7. Lessons Learned

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7.1 GENERAL FINDINGS

The preceding chapters have provided a broad overview of current developments in the wider in Europe and elsewhere in the world in relation to Geographic Information (GI). Focusing specifically on Europe, it is also clear that these developments need to seen in a wider policy context, including:

- The demands for an inclusive society in the Information Age, and a reduced gap between citizens and governments;
  - Demands for greater openness, transparency, and accountability;
  - More responsive and effective government;
- The demands by society for improved policy making and implementation;
  - The increasing concerns for sustainable development;
  - The demands arising from emergency planning and national security.
- The expansion of the European Union (EU);
- The drive across Europe for harnessing technology and information in support of economic and social processes.

Within this broad context, the evidence presented in this volume shows that:

GI has a major role to play in addressing societal demands and exploiting the opportunities opened up by policy and technology,

GI has economic value in its own right as a major component of Public Sector Information, and the basis for the development of new markets and jobs in the value-adding and location-based industries,

GI has a social and policy value because it provides the basis for integrating policies and targeting intervention where is most needed, thus providing tangible benefits to citizens, business, and governments.

Governments across the world increasingly understand the value of GI and are taking action to develop and exploit this asset.

Whilst these are some of the general findings, the following have important policy and strategic implications:

GI is not just about having a lot of data. It is about developing a strategic infrastructure to underpin the development of the Information Society and the Knowledge Economy,

A Spatial Data Infrastructure (SDI) means a framework of policies, institutional arrangements, technologies, data, and people that enables the effective sharing and using of geographic information.

Like any other form of infrastructure (e.g. transport), for an SDI to work effectively it is necessary that:

- It operates at all levels: local, regional, national, European, global;
- It is well connected with other related infrastructures such as those of e-government, and public administration in general, research, and the private sector;
- It is regularly maintained;
- There are clear lines of responsibility for its development, operation, maintenance, and regulation.

The evidence gathered by the GINIE project and summarised in this Volume clearly supports these findings. However, it also indicates that whilst enormous progress is being made, there are still major obstacles in the way, including the following:

1. **gaps in spatial data**: spatial data is often missing or incomplete,
2. **lacking documentation:** description of available spatial data is often incomplete,
3. **spatial data sets not compatible**: spatial data sets can often not be combined with other spatial data sets,
4. **incompatible geographic information initiatives**: the infrastructures to find, access and use spatial data often function in isolation only,
5. **barriers to sharing and re-use:** cultural, institutional, financial and legal barriers prevent or delay the use of existing spatial data.
6. **the case for interoperability** in wider Europe (not only of GI) has not been made sufficiently both in private and in public contexts and

needs to be developed; many obstacles listed below can be corrected in parallel with building an interoperable Europe;

7. **Lack of coordination and leadership:** these are necessary to the effective development of SDIs. However, at EU level coordination is still weak and insufficient.
8. **Isolation** of the GI communities from e-government developments and poor integration of SDIs and other strategic infrastructures.
9. **Gross underestimation of the cultural and organisational issues** that influence the speed with which progress can be made:
   a. Putting emphasis on services rather than on data requires a profound rethinking for many organisations in the public sector about their mission, their relationships with users and other organisations in the private and public sectors, organisational structures, and role of information as a strategic asset to support the discharging of the mission.
   b. Closely linked to the above is the need to rethink relationships and information flows in a network environment rather than a hierarchical one. This puts much greater onus on interoperability of systems and services, which is still poorly understood by public sector organisations even when procuring new services.
   c. Central to developing a sustainable SDI is fostering and maintaining relationships of trust among all stakeholders. Trust requires clear rules on confidentiality, non abuse of monopolistic positions, fair trading and market regulations.
10. **Insufficient evidence** of short and medium term benefits of SDIs leading to resistance to change.
11. **Insufficient consideration given to the crucial need for capacity building** (education, training) **and targeted research** throughout the wider Europe for the successful deployment of SDIs and the delivery of the wider benefits.

Europe is not of course alone in this situation but it should not be complacent, particularly if it is serious about the commitment expressed by the European Council at the Lisbon Summit in 2000 *"to make the European Union the most competitive and dynamic knowledge-based economy with improved employment and social cohesion by 2010"*.

To meet the challenges we need to recognize the added complexity in Europe of its multi-national, multi-lingual, and cultural context compared to other parts of the world as well as the opportunities that this also offers.

Specifically in relation to the barriers identified above, INSPIRE sets out to address specifically barriers 1-5. The GINIE consortium strongly supports this initiatives, which if fully implemented promises to be a very significant development in Europe, particularly if seen in conjunctions with other two

important ones namely GMES and GALILEO. Notwithstanding this support and commitment, the evidence presented indicates that there are other important barriers that need to be addressed as a matter of urgency to underpin the implementation of all three initiatives. They focus less on data, and more strongly on the other key components of SDIs, namely policy, coordination, and people.

The following sections of this Chapter articulate these findings and focus on the specific lessons learned in reviewing SDIs developments in Europe and elsewhere, the strategic requirements for embedding SDIs in the broader context of e-services, the opportunities opened up by recent developments in technologies and standards, the needs to integrate local level developments into higher level ones, and the requirements for capacity building respectively.

7.2 ON SPATIAL DATA INFRASTRUCTURES

The review of development across Europe undertaken in Chapters 2, and 3 indicates that most countries are committing themselves to the development of such infrastructures, whether at national or regional level, or both. There are differences in institutional arrangements, extent of political commitment, and legal framework, but the similarities are much greater than the differences. Moreover, as greater dialogue among the individuals and organisations with a major responsibility for SDIs and comparison of experiences takes place, we also see an increasing convergence in technologies, standards, and approaches.

7.2.1 The features of a successful SDI

Based on the review of SDIs and related activities in the previous chapters, an SDI is most likely successful when:

- it is developed, used, and maintained by several agencies responsible of key data resources including socio-economic, environmental, land and property, and reference data (e.g. addresses, administrative boundaries, physical infrastructure, and topographic features).
- it is ready to answer to real needs, particularly at times of emergency such as natural or man-made disasters,
- its framework data conform to common specifications, are maintained up-to-date, and are easy to find and access
- it is multi-level from local to regional and national levels,
- there is functional homogeneity in the framework across levels of jurisdiction.

- there is clear authority in managing the framework
- it supports sufficient economy to justify itself.

If the characteristics highlighted above are those of a fully functional SDI, the experiences of SDIs reviewed in this Volume show that the more successful SDIs in terms of coming closest to these characteristics are underpinned by consistent political support at the highest throughout its development. Conversely, the experiences that are more patchy in geographical coverage, and more mono-thematic in content tend to have developed in a climate of more limited political support.

This of course does not come as a surprise but it is important to have it confirmed by a wide range of national and international experiences, some of which have more than 10 years of development behind them.

