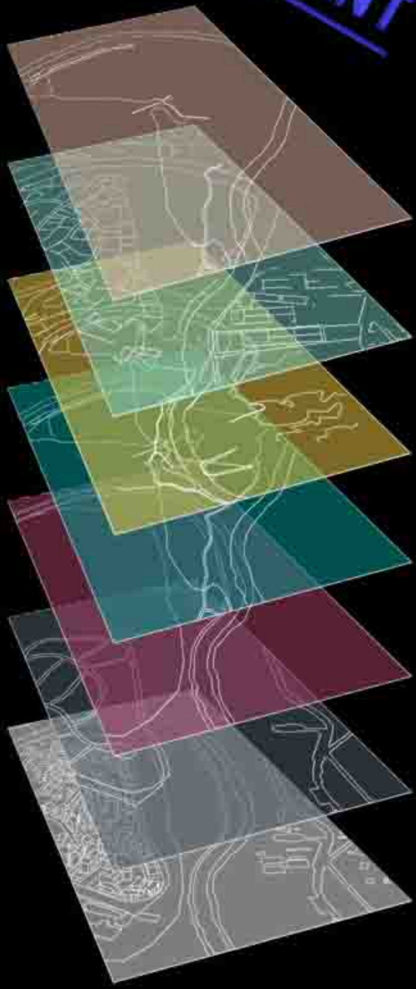
Plan4all

INSPIRE COMPLIANT

Plan4all Project

Interoperability for Spatial Planning

Mauro Salvemini, Franco Vico, Corrado Iannucci (Eds.)



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INSPIRE · Infrastructure for Spatial Information in Europe

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Note of the Editors

Corrado Iannucci, Mauro Salvemini, Franco Vico

For several reasons, few projects funded by European Commission end with a printed book summarising the outcomes of the project and its achievements. In this case, while the project activities were still running, Plan4all considered this opportunity and has found it useful to prepare such a book, mainly on the basis of the idea that the achieved results about spatial planning interoperability should be spread among the wider communities at EU and international levels.
The Plan4all project has been able to deliver technical results that will surely be of interest to spatial planners, GI experts and ICT professionals. On top of such technical results, the Plan4all project fosters the exchange of ideas and experiences between those professional communities, whose need and interest for a more extended dialogue has also been evidenced during the workshops convened by the project.
To be fruitful, such dialogue requires a common language, going across the borders and the constraints of the “dialects” peculiar to each discipline. The Plan4all project has aimed to contribute to this common language; this book, focussing on the approaches more than on the technicalities, is also a result of such effort.
The book has the following structure:

- Chapter 1 and Chapter 2 define the contexts concerning spatial planning and ITC and the need for interoperability of spatial planning data; the key concept of Spatial Data Infrastructure is also introduced;
- Chapter 3 gives an overview of the whole Plan4all project, with its structure of work packages;
- Chapter 4 is a summary of spatial planning in the EU Member States, with similar problems and different solutions, even within the same country;
- Chapter 5 describes the metadata and their catalogues as a tool for information sharing;
- Chapter 6 and Chapter 7 address the data models that are the convergence point of ICT experts and spatial planning domain experts;
- Chapter 8 reports the network architecture that supports interoperable solutions for spatial planning data;
- Chapter 9 shows how it is possible to deploy such interoperable solutions;
- Chapter 10 summarises the findings and suggestions collected through the workshops convened at the country level; and
- Chapter 11 includes some comments and suggestions provided by consortium partners, as posted on the project blog.

A list describing the 24 partners that have cooperated inside the Plan4all Consortium is attached. They come from 15 different countries, express different competencies and are active in various sectors including academia, public administration, private sector, pan-European and national organisations. The diversity of the Plan4all partners has been a factor in the complexity of the project and also a strength at the same time.
This list can be seen as a sort of European directory of the entities that are aware of the problems and of the possible solutions for the interoperability and harmonisation of the data related to the domain of the spatial planning. This directory can also be a reference for any possible future actions in this domain.
The Editors would like to firstly thank Krister Olson, who as Project Officer has authorised and supported the specific idea of producing this book, among the various publications of the project.
All the consortium members have contributed to the book, but specific thanks have to be given to the authors of the chapters who summarise the works performed during the project duration, and also to project coordinator Tomáš Mildorf, who was the leader of the process of realisation of the book together with EUROGI, who have managed the necessary resources.
Julia Leventon has been of great help having the patience to revise the English language and Francesco Buscemi has expressed his creativity in designing the cover and taking care of editorial printing.
The present book has been made possible by the joint effort of all the mentioned people.

