infrastructure (SDI)
The relevant base of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data. Equivalent to Infrastructure for Spatial Information

Thematic data
Application-specific data such as environmental data