7.2.2 Political Support

Sustainable political support at the highest level is crucial to the success of an SDI initiative, because:

- Most geographic information is collected, maintained, and used by public sector organisations, which are dependent on the policies set by government in respect to organisational priorities, funding, and regulatory mechanisms;
- Geographic information is an expensive commodity as well as underpinning a large number of government services to the citizen. It is therefore an area of tension between policies aimed at maximizing government revenue, and those such as e-government aimed at maximizing benefits to citizens. Political support is therefore needed to resolve these conflicts.
- SDIs are not primarily about technology, but about developing a clear framework of agreements among government agencies, and between government, the private sector, and citizens on the terms through which the use of public sector information, including geographic information, can be maximized for the benefits of all. These agreements often require attention and political support at the highest levels.
- Governments therefore play an absolutely crucial role in the development of SDIs and of the Information Society because they are at the same time data producers, users, policy setters, and regulators who provide guidance to major public sector organizations.

Political support needs to be sustained over time.
For their very nature political priorities may change due to external circumstances, change of administration, or even only change of key individuals. The experience of some of the most well developed SDIs in the world indicates that even after many years of successful development they remain sensitive to changes in organisational priorities and political leadership.

With these considerations in mind, it is clear that one of the absolute priorities for the development of an SDI is persistent action to gather and maintain support among political decision makers at all levels. Political support is needed to endorse and propagate the vision, establish the legal framework, and allocate resources to get results. This requires selling the benefits of SDIs throughout their development, without ever taking support for granted.

7.2.3 Selling the Benefits

An SDI can and should be developed at local, regional, national, European, and global levels. Therefore, there is a need to address politicians and decision-makers at each of these levels and demonstrate the benefits of having an SDI.

The benefits have to address areas of high political priority such as crime reduction, health, education, spatial planning, environmental protection and risk management. One must demonstrate how to support e-government and general economic development, reduce duplication and waste of resources, and increase competitiveness through the development of new industries in the location-based services.

One of the difficulties of selling the benefits to decision-makers has been the dearth of systematic evidence of the full social economic and environmental costs and benefits of SDIs. This was clearly brought to the fore in the context of the Extended Impact Assessment of the INSPIRE initiative. Some good examples of significant benefits were uncovered, as well as a handful of recent studies such as those undertaken in the Netherlands by Berends, J., and E. Weesie. (2001), and ECORYS-NEI. (2002). However, it was difficult to extrapolate from these individual cases and studies to a more generic case, and the assessment had largely to rely on the expertise of the panel of experts assembled by the European Commission DG Environment for the task. The results were positive given the constrains on time and resources and it was concluded that developing INSPIRE as proposed would yield annual benefits of over 1 bn. euros per year against an annual investment of 200-300 million euros for ten years in the EU25 countries. These benefits were identified largely in the environmental sector alone, and

it was the opinion of the panel of experts that greater benefits with only limited additional investment could be achieved if other thematic areas were also considered.[68]

The study above indicates that there is a valid economic as well as social and environmental case for developing SDIs. Nevertheless, as more and more countries and regions undertake such endeavour it is imperative that systematic, comparable studies of costs and benefits are carried out over time to move from "best estimates" to solid evidence. In addition, it is very important to move from a narrow focus on SDIs to their potential contribution to regional competitiveness, innovation, productivity, incubator effects in information value-adding industries, job creation and so on. This is an effort where the GI community and the discipline of regional studies and economics need to work much closer together. A very fruitful area of study in this context is in the Accession and pre-accession countries as shown in Chapter 3. Here a very clear link seems to have been made between the development of SDIs, and broader aims such as the modernisation of public administration, the implementation of legal reform, and the opportunity to jump-start the transformation of economies largely based on manufacturing and agriculture towards advanced service and information-based sectors. Documenting and analysing these changes and impacts in these countries would be of enormous values to Europe as a whole.

In the current absence of such studies, the best strategy available is to use examples and cases from different parts of the world as they become available, suitably adapted to address local concerns, and as the local SDI develops it is important to focus on applications that can deliver *quick wins*, rather than spending a long time before showing any payback. At the European level, there are a number of key policy areas that can provide good case-studies for the benefits of having an SDI, or conversely the costs of not having one. These include risk management (for example the Toulouse explosion or Chernobyl), environmental management (water framework directive, floods in Italy and along the Rhine basin), and transport (impact of blocked tunnels across the Alps).

One of the important messages from the more successful SDI experiences is the need to manage expectations. The development of an SDI also requires education, and the change of organisational cultures. These are often lengthy processes for many public sector organisations that have difficulty in adapting quickly to change. Some of challenges that need facing include the need to work more horizontally across departments and agencies, having greater

[68] (see http://inspire.jrc.it/reports/fds_report_sept2003.pdf).

sensitivity to customer needs and requirements, and using information more effectively, as well as the ability to "let go" to "my" information. We are therefore talking of long term processes that may take 20 or more years! At the same time however, SDIs do not need to wait until such changes take place. On the contrary they can be used as an opportunity to leverage change, as shown in the Accession and pre-Accession countries.

Selling the benefits nevertheless has to be realistic and not based on hype. It must recognise that technology adapts to social processes more often than the other way around, and that the process of change is not linear but complex, messy, and iterative.

7.2.4 Coordination

Coordination is one of the most important aspects in the development of an SDI, as the experience of all the countries analysed in this Volume indicates. The countries with the most developed national SDIs such as the US, and the Nordic states are all characterized by strong multi-agency coordinating frameworks. Countries with the least developed national SDI, such as Spain, Belgium and Austria, also have the weakest co-ordination at the national level. These countries have on the other hand excellent examples of regional SDIs because it is at that level that good coordinating mechanisms have developed. Coordination is therefore crucial.

The roles of the coordinating body are manifold and include:

- leadership,
- mediating inter-agency conflicts,
- sustaining political support,
- selling the benefits to multiple audiences,
- providing technical guidance and enforcement of common standards,
- raising awareness and disseminating the results.

In addition coordination can also play a very useful role in identifying gaps or inconsistencies in the legal and organisational framework, and suggesting remedial action to the government. This is particularly important as the legal framework within which SDIs operate is strongly affected by many other policy areas, such as Public Sector Information legislation, Freedom of Information, international conventions (e.g. Aarhus), competition law, and so on. Moreover all these areas of policy may have some variation not only at national but also across sub-national levels.

Whether all of these activities are performed by a single organisation or more than one, for example one focusing on operational implementation, and one more on strategic and legal issues, will depend on the circumstances. There is no question however that all of these activities are essential.

This central activity for the life of an SDI does not need to be expensive or imply large bureaucracies. 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. This is therefore not a large structure or budget, but a successful model, providing a good return on the investment made.

There are three other lessons from the US experience that are of particular relevance to Europe:

- Even if political support comes from the highest possible level, without firm coordination the centripetal forces of each agency pulling in its own direction would undermine the SDI. Never underestimate "departmentalism"!
- Coordination needs its own budget to be effective.
- Like in any complex project, you need to think big and act small, i.e. keep and promote the vision, but phase implementation.

A further very important reminder is that where the FGDC has been particularly successful is in coordination at the federal level for which it has a mandate. Greater challenges have emerged in respect to coordinating a truly National effort involving State and local jurisdictions as shown in Chapter 5.

Translating such difficulties in a complex setting such as that of Europe indicates that the efforts of coordination need to be much higher, sustained over time, and backed by appropriate legal frameworks, and dedicated resources.

Hopefully INSPIRE will provide a major step forward in establishing such framework, in conjunction with the PSI Directive and other related legislation. Given the multi-national nature of Europe, coordination will require efforts at all levels, European, national, regional and local, whilst mindful of the principle of subsidiarity. In principle, the experiences reviewed in this Volume indicate that coordination needs to include both an operational and strategic level.