The Editors.

Forewords

Foreword

Tomas Mildorf
University of West Bohemia

The Plan4all project proposal was put together when I was in the middle of my traineeship at the Joint Research Centre in Ispra. After negotiation with the Commission, the project started in May 2009. At that time, everyone had his/her own vision of the future Plan4all results that were later assimilated to a common goal and understanding. 24 partners from 15 European countries demonstrated the feasibility of spatial planning data harmonisation despite the diversity of their languages, cultures and disciplines. Tremendous work was done to make a huge step towards the interoperability of spatial planning data. I am grateful to all the partners who took responsibility for the project execution, to all affiliated partners who contributed with their expertise and to all stakeholders who provided us with their feedback.
The Plan4all contribution is not only a solution for environmental policies of the European Commission; it should be understood as a framework that can be exploited on any governmental level, by many organisations in public and private sectors and in cross-border activities. It also creates a challenge for follow-up activities and further research into spatial planning and data sharing.

Foreword

SDI for ePlanning

Zorica Nedović-Budić
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Planners were among the first and most prominent users of geospatial technologies from the time when they became more widely accessible and affordable in early 1980s until today (Masser and Craglia 1997, Warnecke et al. 1998). In the short span of less than two decades, we have moved from standalone geographic information systems (GIS) to spatial data infrastructures (SDI). The ultimate objectives of both GIS implementation and SDI initiatives -- to promote economic development and to foster environmental sustainability – are all closely related to the general purpose of planning (Masser 2005). However, with all the technological dynamics that had shaped the ways in which spatial data is retrieved, manipulated and shared, one aspect that has remained constant is the predominantly generic nature of the supporting interfaces, functionalities and frameworks. Plan4All project addresses the very core issue of customising the implementation of the European SDI initiative – the INSPIRE Directive -- to the needs of spatial planning as it is practiced across the European Union (EU) region.

The context – substantive, cultural, socio-economic -- is recognised as an important consideration for SDIs to be understood and viable (Masser 2005, Nedović-Budić et al. 2011). The diverse nature of planning systems across the 29 countries presents a substantial and challenging task before the Plan4All team. The 2006 classification of European planning families based on the European Spatial Planning Observation Network (ESPON) 2.3.2 project identified five legal groups of planning systems: British, German, Scandinavian, Napoleonic and East-European (Lalenis 2007). In addition to this typology based on the legal systems, the traditions -- comprehensive-integrated, regional-economic, land-use planning and urbanism – as well as the administrative systems and related distribution of power and authority among various territorial levels also determine the nature of planning.

Concomitant to this complexity and diversity of planning are: a) qualitative and quantitative data, planning documents, and the attached meanings and terminologies that are used to signify and label planning processes and phenomena as they are understood in different cultural and socio-political contexts; b) planning functions as required by planning laws and local circumstances and relevant analyses, applications and decision-support systems; and c) the network of actors involved in the planning process, with the nature of their participation ranging from data producers and users to various stakeholders. Respectively, these areas correspond to the three foci of the Plan4All project – metadata definition, data model, and network services architecture.

METADATA for planning data

Participants in the planning process rely on many types of information, including formal analytical reports and quantitative measures, complemented by understandings, arguments, and meanings attached to planning issues and activities (Innes, 1998). Planning decision and policy-making processes are dependent on accurate localised information and on deeper understanding of the broader societal issues and trends and considerations of variety of stakeholders' interests. Extensive data collection, dissemination, interpretation, analysis, and presentation activities are undertaken in planning organisations on a daily basis. Planning information is often integrated and such process often involves the use of data represented in various scales ranging from large (e.g. 1:5000) to small (e.g. 1:25,000) and with boundaries derived through institutional, administrative, or analytical processes (e.g. planning jurisdiction, districts, census tracts, neighbourhoods or subdivisions, traffic analysis zones, blocks, and parcels) as well as those defined ecologically (e.g. critical areas, watersheds and drainage basins, airsheds, and habitats). In addition, there is graphical, numerical and textual information from planning documents – plans, ordinances, and reports.

