

## **CAN A SUCCESSFUL SDI DRIVE REGIONAL COMPETITIVENESS?**

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### **Abstract**

Over the last two years, more than €2 billion of European Union funds have been committed to Information and Communication Technology (ICT) research projects. This investment has been made with a view to making Europe more competitive on a global scale; this is the regional competitiveness we refer to in this paper. This investment can also benefit those working in the field of Spatial Data Infrastructures. Primarily in Europe via the funding and direct involvement in ESDIN (European Spatial Data Infrastructure Network), but also globally for those tracking ESDIN progress and lessons learned.

The ESDIN eContentplus project, co-funded by the European Union sets out to tackle practical elements of the INSPIRE Directive (Infrastructure for Spatial Information in Europe). It will address the INSPIRE challenges by testing the theory of integrating National Spatial Data Infrastructures (NSDIs) to provide Europe with a framework of geographic reference information or in other words a European Spatial Data Infrastructure for which INSPIRE is the legal instrument.

The ESDIN consortium is developing best practice for geospatial data management and is working collaboratively with a large number of national mapping agencies, universities with EuroGeographics as the project co-ordinator. Collaboration and knowledge sharing are key to ensuring the success of any SDI, they will drive the ultimate success of the SDI and can facilitate regional competitiveness, in this case we are referring to the European Knowledge Economy and the Lisbon Agenda.

ESDIN can help meet some of the European ICT challenges and drive some of the aspirations of the Lisbon Agenda. However, in order to do so, it needs local players working closely together to share information and improve decision making that will then underpin the NSDIs that ESDIN is integrating.

At the European Council meeting in Lisbon (March 2000), the Heads of State or Government launched a "Lisbon Strategy" aimed at making the European Union (EU) the most competitive economy in the world and achieving full employment by 2010. This strategy, developed at subsequent meetings of the European Council, is built on three main tenets:

- It is economically sound preparing the ground for the transition to a competitive, dynamic, knowledge-based economy. Emphasis is placed on the need to adapt constantly to changes in the information society and to boost research and development. This is supported by eContentplus funding – the primary source of funding for ESDIN
- Social stability designed to modernise the European social model by investing in human resources and combating social exclusion. Member States are expected to invest in education and training, and to conduct an active policy for employment, making it easier to move to a knowledge economy.
- An environmental pillar that outlines the fact that economic growth must be decoupled from the use of natural resources. It is a much softer political target to work around environmental issues, hence the main thrust of the INSPIRE Directive.

INSPIRE is engaging hundreds of organisations and thousands or tens of thousands of individuals working within the European Community. If successful, meaning that National Spatial Data Infrastructures can be integrated and geospatial data can be more easily accessed and shared across borders for environmental planning, emergency response and disaster management, there is also a potential knock-on effect that it will make Europe more competitive and potentially help meet some of the aspirations of the Lisbon Agenda. However, this will not be possible without coordination and collaboration at a local level to support and sustain national SDIs.

### **Introduction**

SDIs tend to promote policies and partnerships to improve data access and sharing (via data integration or aggregation) across departments, organisations and national boundaries. They include trying to establish base reference mapping that can act as the gold standard data or framework data sets (with relevant and up-to-date metadata) and they are increasingly promoting the use of portals or geohubs. There are several aspects that are common across most SDIs and those are institutional, operational and technical challenges. Fundamental challenges that still remain are the willingness to share data and the capability for sharing geospatial data with all stakeholders. This exchange of data can be referred to as part of the geospatial data supply chain, i.e. from those organisations involved from data capture to data maintenance stages through to data sharing, subsequent use and feedback on currency and quality.

By the early 1990s, the concept of SDIs being developed, notably in Canada, the USA and the UK. Over 10 years ago Masser (1998) and Onsrud (1998) catalogued the SDI

efforts underway in over twenty-five countries worldwide. Now in Europe alone there are 27 Member States most of who are working on a national SDI. These are supported by localised or sub-regional SDIs, which are delivering the following example benefits:

- The SITAD project (Sistema Informativo Territoriale Ambientale Diffuso) set up by Regione Piemonte working with the Provincia di Torino and Città di Torino (representing three levels of public administration in Italy). This project is redefining geographic data production, usage and distribution among local authorities. It considers the INSPIRE principles, works under the umbrella of the NSDI (Portale Cartografico Nazionale - [www.atlanteitaliano.it](http://www.atlanteitaliano.it)) run by Ministry of Environment in Italy and has been developed in line with the most important national initiatives around geospatial data, such as CNIPA and IntesaGIS.