Operational Coordination:

- To contribute to the definition of European specifications for common data models and encoding methods, and provide technical advice, support, and technology watch.
- To promote international standards for interoperability.
- To coordinate the activities of the organisations charged with thematic data model harmonization.

- To manage GeoPortals at the various levels (European, national, regional/local).

Strategic Coordination

- To support the development of National/regional SDIs through institutional capacity building, and comparative studies with common methodologies of national experiences and legal frameworks that relate to GI and SDI.
- To ensure that policies and actions at the European and national levels are consistent with the development of a common infrastructure (policy watch).
- To liase with national organisations in raising awareness at the political level through the dissemination of use-cases and pilot projects that have a direct relation to political top priorities such as environment and security.
- To embed SDI within Information Society strategies to develop spatially-enabled e-government services.

The last point is crucial as discussed below.

7.3 SDI AND E-GOVERNMENT

There are at least four major reasons why SDIs need to be embedded into e-government strategies and the development of e-services:

1. SDIs are only of value if they provide a service to society at large, and meet the needs of users including citizens, business, and government. These needs maybe in some instances of a spatial nature and in other not. Given that the whole ethos of e-government is to provide one-stop seamless services, it makes no sense to artificially partition spatial from non-spatial services.
2. Much of the legal framework that is relevant to SDIs applies to public sector information in general such as the PSI Directive, access to environmental information, competition law, and so on.
3. The development of SDIs needs to tap onto the political commitment for e-government expressed at the highest level by the European Council in 2000 and reiterated in subsequent eEurope Action Plans,
4. The approach to the development of e-services and SDIs as well as the technologies are broadly the same, and in many respects the greater complexity of spatial data has enabled the GI community to make greater progress in matters of interoperability and services which can be of immediate use to e-government strategies. There is therefore a good synergy to exploit.

With these considerations in mind, the following Sections discuss the lessons learned during the GINIE project in respect to e-, service, interoperability and technology. Although the focus is primarily on geo-spatial services, these same findings also apply to e-services in general and should be considered by those in charge of e-government strategies.

7.3.1 Characteristics and business models for e-government services

To share data across European information communities needs to be seen in the wider context of current institutional and organisational arrangements. Most government organisations have vertical reporting structures from the local to the central level, and operate in silos with great difficulty in horizontal coordination within each organisation, let alone across multiple ones. This is well documented by a growing literature spanning several years[69]. Moreover, in many countries there are constant changes to the functions and status of public sector organizations from direct service providers, to "enablers" of services delivered by the private or voluntary sector or mixed partnerships, and from state bureaucracies to Quasi Non-Governmental Bodies (Quangos) or agencies with greater financial autonomy. Information flows and policy sit squarely into this changing environment. As recognised by Maxwell (2003) Information policies are:

> *social, political, legal, economic and technological decisions about the role of information in society. These decisions operate both at a societal level when applied to national and international policy, and at an instrumental level, as they impact the creation, dissemination, use and preservation of information. The definition underscores some of the complexity inherent in the information policy arena.*

Unfortunately, most organisations do not have a coherent information policy addressing access, dissemination, and sustainability of the infrastructure (technical, financial, and organisational including training, and personal development) at all. At most they have an IT strategy but rarely an information policy and a strategy to implement it. Pushed by government policy to go "on-line" most public sector organisations react by having a web site that is of variable quality (IAB 2002), and often devoid of relevant content. As noted by Smith (2001) in his survey of local government web

[69] (see for example the special issues of the Journal of the Urban and Regional Information Systems Association http://www.urisa.org/Journal/APANo1/Final.pdf)

sites in the UK, the vast majority are only glorified tourist information services, or provide the digital version of whatever document they have in paper. Even where examples of best practice exist, they are often confined to a small unit somewhere in the organisations, largely ignored by the rest, and prone to major instability if key staff leave the organisation. This is of course a generic consideration that is not specific to SDIs.

With this in mind, it is clear that in spite of the many excellent examples showed in this Volume there is still a massive and long term challenge for public sector organisations in recasting their way of operating and move from vertical silos-oriented bureaucracies which give priority to procedures rather than outcomes, to network, partnership-modelled organisations which are outcome-driven. For these new types of organisations, information is absolutely central to their mission.

Moreover, organisations that are outcome-driven must be put user-requirements at the starting point of their strategies, and not as is all too often the case at present just pay lip-service to users. Different jurisdictions, agencies, disciplines, professions, industries, companies etc. have different business models and thus different needs for spatial data and spatial processing. Since the goal is to provide a useful infrastructure for use by all these groups, one must look for their common requirements.

To build e-service models the following aspects have to be kept in mind and should be integrated:

- The different e-service requirements of different stakeholders/users at the European level;
- The provision, price and licensing of services; and
- The funding model for services;
- The market model for services (to develop a free market);
- The liability issues that might apply to services (history and audit).

Different types of e-services need to be considered. One type of service described Section 7.4.4 is the set of registry services that can be used to register metadata, query metadata, and link to data and service servers. These almost certainly would be free services that are part of public registries. Another type would be spatial e-services packaged with specific kinds of data to provide, for example, accessibility information, routing, geocoding or visualisation. Some of these e-services are most appropriately purchased on a per-transaction basis from private sector providers. Others may be seen as generally useful across domains and stakeholder groups and also supportive of private sector value-adding, and thus appropriately provided by government.

Designers of the SDI need to answer the following questions about a service:

- Who is providing the service?
- Who is the service for (target)?
- How is it resourced (finance etc.)?
- Which type/level of service is it?
- What is the service for and what is it trying to achieve?
- Who will regulate the service?
- How does it work, how is it built and maintained?
- How will sustainability be maintained?
- Who are the partners and who do you work with?
- Is the service accessible and guaranteed?

The target groups of e-services are the citizens of Europe, government, business/commerce and research/education. E-services for e-government can open opportunities for citizens, but those proposing e-government e-services must consider the implications of removing barriers to the awareness and use of geodata and geoprocessing services.

The question "e-services: what kind?" has not yet been sufficiently answered. It still has to be clarified how e-services can be funded and maintained in a sustainable way. The private sector may build services, but only if they see a profitable business model, and the experience of the last years of the 1990s indicates that such business models are unstable. If the data is public sector data, then the public sector must put in place the framework necessary (e.g. finance and access and reuse conditions) that will encourage the private sector to provide the required services.

7.3.2 Financing and Funding Options

There is growing awareness about the need for SDIs as resources for good governance and market development. However the development of an SDI cannot be successful without policies and funding that support it. This topic includes both the issue of funding or financing, and the issue of pricing, such as who pays, what is the price of the data, and what are the access policies? The balance between funding via general taxation or user fees is different in different traditions and cultures. Different traditions and cultures also vary in the type and quality of services provided, and this will certainly emerge in policy discussions.

There are four different models for SDI funding.

1. **Government Funding** (funds derived from taxation). Government funding is based on the idea that spatial data produced by the government should be thought of as public infrastructure that ought to be available to everyone "for the good of the commonwealth," e.g., the US Geological Survey.