Metadata is, obviously, the first call of duty for an SDI to secure understanding of the diverse datasets – their origin, contents, purpose, format, and access among others. The variety of terms used in planning across different European regions and countries presents a major challenge. Understanding urban ontologies is the scientific underpinning of the translations that need to happen to ensure cross-cultural and cross-boundary planning. Resulting from the 'Towntology' project Laurini (2007) suggests an approach by which the initial definitions (sub-ontologies) are collected using a decision tool and then consolidated with a tool that would allow for transforming verbal or multimedia definitions into descriptive logics codable with OWL. The author emphasises the language problem as the major challenge to be overcome with creative solutions. The GEneral Multilingual Environmental Thesaurus (GEMET), developed by the European Environment Information and Observation Network (Eionet; http://www.eionet.europa.eu/gemet/about) offers one such pragmatic approach to communicating within the linguistically and culturally extremely diverse environment. The more fundamental research on planning ontologies and their commeasurability across cultures and the SDIs embedded in them is essential for resolving the issues of interoperable terms and meanings (Saab 2009).

DATA MODELS for intelligent planning process

Planning intelligence is the most advanced level in a hierarchy starting with data and moving toward information and knowledge. The intelligence is achieved through conversion of data into higher forms via statistical analysis, modelling, simulation, systems analysis, and decision-support systems (also referred to as planning support systems or PSS). The planning intelligence function provides support to all other local planning programmes—advance planning (long-term strategies), problem solving (short-term projects), and development administration and management. This analytical and decision support is needed for a comprehensive range of considerations, such as land use, economic development, environmental protection, community health, housing, provision of transportation and utility infrastructure, and supply of public services, amenities and facilities, among others.

Instrumental (functional) and communicative (substantive) rationality as the key theoretical underpinnings of planning provide insight into the evolving role of geospatial technologies and tools in planning practice (Nedović-Budić, 2000). Guhathakurta (1999) believes that the contributions of spatial technologies are capable of transcending the ‘‘communicate versus calculate’’ dichotomy as planning draws upon both facts and values. The attempts to conceptualise the planning activities and needed support and translate those to data and application domain models are only rare. Hopkins at al. (2005) provide a set of conceptual schema for organising the planning data, actors, assets, actions, decision situations, plans and system architecture for implementation of Planning Markup Language (PML; Figure 1).

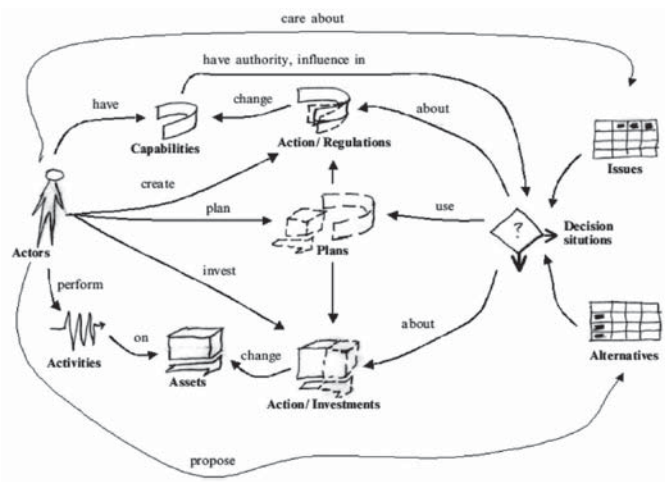

Figure 1: Elements of Planning Data Model (after Hopkins et al. 2005)

NETWORK SERVICES for ePlanning

Planning requires networking and involvement of various parties – some for the purposes of data collection and/or dissemination, some for the purposes of the participation in the planning processes and decisions. With regard to data sources and/or recipients, the primary and secondary sources include libraries, national, state, and local agencies, other public and quasi-public bodies, survey organizations, and commercial organizations and groups. The participants in the planning process also cover a wide range of other relevant public institutions and private actors, such as businesses and individual citizens as well as non-profit groups and organisations.

Ideally, an SDI should provide benefits to all involved entities – as a means of data exchange, access, communication and networking. In particular, the needs of cooperating members must be met, and the additional provision made for other non-participating members to take advantage of the SDI contents – data and/or services. As the number of participants grows, the data pool is broadened to enable the realization of further benefits and economies of scale. Beneficiaries of the evolving SDIs provide means for networking and referencing various data sources and for ensuring consistency and compatibility of data development across administrative and organizational boundaries. For the purposes of planning the SDIs would also facilitate and support the planning process. Research in the enabling network services and customisation of latest ICT and geospatial tools to serve SDI purposes is of ultimate importance for the ensuring and enhancing its utility to planning.