Created in 2003 it facilitates the coordination of public sector organisations to collect, manage, distribute and reuse spatial data. It aims to reduce the duplication of initiatives and economic efforts either on a local and a regional level, provide more information and help share data with citizens and the private sector. It addresses non-optimal use of economic resources, which in turn makes the region more competitive because they can respond more quickly to requests. The SITAD community has stated that participation in national and international initiatives, moving beyond the local level, is absolutely necessary in order to transfer knowledge and awareness to supporters and other GI actors on the theme of geographic information enrichment. This fits with the ESDIN approach to share best practice information from the highest, European level. SITAD is a Spatial Data Infrastructure that involves the entire Public Administration of the Piedmont Region. Following the initial costs for set up and implementation, many regional bodies are now using this Infrastructure in order to share regional environmental data and metadata, saving time and costs.

- Another activity that involves public sector administration, but is driven and supported by academic professionals is GeoTest. This is an initiative between the National Land Survey of Sweden, Future Position X (FPX) and the GIS Institute at the University of Gävle. It relates to the development of a testing and demonstration environment for geospatial data. One of the aims is that GeoTest contributes to the implementation of INSPIRE in Sweden and is part of the national geodata strategy work. This is another good example where collaboration across sectors GeoTest is part of the national geodata strategy.

GeoTest works across the supply chain where stakeholders are addressing issues relating to geospatial data testing, such as standardization, communication, competence and harmonization. They assure the quality of the entire test process from data producer to users and citizens. The goal is that geodata is 'safer' for all parties in the supply chain, as well as making more efficient use of the geodata available to SDI stakeholders via different portals and web services. Local players

add strength and depth of knowledge meaning that when the need arises to support SDI developments, they will be able to scale up activities and secure the provision of know-how. At the National GeoTest Centre of Sweden, producers, users and test teams are offered a meeting place to exchange experiences and development methods. Experience and knowledge from a variety of research and development projects undertaken both in Sweden and abroad is provided and they are a reference group for ESDIN.

- A practical example that specifically relates to local decisions for local government in the UK applies to schools. Pupils living in Dudley in the West Midlands go to school in areas like Wolverhampton, Walsall and West Bromwich and vice-versa. If the local authority in West Bromwich decides to close a school in their area, it may make perfect economic sense to them, but not for pupils travelling daily from Dudley. This is a localised example of sharing data amongst public sector bodies where it impacts citizens immediately and has practical and cost ramifications.

This is the most basic level of SDI building, unless we can share such information or geospatial data we cannot hope to plan infrastructure at the regional and sub-regional level. It is argued that by optimising decisions at this local level will improve decision making and save time and costs over time. In the context of ESDIN and competitiveness at the EU level it has to start with data sharing at the sub-national or local level. Again knowledge sharing of how such issues are tackled within and across other parts of the UK or even Europe can work towards the long-term aspiration of the European knowledge economy simply by making people smarter around local investment decisions, such as school closures.

In a report called Advanced Regional Spatial Data Infrastructures in Europe findings were presented from a workshop of the same name that was organised by the European Commission Joint Research Centre in May 2008. The objectives of the workshop were to review the state of progress, analyse the different organisational models established with local and national stakeholders, and assess the social and economic impacts of the regional SDIs. Eleven regional/sub-national SDIs in Europe are presented in the report: Lombardy and Piedmont (Italy), Catalonia and Navarra (Spain), Wallonia and Flanders (Belgium), North-Rhine Westfalia and Bavaria (Germany), Northern Ireland (UK), Brittany (France), and Vysočina (Czech Republic). It must be noted that there are other regional SDIs working across Europe, for example in Austria, Czech Republic and Poland and in other parts of Germany, such as Saxony; these are not in this report.

The findings of the report were presented in the context of the broader European framework provided by INSPIRE, including national State of Play studies and other overseas experiences from the USA and Australia. It stated that these regions are leading the way in SDI development in Europe making use of the most advanced technology available in the market today and acknowledging the importance of

standards. A key observation is that again the local level was highlighted as crucially important for coordinating and organising developments through numerous partnerships and organisational models.

Working in this way across the supply chain is difficult because it requires commitment and investment from all of those individuals and organisations involved, as well as political buy-in and endorsement. It mentioned that the largest social and economic benefits of an SDI can be found, supporting operational day-to-day applications affecting millions of citizens and local businesses at the local level. The report states:

“From this perspective, the main lesson of the European experiences, supported by those in the USA and Australia, is that Spatial Data Infrastructures are foremost social networks of people and organisations, in which technology and data play a supportive role. The technology is cheap, data is expensive, but social relations are invaluable.”