2. **Private Sector Funding** (funds derived from user fees). Data and services can be sold through contracts or on a transaction basis, to recover cost of production and to distribute that cost fairly among users. This is the "cost recovery" or "data capitalization" alternative. The user contributes to the costs of areas such as collection, updating and quality control, that are not fully funded from elsewhere.

3. **Public Sector Funding** (funds derived from fees charged to public agencies).

4. **Indirect Funding** (funds derived from advertising, sponsorship etc.).

From these basic models, mixed models combining different funding sources can be defined. We are likely to see a combination of public and private funding with significant private input into the policy-making process. Around the world, a number of spatial data collaborative initiatives are emerging. For example, in the U.N., GRID/Arendal is supporting a Spatial Data Consortium within the Consultative Group on International Agricultural Research. In Canada, there are the Geospatial Data Sharing Alliance and the Conservation Spatial Data Consortium. The Netherlands and Australia have also experienced some innovative funding models as discussed in Chapters 2 and 5. In the U.S., a number of states have spatial data clearinghouses that operate as part of the US Federal Geographic Data Committee's Clearinghouse Activity. Sometimes collaborative initiatives involve creative data sharing agreements. For example, sometimes data, rather than money, is used to pay for other data. Or, base data might be provided at no cost but full market pricing principles could be applied to value added products derived from the base data. The comparison of the three case-studies in Chapter 5 also highlights the importance of adapting to local circumstances working with industry, and enabling the emergence of new organisational structures and types that can leverage the necessary resources.

The funding model for the European SDI could be a combined model, which encompasses grants (Government Funding) and cost recovery (Private/Public Funding) in an efficient way. But it is likely that most of the

funds will have to be Government Funds, at least in the initial implementation stage.

This approach is the one currently being proposed by the Impact Assessment of the INSPIRE initiative with EC funding focused on the European level coordination, and the support for developing agreed specifications, whilst most of the total investment comes from the Member States. It should also be underlined however, that other sources of European funding could become available for selected regions if SDIs were linked to environmental reporting and sustainable regional development.

7.4 TECHNOLOGY

The central point of any infrastructure that supports e-government or spatially-enabled services is the need for users to find the information or service they need quickly, and efficiently.

This presumes that the information or service required exists in the right format or "package" (including access conditions, price, level of service and so on), and that its availability is registered in searchable catalogues, also referred to as Registries.

Central to all this is the importance of metadata, i.e. of information documenting the data resources and services that are available. The extent to which metadata is crucial in underpinning the delivery of services to citizens, business, and government is increasingly being recognized by many governments across the world. As an example, the UK Office of the e-envoy in publishing its "e-Government Metadata Standard" Version 2 in May 2003, argues that structured and consistent metadata is needed across al government organisations to deliver the UK's Modernising Government agenda, and for this reason mandates the e-Government Interoperability Framework and Metadata Standard across all government information systems.

Metadata is of course of little use without registries in which metadata can be published and found. Like a card catalogue or computer index in a conventional library of books, a registry reduces the number of places the user or application has to look when searching for a particular resource. Digital registries and e-services are fundamental components of any Spatial Data Infrastructure (SDI) because the SDIs includes large numbers of distributed and already existing digital data sets and computing services, far too many for anyone to know about. It makes sense to organise them in a network for automated access by authorized users. The Web, conveniently, provides the basic network infrastructure.

Online registries and e-services are components of distributed computing,

in which software running on nodes of a network is able to use software and data on other nodes of the network. Sharing geographic information and services among different user communities is the main challenge facing producers and users of geographic information.

7.4.1 Interoperability

The key to information sharing is interoperability. Interoperability is the ability of autonomous, heterogeneous, distributed digital entities (e.g. systems, applications, procedures, registries, services or data sets) to communicate and interact or be used together despite their differences. Two types of interoperability are necessary for efficient sharing of spatial information:

- **Technical interoperability** refers to the ability of different geoprocessing software systems to communicate and interact through shared interfaces; and
- **Semantic interoperability** refers to standards that support the ability of people and software systems to find and use spatial data produced at different times by different people for different purposes, in which geographic features may be represented using different naming schemas and "geometries". ("Naming schema" refers to a "data dictionary" of geographic feature names. "Geometry" refers to spatial reference systems for representing the location of features). Semantic interoperability depends largely on data producers adhering to standard feature naming schemas and metadata schemas. Some of the difficulties associated with this will ease when "semantic translation" becomes technically feasible.

7.4.2 Interoperability Standards and Data Issues

To share data across information communities will require more than harmonisation of schemas for semantic interoperability, as described above. Different jurisdictions, agencies, disciplines, professions, industries etc. have different needs with respect to other matters, including the quality or currency of data. What are the measures of data quality? What quality information needs to be included in the metadata? What about data heritage (source or, if sources, what operation produced the result?), authentication (of heritage) and validation (of accuracy)?

To share data across information communities will require semantic interoperability at the information and service level. Semantic interoperability at the service level (e-services that provide semantic translation) is not possible yet, but progress is sufficient to ensure that some capabilities will be

delivered in products in the next few years. Semantic interoperability at the information level requires data coordination, which involves:

- harmonisation of data models, i.e. how the data is structured in terms of the words and numbers used to describe geographic features; and
- harmonisation of metadata schemas, i.e. the data model, plus details that include information about when and how the data was collected, what words mean, what updates have been made

With respect to data coordination, it is useful to think about two classes of data:

- **Base data**: There are several generally useful data layers that ought to have a single data model and metadata schema across Europe (and ultimately, across the world). These include layers such as elevation, water bodies, political boundaries, transportation, surface geology, vegetation and land use. A standard data schema and metadata schema (which includes the data schema) ought to be agreed upon by appropriate authorities, and then all such data can be converted to the standard schemas.
- **Information Community data**: "Information Communities" are groups of people whose profession, discipline, industry, region, nation, government mission or other common interest, including their natural language causes them to have special shared requirements for naming geographic features and for representing relationships among these features. Their data models and metadata schemas ought to conform to base data models and schemas as much as possible and, beyond that, committees within these communities ought to work toward harmonisation within their communities, with consideration for the needs of data sharing partners outside the community.

Organisations will sometimes create profiles of data models and metadata schemas. A profile is a version of a particular schema, adapted from a more normalized schema to meet specific domain needs. Even with such changes, a profile should contain enough standard structure to be publishable on a registry, though the data will be limited in its usefulness to people not working in that domain. A local authority, for example, may have its own profile of a street database.

The power of a Web-based SDI built on open, standard specifications provides many new incentives for data coordination. When more people can use a data collection, the data collection has more value. When you can use others' data, you do not need to expend precious resources to create your own. When data can be maintained in a single place for use by all, no one needs to store a "stale" copy of the data. In time of emergency, data that has been

developed and maintained for routine work can be immediately accessed to save lives and property. And, when semantic translation technologies have matured in the next 2-5 years, Information Communities will find value in each other's data.