The next step – validation and evaluation

Plan4All project deals with three elements that are necessary for an SDI to be of service to the planning purposes – metadata for planning data; data models & application schema for the (intelligent) planning process; and network services as underlying technological infrastructure to support online planning activities (access, manipulation, exchanges and communications). The project also validates its findings and recommendations through a large scale testbed.

Similarly, a holistic evaluation of SDI facility is necessary. In addition to access, horizontal and vertical integration, flexibility, suitability, and movement of spatial information resources are important for effective planning and policy-making. However, evidence about the benefits planners desire and derive from SDIs is mostly anecdotal. The agenda for future research should consider if and how SDIs for planning are providing utility to the planning mission, functions and actors. To learn how existing SDIs satisfy planning information needs we need to evaluate data products supplied at the national, state, and local levels, or developed through cooperative initiatives and programs, against the specified criteria. For example Nedović-Budić at al. (2004) suggest the following criteria: awareness of SDI efforts and products; data availability; data accessibility; relevance of data to local planning; flexibility/adaptability of data to planning applications; effect on decision making; and impact on local cooperation. Crompvoets et al. (2008) review a wide set of perspectives for undertaking the assessment of SDI. However, regardless of the perspective, it is important to know if SDIs make a difference and, if yes, how so – as a basis for their improvement and better adjustment to the nature and needs of planning.

REFERENCES

Crompvoets J, Rajabifard A,van Loenen B, Delgado Fernandez T (Eds.), 2008 *A Multi-View Framework to Assess Spatial Data Infrastructures* (RGI, Wageningen)

Hopkins L D, Kaza N, Pallathucheril V G, 2005, "Representing urban development plans and regulations as data: a planning data model" *Environment and Planning B: Planning and Design* 32 597-615

Innes J E, 1998, "Information in communicative planning" *Journal of the American Planning Association* 64(1), 52-63

Lalenis K, 2007 *Typology of EU National Governance and Spatial Planning Systems* PLUREL project WP2.2

Laurini R, 2007, "Pre-consensus ontologies and urban databases", in *Ontologies for Urban Development* Eds J Teller, J R. Lee, C Roussey (Springer Verlag, Studies in Computational Intelligence, 61) pp. 27-36

Masser I, Craglia M, 1997, "The diffusion of GIS in local government in Europe", in *Geographic Information Research: Bridging the Atlantic* Eds M Craglia, H Couclelis (Taylor & Francis, London)

Masser I, 2005 *GIS Worlds* (ESRI Press, Redlands CA)

Nedović-Budić Z, 2000, "Geographic information science implications for urban and regional planning" *Journal of the Urban and Regional Information Systems Association* 12(2) 81-93

Nedović-Budić Z, Mary-Ellen F. Feeney M-E F, Rajabifard A, Williamson I, 2004, "Are SDIs serving the needs of local planning? Case Study of Victoria, Australia and Illinois, USA" *Computers, Environment and Urban Systems* 28(4) 329-351

Nedović-Budić Z, Crompvoets J, Georgiadou Y (Eds), 2011 *Spatial Data Infrastructure in Context: North and South* (CRC Press, Boca Raton FL)

Saab D J, 2009, "A conceptual investigation of the ontological commensurability of spatial data infrastructures among different cultures" *Earth Sci Inform* 2 283–297

Warnecke L, Beattie J, Kollin C, 1998 Geographic *Information Technology in Cities and Counties: a Nationwide Assessment* (Urban and Regional Information Systems Association, Chicago IL)

Foreword

Bruce McCormack
EUROGI

Land use planning, spatial planning, physical planning and other terms are used to describe the process of decision-making regarding the use of land and buildings. Whatever term is used, one thing is for sure, namely, that decisions taken about how land and buildings or other structures are used effect every citizen in direct ways on a daily basis. The impacts are however not just directly on citizen's daily lives, but also on general national, and ultimately global, conditions.

It is instructive to take but a single example that highlights the wide ramifications of planning decisions. If plans require towns and cities to grow in compact ways and there is a bias against permitting single family houses to be built in the countryside for urban people, then commuting distances are reduced with associated reductions in greenhouse gas emissions; biodiversity would be less threatened; water quality in countryside streams would be protected from inadequately maintained sanitation systems; and last but by no means least, significant cost savings would be made in the provision of essential services.