### **Objectives**

The ESDIN contribution to regional and sub-regional SDIs falls therefore into four categories that this paper addresses:

1. Outline the intention of the European Union to become more competitive in the ICT arena worldwide and explain how ESDIN fits this model;
2. Explain how local SDIs can support national SDIs and how they can observe and learn from regional SDI activity, such as ESDIN
3. Examine the approaches of ESDIN for solving data management issues;
4. Determine how these solutions can help SDIs and more broadly speaking the competitiveness of regions, such as Europe, in the area of ICT.

As mentioned previously the Lisbon Agenda plans to make Europe more competitive on the global ICT stage, as a result there are several EC funding mechanisms available for European organisations. The geospatial sector has been poorly represented in recent times when applying for such funding. Although perceived by those working in the geospatial industry as extremely important societal issues, the European Union has tended to provide funding in the past to other industry sectors. An element of this is down to poor proposals emanating from the geospatial domain, but also because of the need to understand how and where this can benefit the European knowledge economy and competitiveness. ESDIN is one of a small number of proposals that has obtained funding and according to a spokesperson from the European Commission this was provided because of the broad coverage and accessibility of the expected results.

The second objective of this paper marries up with some points made recently in an industry article (Ramage and Sanderson, GEOConnexion May/June 2009) that the concept of an SDI is strategic or global. Such concepts tend to gather dust on library shelves unless local actors take hold of the ideas and act on them. Hence the phrase, think global, act local (ascribed to Geddes, 1915). Implicit in a Ron Lake blog was the concept of the need to finesse the people and organisational issues by reducing the

scope of SDI implementation to the city state level. This view was echoed by Tosta referenced here:

[sdi.jrc.ec.europa.eu/ws/Advanced\\_Regional\\_SDIs/presentations/masser\\_mcdougall.pdf](http://sdi.jrc.ec.europa.eu/ws/Advanced_Regional_SDIs/presentations/masser_mcdougall.pdf)

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

For the interoperability envisaged by the SDI movement to succeed we need to establish the basis for the collaborative effort either through public service initiatives (EC Framework or eContentplus Programmes including ESDIN) or through the free market. This will be the basis for successful SDIs and regional competitiveness.

The third objective is to address some long-standing industry problems, such as data consistency and integrity, by looking at possibilities for online data quality validation. There are some specific data lifecycle maintenance topics of interest to organisations across the supply chain, such as:

- Cross-border data consistency methodologies for edge-matched maintenance; important for combining spatial data of adjacent regions seamlessly from different sources;
- Stable Unique Identifiers (UIDs); workable at a European level in a data maintenance framework for regional or national data holdings;
- Incremental updates deliveries at a European level; assessing methodologies and best practice for change-only updates.

The final objective is to consider what ESDIN will provide to the market place as a whole, in terms of best practice around SDIs and how this translates into competitiveness as part of the European ICT agenda. A useful approach for doing so is knowledge spillovers. In their paper from September 2008, (“Collaboration networks as carriers of knowledge spillovers: Evidence from EU27 regions”), Hoekman, Frenken and van Oort present the concept that the geography of innovation traditionally concentrates on localised knowledge spillovers, yet neglects collaboration networks as a means to access knowledge outside the region. ESDIN could be such a collaboration network. The presented results from this paper were suggested to be useful for two science base sectors, i.e. biotechnology and the semiconductor technology:

“The spatial diffusion of knowledge and its effect on innovation is of major importance to ensure productivity growth and to improve the welfare of nations. As knowledge is hard to appropriate it generates benefits to other agents through several spillover mechanisms. Understanding the geographical structures that underlie these spillover benefits is necessary for any evidence-based innovation policy to stimulate Europe’s transformation towards a knowledge-based society.”

The final section of the ESDIN Mission Statement states ‘Stimulate the development, use and re-use of European digital content in the global network’. As a best practice network ESDIN will be invaluable for INSPIRE stakeholders. From a global perspective it should also promote European digital content and provide some inspiration for other SDI initiatives across the globe. If ESDIN is successful in its objectives to work with project members and industry reference groups then hopefully knowledge spillover will benefit Europeans as a whole and support the geospatial industry at the same time.

As stated earlier in the paper ESDIN will address the INSPIRE challenges by testing the theory of integrating NSDIs, but it will take involvement from ESDIN participants working on sub-national SDIs to ensure the requirements, data and information are useful, relevant and shared at different levels across the supply chain, i.e. from local to NSDI level.