Semantic incompatibility is a long-term problem for the whole IT community, not only those involved with GI (see W3C's work on the "Semantic Web"). Solutions will be driven by need, and some solutions developed outside the geospatial domain are likely to be very useful for it. Hence, it would be useful to create a typology of needs in the area of spatial data semantics. Here we list a few:

- There is a general need for harmonisation of data models and metadata schemas for base data;
- There is a need for basic agreement about how to encode data models and metadata in XML schemas. There is a need to explain the standard ways of defining variables in data models and structuring the contents of data sets, the access conditions, the quality etc.;
- There is a need for data element thesauri that enable simple automated semantic translation;
- There is a need to structure registries' interfaces to enable "Google-like" "spatial search engine" searches;
- There is a need for research in the area of automated translation between schemas;
- There is a need to move towards a geospatial semantic reference framework that will be compatible with the technical interoperability spatial framework defined in OGC. Additionally, an open framework for spatial semantics should be defined. A starting point could be a White Paper, to define problems in different domains, infrastructures, themes and services, to be delivered in Europe's ACE-GIS project on web services and semantic interoperability (Adaptable and Composable E-commerce and Geographic Information Services http://www.acegis.net.); and
- There is a need to stress the importance of semantics across the e-government and SDI initiatives being undertaken in Europe.

7.4.3 E-Services

E-Services are network-resident processing services. They are accessible through interfaces that enable diverse applications with conforming interfaces to programmatically "bind" or couple with them. That is, an application can send instructions across the network to instruct an e-service on a remote

server to perform a processing task, and the e-service will return the result of the processing back to the application. E-services can invoke other e-services, which is called “service chaining”.

E-services called “Web Services” are the basis for today's dominant distributed computing paradigm that based on the Internet and the Web. The Web Services architecture is, like the Web that supports it, based on open interfaces. In open Web-based distributed computing, registries make it possible for online services to be found and used. In a more closed Web-based distributed computing scenario, Application Service Providers, or ASPs, provide online services, but the service links are small in number and fixed rather than being numerous and available through a catalogue. Such control, of course, is an advantage in some cases.

7.4.4 Registries

A registry is a set of special e-services that support organisation and discovery of and access to online data and processing services (e-services). Registries help users or application software or other services find or retrieve data or e-services existing anywhere in the distributed computing environment.

Registries are used in the larger Web Services world, but in this Section they are discussed and described in the SDI context of geodata and spatial technologies. In this context, registries are catalogues of both online geodata and online geoprocessing services. As indicated in Chapters 2,3 and 5 several countries and regions across the world are now seeing the advantage of building interoperable registries based on open standards and specifications such as those of the OGC.

Registries provide:

- Methods to register metadata about information resources and services, and methods for changing the metadata;
- Methods for searching the metadata collections to discover and evaluate resources whose metadata is published in the registry; and
- The method by which the application connects to the online data source or spatial e-service.

OGC's Catalogue Services Specification provides a framework that enables multiple registries to be “viewed” as one registry. Stewards of geodata and online geoprocessing services in a nation, a discipline, a metropolitan area or an enterprise can virtually combine, or “federate”, their registries if their registries conform to the OpenGIS Catalogue Services Specification. A query to one can thus query any or all of the others. This multiplies the potential value of the data and services whose metadata are published in any of the federated catalogues.

Much spatial data at the present time, of course, is off-line, but metadata for such data can nevertheless be registered in a registry. This situation describes today's spatial data clearinghouses. A clearinghouse helps a user find and evaluate data, but it does not usually provide the means for automatically viewing, downloading or operating on the data. Most clearinghouses around the world are being updated to conform to OGC's OpenGIS Catalogue Services Specification as shown in Chapters 2 and 5. Countries implementing registries based on OGC's OpenGIS Catalogue Services Specification include Australia (CANRI's NSW Natural Resources Data Directory), Canada (Geoconnections Discovery Portal), the UK (AGI's GI Gateway), Germany (GDI NRW), Netherlands (RAVI's NCGI), South Africa (National Spatial Information Framework), Spain (IDEC in Catalunya) and others. A more detailed introduction to building registries for e-services can be found on the GINIE Web site.

7.4.5 Metadata and XML

The UK Office of the e-Envoy has published an "e-Government Metadata Standard (e-GMS)" Version 2.0, dated 16 May 2003, which begins with the following list of reasons that metadata and metadata standards are important:

- Modernising Government calls for better use of official information, joined-up systems and policies, and services designed around the needs of citizens;
- Considerable work has already been done to standardise government information systems so they can be accessed easily from central portals;
- New systems for the handling of electronic records are being devised. Official records will not always be stored in paper format;
- Metadata makes it easier to manage or find information, be it in the form of web pages, electronic documents, paper files, databases or any other media;
- For metadata to be effective it needs to be structured and consistent across organisations; and
- The e-GIF (e-Government Interoperability Framework) is mandated across all government information systems. By association, so is the e-GMS.

The Web provides a wonderful tool for managing geospatial semantics issues: the eXtensible Markup Language (XML). XML is a flexible and powerful means of encoding data in text for programmatic manipulation. Although it started out as a language for “marking up” or encoding a document for presentation on a Web page, it has quickly evolved into a

mechanism for general data description. As plain text, XML can be read and understood by data managers and can equally be parsed by software programs. XML is easily transformed by simple programs and it is relatively easy to integrate and combine XML-based data from many disparate sources. Most ordinary Web browsers include software that can “parse”, or process, text that is structured in XML.

Today, XML is used in a variety of industries including finance, chemistry, e-business, document publishing, multimedia, telecommunications, graphics, and e-government. Each of these domains is developing and reaching consensus on an XML *namespace,* which is a carefully defined set of terms, a *vocabulary* or *ontology,* based on the communication needs of the domain. Like these industries, individual organizations and information-sharing communities are developing their own XML namespaces.

OGC's Geography Markup Language (GML) specifies an XML namespace suitable for very many geospatial data requirements. In particular, its standard way of expressing locational geometry is applicable in virtually all situations. However, GML and XML do not by themselves solve the problem of two data producers whose data schemas (and metadata schemas) present the same kinds of information in different sequences and structures and whose data dictionaries provide different type names for the same type of geographic feature.

7.4.6 GeoPortals

A GeoPortal is an assembly of components that provides a community-wide Web-based access point to resources such as distributed spatial data sources, online geoprocessing services, news, tutorials and tools for collaboration. An SDI geospatial portal would employ standard software interfaces to connect people through a registry to raster map, imagery and vector feature services set up by providers. It would likely provide specialised glossary, thesaurus, schema examples, XML tools and data committee email lists to support the creation, maintenance and harmonization of schemas. A portal often serves a specific community but it may use a generic user interface that other communities can adapt. A portal usually offers personalised or customised views, serving, for example, a particular Information Community. To achieve a linking of registries and clearinghouses, existing registries and clearinghouses in different countries need to be extended with interoperable specifications such as the OpenGIS Catalogue Services Specifications. GeoPortals can:

- Demonstrate what can be achieved by making public sector data more visible and accessible;
- Provide "one-stop shopping" for spatial data and services;

- Provide services that respond to user needs; and
- Identify priority areas for improvements and gaps to be filled.

As a tool to promote SDI development, a GeoPortal provides a measure of progress of SDI development through indicators such as the number of services and catalogues available over time and measures of user feedback.

7.4.7 Phased Implementation

The experiences of implementing SDIs in Europe clearly show that different models and approaches emerge as a result of the different cultural and institutional circumstances. Some countries spend longer time in the planning stage, developing a coherent conceptual model of the SDI and its components before starting implementation, others are more pragmatic and start with whatever is already available and develop as they go along. One model does not fit all.