The above example highlights one facet of planning, namely, its role in the avoidance of negative effects. Planning however has the potential to shape broad patterns of growth and local urban form to produce new and positive circumstances. For example, at a broader scale, focussing new economic development can help to create agglomeration economies that help support ongoing sustainable economic growth. At the local scale, creative use of topography, views, orientation, aspect and existing vegetation, along with sensitive design can create housing estates with a strong sense of place, which are defensible from anti-social behaviour, are affordable and look good.

Sound planning which avoids the negatives and reaps the positives requires a strong, solid evidence base, which is itself built on good, relevant and up to date information and useful tools for manipulating the information.

Evidence in the form of facts about real world circumstances is of course not the only input into planning decision-making. Other main inputs are norms and values of citizens, communities and society at large, political considerations filtered though elected representatives, financial drivers in a market economy, as well as other factors.

Plan4all does not begin to address the norms and values, political or other issues but instead deals directly with key aspects of the all important information base and

tools that underpin a sound planning system.
Land use planning has geography or location, at its core and this aspect needs to infuse every aspect of the planning information base. EUROGI is an organisation not of planners, but geographical information (GI) orientated organisations, which themselves have up to 6500 organisational and individual members across Europe. The strong commitment to advancing the use of GI and the superb expertise base that we can draw on has, without doubt, been a major contributing factor in the success of the Plan4all project. This fusion of location specialists and planners has been rewarding for those involved, giving rise to useful outputs which will be of particular benefits to planners in their quest to improve the evidence base for their activities.
I am thus most pleased that EUROGI has played a key role in the project, and more particularly, has taken responsibility for producing this book. I am sure that through this book, the impact of the Plan4all project will be leveraged substantially and will have a significant impact across Europe amongst the wider planning community.
Finally, on behalf of EUROGI I would like to thank all those from the many participating organisations for their input and the long hours and deep thinking that they have contributed. Your efforts will be rewarded, in no small part through the widespread use of this book.

Foreword

How challenging is the interoperability for spatial planning?

Mauro Salvemini
AMFM GIS Italia

Since the beginning of the 90s, issues of interoperability have received a increasing attention from within the culture and the praxis of European technical and professional communities as a result of scientific and technical initiatives and subsequently from the INSPIRE Directive. It is worth noting that in the presence of a multicultural and multilingual environment such as Europe, interoperability used to be treated mainly in specific scientific contexts and primarily at a theoretical level and for commercial and institutional purposes. It later received practical consideration for the benefit of solving some urgent issues, mainly related to sharing data in the different phases of natural disasters and risk management.
Information regarding the land and the territory, which used to be called cartography, has historically been considered and treated as strictly rooted to the native civilization. Therefore any initiative addressing the interoperability of Geographic Information (GI) directly impacted local cultures. The fact that almost seventy years ago, European nations where still at war and were using their own, classified military and civil cartography is a crude but indisputable consideration which gives some light to the new praxis of sharing geospatial data as fostered by the political decision of EU Parliament that passed the INSPIRE directive. Therefore, the INSPIRE directive, more than other technical and administrative acts, impacts the local culture that deals with the description of the territory and the land where the ancestral history and the origins of all populations are rooted. Nowadays, the multicultural dimension, so prominently fostered by the media and the World Wide Web, is only scratching the surface of the real understanding of land as known and perceived by local communities. The impressive GOOGLE tools let the user know and perceive physical aspects of land in a real image that is truly and fully understandable by anyone who already has a sufficient knowledge of the area. The tags voluntarily seeded on GOOGLE pictures help specific user categories by supporting their understanding, but are insufficient for ensuring the interoperability of deep understanding of the territory and its components. The contemporary society that uses freely available geo-web tools is focusing on where to go and how to get there, while que-

stions of “what is it?” and “which are the components of the land?” are not considered due to the lack of interpretative information provided by the web. Interoperability of land detailed knowledge remains a hard aim to achieve because of the resistance and difficulty in sharing cultural information behind geospatial data.

Interoperability and e-government

Interoperability is also only accepted as long as it does not touch specific interests, personal data, or impact sensitive issues such as faith, religion, local customs and personal interests.