### **Methodology**

As the only UK technology provider working in ESDIN, 1Spatial is helping the consortium to develop best practice for geospatial data management. Co-ordinated through twelve work packages the project deals with methodologies in two of these for Metadata and Quality, and Data Maintenance and Business Processes in National Mapping and Cadastre Agencies.

ESDIN will help Member States, candidate countries and EFTA States (European Free Trade Association) to prepare their data (and maintenance processes) for INSPIRE Annex I data themes and improve access to them. Specifically the project will:

- Aggregate data through the development of web based services for several INSPIRE themes at different levels of resolution from the European to the local level;
- Implement services that will support the aggregation of ‘interoperable’ data in a more cost effective and efficient way;
- Build sustainable best practice networks to ensure the organisational development necessary to achieve the goals of the project and its continuation afterwards;
- Spread best practice in the integration of local (large scales) reference information with pan-European (medium/small scales) reference information, and interoperability with other data themes;
- Test INSPIRE Implementing Rules and specifications in a live operational environment and recommend improvements where identified.

ESDIN will enable agencies, technology providers, academics, professionals, value added resellers and end users to significantly raise the prospects of success for the European Spatial Data Infrastructure. The solution will result in the provision of data for a number of INSPIRE Annex I themes at a range of scales, from a European view

down to a local view. The project will also assess the suitability of this information as a basis for linking to other information themes (INSPIRE Annex II-III). Achieving interoperability of data within a theme, between themes, across borders, for different applications and at different resolutions will require some basic components of interoperability being put in place, including services capable of transforming data and providing access to the data, such as; transformations to European data specifications, providing common semantics, support for multi-lingual aspects, transformation of coordinates (to common coordinate reference systems), generalisation (from 'large' to 'small' scales) and edge-matching (to address inconsistencies at national borders). ESDIN aims to develop, test and implement these.

The project will also address the challenge of 'business interoperability'. Across Europe there are a number of different business models and associated pricing and licensing policies. Management of intellectual property rights, with simple data licensing, digital geo-Rights Management providing fast and easy user access to data, will be important components of the proposed solution delivered in this project. Finally, quality of data is also a prime concern of users and there is a need to establish a standard approach for reporting data quality in a manner understood by users and for a range of data. This project will prepare guidelines for the creation of discovery metadata and data evaluation for the data providers of reference information and develop a quality model based on best practices at the data providers in Europe and on international standards. By following supply chain principles, where communication and activity needs to take place with multiple participants across the whole supply chain, there should ideally be a feedback mechanism in place. This means that data consumers or end users can feed back inconsistencies or perceived errors in the data for the original data creator or provider to assess and resolve, if appropriate.

## **Results**

As it stands, INSPIRE, as the European SDI, is purely theoretical. ESDIN will work on best practices for integrating the National Spatial Data Infrastructures (NSDIs) of Member States to provide the European SDI. This will ascertain if users can access and share geospatially referenced data for a variety of data themes at a European or local level. With so many NSDIs at different points of development across Europe, data varies quite significantly in quality, coverage, content and structure.

Pulling data together or aggregating it across Europe from the different sources, different themes and at multiple resolutions through a services-based approach is a concept yet to be implemented in practice on any significant scale. The work in ESDIN will provide a practical and pragmatic approach to addressing these issues.

## **Conclusions**

A key lesson, which is one of the main thrusts of this paper, is to highlight the importance of participating in knowledge sharing fora. This means observing or participating and learning from projects like ESDIN at a national and international

level, in order to create knowledge sharing communities. As it stands ESDIN has brought together experts from a number of different countries and has been working in important domains like Unique Identifiers (UIDs), feature level version control, edge-matching and change propagation. So far good practice has been shared from a number of countries and there is now an underlying framework to help create methodologies implementing those domains, establishing cross-border geospatial data harmonisation and data maintenance strategies.

Spatial Data Infrastructures require significant investment and those backing that investment will be determining the success of their SDI based on a number of factors. In particular, the accessibility of geospatially referenced data for decision-making in the event of natural disasters like flooding across borders. However, there is also a wider business imperative relating to SDIs and in the European context this means ICT competitiveness. In order to establish and maintain its leadership in key ICT areas Europe has to do more in research and innovation in ICT. This paper suggests that investing in the geospatial arena and projects such as ESDIN will support competitiveness and help build the European knowledge economy through data management best practice and knowledge sharing.

Based on some of the examples of local or sub-national SDIs, there are a series of lessons that have been learnt. These relate to the importance of sharing information in a number of relationships:

Public administration: public administration,

Public administration: private sector,

Public administration: academia and

Public administration: citizens.

This approach can help improve public sector information reuse across the supply chain and save time and costs, both of which can help to make a region more competitive.

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