Focusing on the endeavour of developing a European SDI, a phased implementation that builds and supports the existing national and regional SDIs is crucial. Collaboration and complementarity are key principles. At the same time, it is clear that national SDIs do not exist in every country or region. Therefore some legal backing requiring Member States of the EU to develop a base-line SDI seems necessary, whilst leaving the details of how this is undertaken to national responsibility.

To support the development of national and regional SDIs, and their interoperability at the European level, there is a need to support organisational and institutional capacity, promote international standards and best practice, and provide technical coordination and support. Coordination and support should include the development of European specifications for data content based on what already exists, whilst keeping the impacts on national databases to a minimum.

In addition to this foundation work there is also a need to harmonize the data layers and achieve seamless coherent information. The amount of work needed will vary on the layers and the level of agreement reached across the production chain on common definitions and standards. However, the existing experiences in Europe in relation to developing seamless data bases on soils, land cover, meteorological information, topography, and administrative boundaries indicates that significant harmonization work is needed, and that for each theme specific organisations need to be charged with the task of undertaking this work.

Implementing an SDI needs therefore to consider a series of issues including:

- Identification and selection of who will be in charge of harmonizing the data layers,
- coordination of these organisations vis-à-vis the technical coordinators of the ESDI and existing European agencies,
- how this work will be funded, and
- the relationships between original and harmonized data, issues of IPR and access.

When building national, and European SDIs phased implementation is needed both from the top down (policy frameworks, coordination), and from the bottom up, integrating what already exists. It is crucial that the services implemented work together at each layer of achievement, i.e. be interoperable. Obvious as this may seem, the evidence to date indicates that this is only now starting to happen.

In the European context (but this is equally valid at other levels) a GeoPortal is important for demonstration purposes but also to allow visualisation, processing and access to data. This service must be based on clear user needs, be multi-lingual to act as an European entry point to available services, and provide links to national portals (possibly based on service registers). To achieve this, existing catalogues in different countries need to be extended by building software interfaces.

The value of a European GeoPortal is to demonstrate what can already be achieved by making public sector data more visible and accessible, provide services that respond to user needs, and identify priority areas for improvements and gaps to be filled. It also has the announcement value that something *is* happening, and a measure of progress of SDI development through indicators such as the number of services and catalogues available over time, and measures of user feedback.

It is recommended that a phased implementation for the development of an ESDI is adopted based on subsidiarity, i.e. on the national and regional efforts already undertaken. To deliver the global vision in a sustainable and phased approach the following is specifically recommended:

- That a multilingual GeoPortal be established for demonstration purposes, and to measure the success of ESDI development. Such portal must integrate with e-government services underpinned by location rather than providing GI services isolation.
- That candidate services and capabilities should be identified early in order to construct a baseline ESDI.
- That a core technical committee should be established at the European level at an early stage to define European specifications, and provide technical coordination of the ESDI.
- That the organisational and financial framework for the harmonization of data layers be established in consultation with existing European Agencies and organisations, and the core technical committee of the ESDI.
- That capacity building measure focus on SMEs (Small and Middle-sized Enterprises) in the value-chain of services needed to guarantee the implementation at the local level, and on local government.

7.5 LOCAL TO GLOBAL

7.5.1 SDI Levels

Whilst Section 7.6 will focus specifically on the issue of capacity building raised in the last bullet point above, it is of crucial importance to recognize that a successful SDI that serves the interests of all stakeholders in society needs to address local concerns, and hence be developed not just at macro levels (Global, European, national) but also and maybe primarily from the bottom-up involving local jurisdictions who are closest to citizens and local businesses.

With local authorities being custodian of a number of strategic geospatial datasets, their role is crucial to the development of SDI at national level (NSDI); the lack of progress in data sharing initiatives among local and national, or higher level, governments is often due to a lack of recognition by coordination bodies of the importance of the local level, while local authorities representative organisations are often not acquainted with the broader international developments.

At the European level, there are number of key policy area that can provide good examples for the benefits of having, or conversely the costs of not having an SDI. These include risk management, environmental management, and transportation. But what are the benefits from the local level point of view?

One way to minimise the problem of the underdevelopment of SDI at the local level is to increase the level of understanding and awareness of people (both users and producers of spatial data, and concerns of politicians) about the nature and the value of SDI concepts in general, and the relationships among different levels of SDI in particular.

SDIs, at all levels, are characterised by interoperability but the position of local authorities with regard to interoperability is very differentiated. In the main part we have interoperability of information flows within the vertical silos of bureaucracy when central government sets standards and procedures and then requires local jurisdictions to comply to these, collect the relevant information, and pass it up the chain. This type of interoperability works well

only within its own channel but is useless for sharing information across different channels or information communities.

As an example, it is useful to compare the GI sector with statistics, represented at European level by Eurostat, in order to understand that the process of harmonisation and standardisation of data and procedures for using common language is not immediate and takes time. The project of the European Statistical System has taken 50 years to come to fruition since its inception.

National statistical offices already use GI at different scales in order to give spatial reference to the data surveyed but the geographic address in same cases is very detailed at level of the centroid of the buildings and in some other cases is represented by the address, by the cadastre reference or is referred to large and medium scale maps of territory to which the data belong.

It is obvious that the functioning of an SDI is dependent on the data produced and how they are made available in the infrastructure. From this it follows that what is needed is a sustainable production framework (including contracts, regulations, technical specifications, standards) that irrespective of whom actually produces the data, ensures that the data is produced cost effectively to defined quality, time scale and that it is fit for purpose.

The production of the GI should be adaptive in the sense that it has to focus on quality of the final product and of the framework for production considered as a foundation for further usage. The usage has to be considered in short, medium and long term and from local to global in order to guarantee the best results of utilisation and the most effective production process.

In developing SDIs, data producers and specialised users play a key role therefore their typology has to be carefully investigated in order to achieve the best final results. Moreover, given the considerable funding that is required to produce the data needed for multiple applications, the business benefit and/or the social mission that justifies the funding has to be clear in order to:

- give the correct reason to public authorities, central or local, to invest in data production;
- convince local authorities to collaborate and use data provided by other sources and vice versa;
- set up the correct legislation;
- ensure the access to GI (as part of PSI) determining the adequate cost of data if needed.

7.5.2 User Needs and SDI Principles

Since the purpose of SDI at local/regional/national levels is to improve the quality of policy making, citizen's participation and market development through the increased use of GI it is central to developing a sustainable SDI to foster and to maintain relationships of trust among all stakeholders (citizens, public sector, private sector, voluntary sector). Trust requires clear rules on confidentiality, non abuse of monopolistic positions, fair trading and market regulations.

User needs have to be considered central in ensuring the data utilisation within and through an SDI, for instance considering the main client, the secondary and the tertiary users together with their needs may help in defining roles, recognize and avoid conflict of interest at the user level and to maximise the access to data on service platforms.

An SDI generally requires a regulatory framework needed to ensure equal conditions within the same category of users i.e. government, education, private sector, and non discrimination. It may happen that the regulatory framework in public authorities is not the starting point in building an SDI but it is the final stage of a process which already built up some best practices and test beds. This is not a problem if the SDI has been built on the basis of consensus, cooperation and coordination of stakeholders and users and the integration and the harmonisation of information.