Nevertheless there are some very efficient examples of interoperability applications that run well-established services including bank transactions, freight and goods delivery, passenger movements and a consistent number of e-government services; all these take place at a national and international level, while also solving cross-border issues. The ITC techniques and tools, from web- services to communication standards, which are used to ensure the functioning of such complex systems, are based on and use the same architecture that is defined and legally stated by INSPIRE. Specifically speaking about the thematic essence of INSPIRE, the 34 spatial data themes from Annexes two and three of the Directive depict a complex scenario, characterised by problems that the Member States will be called on to address when invoking the directive itself and the legislated interoperability. The interoperability process seems to be characterised by serious vagueness about how data for spatial planning will be treated in order to be shared with the European SDI. In this sense the Plan4aLL project has been an unique opportunity for learning more about this issue and for paving the road to acceptance of seven data schemas out of 34 listed in INSPIRE Annexes. The mentioned discrepancies are mainly created by the heterogeneous characters of populations which perceive understand and manage the territory by applying their own cultural schemas.

Interoperability is an intelligent and fruitful form of homogeneity, which needs to be grown and fostered because it currently does not have the same meaning or the same relevance for all communities and populations. This is particularly true during these days where all over the world, but specifically in Europe, it is possible to note the political and social tendency of local regions and authorities to waive their independence from national government and central authorities, often on the premise of affirming strong cultural differences. It is a matter of fact that the same populations and parties that support local independence, local rules and even laws and administrative procedures, appreciate the use of interoperable public services to ensure a sustainable life for citizens. Therefore, in principle, interoperability may be well supported by those who wish to sustain the independence of local cultures. But it is necessary to check the scale of interoperability in order to verify the application of a true interoperable model instead of intra-operable one. Intra operability is the ability of diverse systems and organisations to work together (inter-operate) using proprietary standards or standards that are not open. This approach may ensure the perfect control of a workflow inside the specific system and organisation but makes it extremely difficult to combine data sets and for services to interact without repetitive manual intervention. The differences between interoperable and intra-operable models of data and functions used in spatial planning, e-government and ICT domains, need to be carefully considered.

The private sphere is also very relevant for interoperability. People appreciate data sharing as long as it does not encroach on the private and personal sphere and as long as it facilitates the efficiency of services provided by public authorities. Some communities may become very much less open and more suspicious of interoperability when their own approach to classification of solid property of land and buildings is not fully respected.

The few considerations about the public and private approaches to the interoperability show that it is at the same time desire of interoperability and the conservation of native or local operability and knowledge it means privileging the intra-operability organisational and intra-community praxis.

Europe as a world region and densely populated area hosts a diverse cultural heritage and the local communities rooted on the territory have their own understanding and use of the settled area where so many centuries of history and tradition are present. As soon as interoperability affects these aspects, it becomes culturally and technically very challenging. Demonstration of this resides in the fact that it is necessary to move from languages to dialects in order to understand specific land features. In this way of reading the territory, the granularity of geographic information increases dramatically heading to the single parcel history of ownership and often dealing with multi centennial history.

Through the INSPIRE initiative and directive, Europe is fostering a particularly challenging process of overcoming geo spatial interpretative information for the benefit of making knowledge interoperable and improving the effectiveness of actions. However, existing considerations about the objective difficulties in obtaining a diffuse and widely accepted interoperability have to be taken seriously.

In the current economic and the relative shortage of resources, there is an extremely pressing need for the promotion and sharing of best practices in order to demonstrate that it is possible to achieve good results in interoperability using sustainable resources. Spatial planning is critical both for demonstrating the feasibility of interoperability applied to territories and human settlements and for managing land and cities. The Plan4all project may easily become a monument in this context.

Chapter 1

Spatial planning and ICT

Didier Vancutsem,
ISOCARP

1.1. Introduction

In the past 250 years, we have experienced five major technological revolutions and each of these was linked to a specific technological innovation (1771, The First Industrial Revolution in Britain, based on the mechanisation of the cotton industry; 1829, The Age of Steam and Railways; 1875, The Age of Steel and Electricity; 1908, The Age of Oil, the Automobile, and Mass Production; and 1971, The Age of Information and Telecommunications). Every technical invention and development has resulted in advantages and disadvantages, which have influenced the well-being and prosperity of mankind. But somehow, they have provided the conditions for a long period of sustained economic growth as a process of economic development, which is usually described as a series of waves (Kondratieff waves)(Kondratieff, 1925).

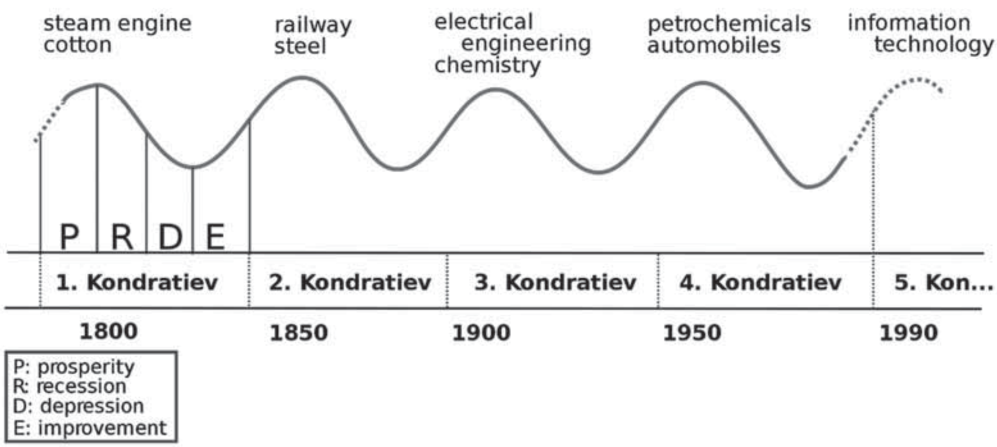

Figure 1.1: Simplified Kondratieff Wave Pattern (2009), Source: Rursus, Wikipedia http://en.wikipedia.org/wiki/File:Kondratieff_Wave.svg

These technological innovations, characteristic for each periods of technological revolution, had a fundamental influence on the behaviour of man and consequently on society. Such influences can be seen in every level of daily life including living conditions, housing and recreation, and have changed our habits and our culture. They have also a number of aspects in common. First of all, specific technologies have a wide applicability to a variety of different production processes, generating both process and product innovations. Secondly, because of this feature, they generate a whole series of new applications. Thirdly, because of large and increasing demand for this bundle of innovations, they create and shape new industrial complexes, which can be characterised by a large number of horizontal and forward reaching linkages: Everything is interlinked.
Among the five technological revolutions, three are directly linked to the means of transportation and communication. The developments of the steam engine, the combustion engine and the microchip technology in the 60s together represent a shift from the moving of goods, to an increased ease of moving people and exchanging information and ideas. The integration of digital technology and computers finally resulted in the development of communication technology and the introduction of the term ICT (Information and Communication Technology). In terms of the on-going microelectronic revolution, we are still in the middle of a learning process. Considering the on-going developments in cloud computing, multi-touch screens, intelligent systems for houses and communication, broadband and broadcasting, also related to nanotechnologies, it seems evident that the Information and Communication Technology will dominate our way of life in the near future. One aspect is however evident from the past 250 years: Technological change involves both technical change and organisational change (Van der Knaap & Linge, 1987).
It remains difficult to evaluate the effects of ICT on the organisation of society and on spatial and urban planning because the topic is very complex and the microelectronic revolution is still in process. Nevertheless, it is evident that the ICT influence is not direct, but indirect via social and economic trends, which cause changes in the behaviour of each individual in society, the economy and, consequently, in culture.
A rapid transformation is currently taking over advanced industrial cities. Old ideas and assumptions about the development, planning and management of the modern, industrial city seem less and less useful. Accepted notions about the nature of space, time, distance and the processes of urban life are similarly under question. Boundaries separating what is private and what is public within cities are shifting fast. Urban life seems more volatile and speeded up, more uncertain, more fragmented and more bewildering than at any time since the end of the last century.
The use of Information and Communication Technology (ICT) has been under con-

stant development over the last decade and has become a standard today in the European Urban and Spatial Planning context. Publishing information via the internet, communicating via e-mail, chatting and using interactive, real-time virtual reality to show the results of a planning process is the planners new normal day. Actual development is the "e-planning" philosophy, which refers to the use of electronic processes in delivering planning and development services, such as the online placement and processing of development applications, and the provision of web-based information such as maps, regulations and state and local policies. Such processes are already installed in several administrations around the world and give positive feedback with strong support from government, industry and communities.

1.2. Industrial change and the emergence of ICT

Technological change has a large number of consequences. Because it involves technical change it may have implications for the use of materials and equipment, as well as for the organisation of work processes. Its impact is not limited to the production process alone, but in the case of fundamental innovations, which are adopted in society at large, its effects are felt throughout society and may lead to organisational change. In this context, questions arise about the nature and direction of the introduction of a whole range of information and communication technologies during the last two decades on the territory and the physical space. Since the new ICT industries are the consequence of the integration of digital telecommunication, computing and media technologies, this has led to a whole new branch of activities in the rapidly growing leisure industry by making use of image construction and the creation of virtual realities (e.g. 3-Dimension images, Second Life, Web 2.0).