The general situation on spatial information in Europe, which INSPIRE is addressing, is one of fragmentation of datasets and sources, gaps in availability, lack of harmonisation between datasets at different geographical scales and duplication of information collection, it is the same situation that often is characterising some EU nations specially at local and central level. These problems make difficult to identify, access and use data that is available.

It may be useful to recall here that three out of the five overarching policy principles of INSPIRE (see Section 1.3.6) highlight the absolutely crucial importance of the local level, particularly in respect to local government. There is a clear need for better collaboration among all level of government, mainly between central and local governments and horizontally among all the stakeholders involved in the production, dissemination and use of geospatial information and related services. It is a matter of concern that discussions about SDIs tend to focus on the higher, often national levels, and rarely acknowledge the contribution of local jurisdictions.

At the same time, there is no doubt that there are huge challenges at the local level. There is lack of awareness at the local level of the importance of data sharing and in most situation local governments are not interested in

participating in the infrastructure; they use the infrastructure to have some services but do not offer their own data.

The motivation, when it occurs, to collaborate in data sharing is mainly related to a variety of reasons including common interest in building new products, economic benefit, reduced duplication, etc., but these benefits need to be balanced against inevitable technical, institutional and cultural barriers. Moreover, previous experiences in some local authorities have diminished their interest in participating because of the requirements and costs (e.g. change of institutional assets, financial and human resources, etc.) related to satisfying for example standards.

The main barriers remain those related to institutional issues, organisational cultures bureaucratic practices, funding, difficulty in cooperation and agreements, political environment, lack of standards, data policy and pricing.

Given that there are more than 100,000 local government organisations in Europe, and several thousand other public and private sector organisations that have a stake in local service provision and territorial management, the situation is highly heterogeneous among in Europe different countries, and among different regions and municipalities within the some country. Furthermore, there is a really common situation where the GI collected by the local administration is done in partnership with the private sector, thus introducing third party rights that need to be considered in formulating policies for data dissemination and use.

This lack of success in sharing geographic information among different levels of government strongly calls for a new approach reversing top-down initiatives and shifting resources to local authorities in order to address the negotiation of agreements supporting local needs and both vertical and horizontal integration of information flows.

7.6 CAPACITY BUILDING

As discussed in Chapter 3, Geographic Information (GI) Capacity Building is the collective set of *activities and processes* that operate within a given society to deliver the correct balance of all necessary *resources* that ensure geographic information is available such that it meets the needs and demands of the given society in a *sustainable* way. It includes:

- provision and raising resources;
- networking and communication;
- education, awareness raising and knowledge transfer; and
- institutional frameworks.
- There is much that the wider Europe at all levels (European, national, and regional) can learn from each other but particularly from the

experience of the Central European and South-Eastern European countries. The following sections discuss the key issues in turn.

7.6.1 Raising of Resources

There are several forms for raising capacity of human resources. These are offered or managed by different entities specialised in GI training or long-term educational programs. Education at universities and some sorts of GI awareness raising and or programs of continuous professional development belong to the recognised forms of GI capacity building. GI associations and societies often practise the latter. But there are (in major part of states observed) also challenges, which concern communication, inter-organisational co-operation, managing organisations and even reforms, professional self-governance, and fundraising etc. These findings implicate the need to build GI capacities in tight co-operation with non-GI experts and educators specialised in public management and administration. There is a need across Europe to empower the abilities and skills needed for self-governance and community building.

Capacity-building includes the knowledge (i) *of the kind* of GI capacities that is needed to gear national/European administration up to the effective use of GI and (ii) *how* to build and develop those capacities. In large part, the development of these capacities is a matter of learning from non-GI professions and from experience of GI communities in other countries.

The capacities needed to secure implementation of European policies are of various kinds. Some are of operational management capacities, specific to very technical areas of policy implementation. Expert knowledge and specialist skills are needed in different areas e.g. in agriculture, in transport, in environment and others; Management in such fields needs to become a part of a policy network linking professional colleagues in the same field across the wider Europe, including the Mediterranean Basin.

There are several sources of financial input enabling the development of the GI sector and GI use. These might be roughly divided into the following groups:

- state budgets; (the only source available n several countries)
- EU funds;
- service charges (by both private and public suppliers)
- Public Private Partnerships
- subscriptions from members enabling different activities organised by the GI Associations
- in kind; (voluntary contributions by members of GI Associations and networks which enables them to deliver their mission and membership benefits.)

- funds supporting development of civic society.

The four latter resources seem to play an important role especially for GI capacity building. There are successful models of sharing public and private investment/resources for development and maintenance of common solutions underpinned by GI and having a key importance for the country, as described in Chapter 2 and 3. Many CEECs and Mediterranean Basin countries use mainly central budgets or international funds with the private companies participating often only with a limited capacity in contracts.

On the other hand there is a high proportion of working in kind in some of the CEECs as by CAGI members in the Czech Republic (the Geo-Application Award). This approach is a successful method of overcome the public-private barriers where they exist, empower confidence and develop partnership working between these sectors to share their resources for development of join solutions, such as e.g. metaIS, MIDAS. Fostering the development of these voluntary resources and building upon them is absolutely crucial, but requires a pro-active strategy. It cannot be "just" expected to happen, and every country in the wider Europe should think hard about ways to incentivate and reward these voluntary efforts.

7.6.2 Networking and Communication

There are several sorts of networks regarding their radius or form as internal, external, and informal. They are supposed to create an efficient relation among organisations and experts for exchange of experience, for detecting of case studies and best practices (see the AGI Awards or the Geo-Application of the Year Contest organised by CAGI) and their dissemination to the non GI partners or to the public. Public Relations and Media, twinning networks, and internship are other possibilities to enlarge the visibility and contacts of the GI community, and make the most of opportunities.

A barrier between public and private sectors still exists in many CEECs and the Mediterranean countries despite good examples as in Hunagi, CAGI/Nemoforum, which show ways of smoothing or removing these barriers. There is a need to find ways to overcome the public-private barriers and to balance the involvement of all sectors of the GI community - government at all levels (Central, Regional, and Local administrations) and private, research, and user communities as well. It is not usually possible to join all these organisations or their representatives in one entity but it seems possible to build up their network and enable their communication. The potential of networks both within a country and in trans-national connection

in supporting the growth and development of GI capacity building should be recognised and exploited.

Universities are often the natural cores of the GI communities. Many of them are members of AGILE or/and scientific societies involved in international co-operation Experts from the universities or educational and research bodies seem to be better accepted as mediators in the cross sector communication and preparing bridges for public-private partnerships and other forms of co-operation or as community leaders.

National GI Associations and their Networks

NGIAs have the potential to facilitate capacity building as discussed in Chapter 6. They can provide a focal point for GI, and act as co-ordinator and communication/information centre of the GI community. NGIAs can provide a consultation for public sector or intermediate between the public and private sectors. Some National GI associations play an initiating or co-ordinating role (HUNAGI, CAGI/Nemoforum) and to a specific extent represent a national connection to the European initiatives, activities and networks.

7.6.3 Education, Awareness Raising and Knowledge Transfer

Education and awareness of the value of spatial perspectives to problems and opportunities in using GIS need to address multiple audiences, including citizens, professional, and decision-makers. To raise citizens' awareness, it is important:

- to have an integrated strategy,
- to provide a clear message (to use *easy to understand* pictures and little text),
- to provide a message that is relevant to the reader,
- to maintain and get a feedback.

In order to increase a broad use of GI awareness of the public, a framework of long-term and short-term educational and awareness raising activities focused on and diversified for different target groups has to be considered:

- education focused on the GI professionals and managers;
- implementation of GI into the existing non-GI educational schemes (build GI focused awareness raising, bring education into schools and university curricula, including programs i.e. MBA);
- awareness raising fitting to the needs, tasks and time capacity of decision-makers (non GI) and politicians;
- public awareness raising (communication on successful projects, Internet in schools, popularisation programs on TV, special training for the P.R. specialists).

The main topics should be incorporated into the educational programs. The education and training of the specialists, professionals, and managers are the precondition that ensures progress is made in the public domain.

Knowledge Transfer

The EU enlargement process opens up new opportunities for using GI and the related technology. There is an enormous opportunity for exchanging experiences between GI-experts from different countries and learning from each other. On the other hand, it opens up new challenges and tasks to incorporate GI and related tools as a widely recognised capacity for the implementation and monitoring of EC policies on all levels.

There is an opportunity for learning from others: both sides have a chance to avoid the mistakes of their western or eastern partner countries, which they have experienced in the previous stages and or periods.

- The unique experience of the CEECs with handling the change on a grand scale might be inspiring for the older EU Member States.
- Learning and adopting the democratic approach and procedures of western countries by the CEECs to build up strong professional self-governance on the national level can be useful for the CEECs.

There are also other diversities concerning the use of GI. In order to achieve a common goal a GI specialist needs to work together with other specialists, generalists and their networks. There is a need for co-operation between GI Associations and other professional organisations for example disciplines such as water management, coastal studies, local development – both urban and rural, public health, telecom, and utilities.

Although the GI community in individual countries and in Europe grows every year, it still remain that these GI specialists and current GI users represent a very small minority of the entire population within any given society. From this point of view training and awareness raising courses for these experts should also include a package on *soft* tools (techniques) that assist the expert to handle diversity and natural resistance of the human surrounding (Metcalf, 1997) to their GI tools and any organisational changes they would wish to initiate and implement. GI is a complex issue due to its current or potential implementation across the competencies of institutions and traditional administrative territorial units. Co-operation and partnership are of a high importance to cross the traditional barriers and to exploit the potential of GI.

7.6.4 Managing Change.

As has been argued over and over again in this Volume, SDIs require not just technology and data, but above all skilled human resources, coordination, and clear frameworks of agreement. People are central to the whole enterprise, not only in their ability to access, understand, and use effectively GI but also to exploit the information resources for their personal development, and that of society.

The previous Sections have also emphasised the need to manage the organisational change that the transition to an information –based society entails. Here, a wealth of experience and useful lessons can be learned from the Accession and pre-Accession countries. Their experience shows that when the whole society is mobilized, enormous change can be accomplished in a relatively short period. As discussed earlier local institutions in particular and public sector in general face big challenges in the transition o the Information-Age. The effective use of GI means that there is a need to consider the management challenges that the institutions and states face and the capacities they need to meet them. What remains unanswered is the question. *Which strategy should be adopted for capacity development?*

Public management is delivered through many organisations. Different kinds of management skills and expertise are needed to deal with management tasks at the inter-organisational level. These include co-ordination and integration of the work of different organisations involved in managing public policies. They also include the ability to design and develop new organisations and management systems that work effectively across organisational and national boundaries. In so doing it is necessary to understand the rivalries and overcome the centrifugal tendencies of bureaucratic politics as well as to take into account the other sources of organisational resistance to change within and among organisations. At the inter-organisational level there is no sharp distinction between governance and public management. The construction of new systems and structures of governance such as those involved in the adoption of a national administration to meet the conditions of EU membership is the management of change on a grand scale. The approaches for planning and preparing for a broad future implementation of GI are to either concentrate on a systematic and strategically prepared use of existing structures or to build up new structures together with the knowledge of the extent of such an organisational change. Success depends on qualified management, sustained concerted effort and well-organised teamwork.

Managing European affairs requires the development of an increasingly complex network of links extending outwards to the EU institutions and

inwards to the domestic administrations. Due to the complexity of the task and the broad scale of models used in the member states it is important to identify the strategic issues common to all the involved countries. It is also important to focus on the benefits derived from the use of GI rather than on the GI itself or the processes related to its creation, maintenance and implementation.

There are several possible strategies that could be used in the capacity-building process (as defined by Metcalf 1997) which include:

- *The short-term strategy,* which leads to the uncritical acceptance of additional (EU/GI) policy tasks without any significant effort to build capacities to cope with them. It achieves no gain in effectiveness.
- *The competitive strategy,* which is based on a shock therapy philosophy, which produces rapid initial results before creating overload.
- *The viable long-term strategy,* which maintains a balance between the development of management capacities and the acquisition of (EU/GI) policy responsibilities. Initial progress is liable to be seen as being slow, but a succession of *challenge-response* cycles leads to an enhanced performance without causing excessive stress or destructive overload. *Making haste slowly* has less obvious political appeal than the promise of quick results but it seems likely to provide a firmer foundation for long-term effectiveness.

Five Conditions for Successful Reform

Reform in government often starts with high expectations and ends up in disarray and disappointment. One reason is bureaucratic resistance to change. Since some resistance is to be expected reform strategies should be designed to take account of it either by overcoming it or circumventing it. Knowledge of the main sources of resistance that should be addressed makes it possible to anticipate them and formulate ways to deal with them.

Political will is necessary but that is not sufficient in itself to guarantee the success of reforms. Effective reforms seem to depend on a combination of five conditions that are partly characteristic of the situation and partly the results of deliberate action taken by the reformers and their political leaders. In summary these include:

- external pressure; *(e.g.: EU affairs, international competition)*
- internal dissatisfaction; *(e.g.: weaknesses of the transition period, inefficiencies of the current system)*
- a reform strategy; *(e.g.: INSPIRE and PSI accompanied by GI Capacity Building strategies)*
- a mechanism for steering and managing the reform process;
- processes, feedback and evaluation.

A mechanism for steering and managing the reform process. In a modern government, reform is the management of change; change in organisations and change in working relationships among networks of organisations. These are very complex and difficult changes to bring about. Passing laws achieves little if there is no capacity for undertaking the detailed work and developing programs that, move step by step towards the strategic objectives. The required capacities do not need to be in the form of a large organisation that centralises the control. Instead of a big organisation, small group(s) with clear political support may work in quite a decentralised way. In the end, the success of reform depends on the commitment of those responsible for implementing the reform itself.

Processes, feedback and evaluation are important both politically and managerially. They can be used to give reforms political visibility and also provide those who are managerially responsible for the means of assessing progress. Reforms often lose their momentum because over time they lose political visibility and support. Feedback and evaluation provide the flows of evidence and information, which can be used to maintain internal and external support.

The following Chapter considers how best to move forward in the light of the lessons learned.