The impact of ICT within existing industries has had a number of different effects. It has lowered production costs of existing products, changed the type and quality of individual products through product differentiation and it has increased the possibilities of customising products. These changes are becoming more visible in a change of production organisation. Although a large number of such changes can be observed in general, it does not imply that investment in ICT will directly lead to a growth in productivity: this is the so-called productivity paradox (cf. Nooteboom, 1990). The costs of ICT investments are visible and measurable, but the returns cannot be measured in a direct way, because of the large number of indirect effects associated with them.

During the 1960s, the industrial economy matured (Rostow, 1960); it shifted from an emphasis on the production of capital goods to durable consumer goods and mass consumption. This structural transformation in the economy has generated a shift in the demand for inputs from physical energy based resources to knowledge and information-based inputs. The emerging information and communication technologies have enabled a rapid economic growth since the 1980s. Access to information has become a crucial and strategic factor in the production of goods and services. This had a considerable impact on the organisation of production and has lead, amongst other things, to the creation of a new role for middle management in medium sized as well as large organisations with regards to the conversion of production and the transportation of knowledge.

The increased importance of information and knowledge at different levels of organisations did not only have a considerable impact on the handling of information and information transfers between people and between organisations, but also on the role of distance as a factor in the transfer process. Distance has developed into a multi-dimensional concept; as a barrier to communication, it tends to become irrelevant in real time when information is codified and available in the public domain (The Economist, 1996). On the other hand, when communication involves the transfer of tacit knowledge, distance is extremely relevant and proximity and direct contact are essential for successful communication. Similarly, proximity and direct personal contact generate the conditions for the creation of trust, which is important for the transfer of tacit knowledge and for learning by accidental encounters (Nooteboom, 1999). Therefore we can argue that distance is of crucial importance for a large number of different communication processes. The spatial effect of the increased variation in the type and nature of communication means that we can witness two opposing processes occurring simultaneously. They consist of a de-concentration process of economic activities related to easy access of different inputs and codified knowledge, and a concentration process associated with the availability of strategic information and tacit knowledge, which are crucial for management and control functions.

1.3. Telecommunications and urban planning

Cities and spatial planning are becoming more and more influenced by the use of ICT in the industrial change. As Cedric Price described, eggs provide the analogy of the evolution of cities. The boiled egg corresponds to the walled city, the fried egg to the industrial city, the scrambled eggs to the multi-centred urban region. William Mitchell (1999) proposes a fourth urban evolution model: the “huevos rancheros”, eggs mixed with other ingredients, to form the digital city.

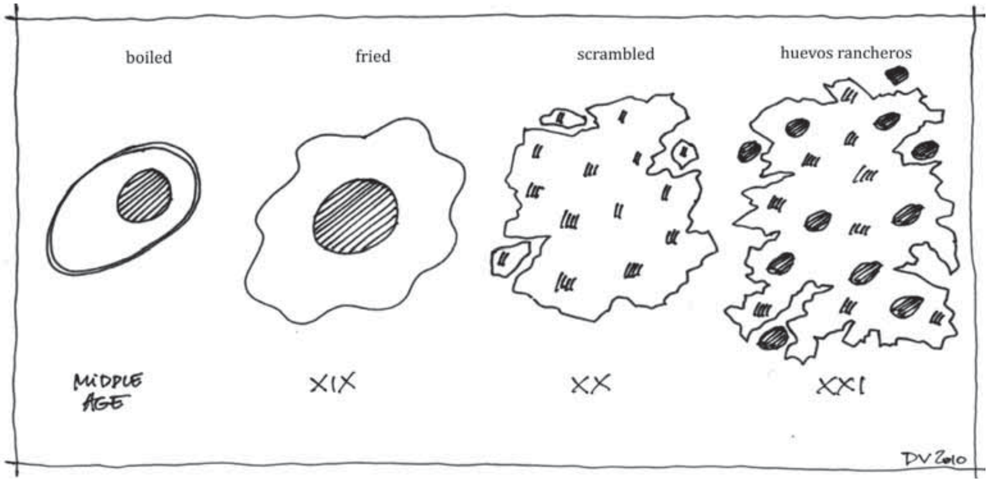

Figure 1.2: The Form of the City, Vancutsem (2010) adapted from "The City as an Egg", Source: Price (1970)

Emerging trends of urban evolution are supported by:

- Digital telecommunication networks such as the Internet and broadband technology;
- "Nomadic" tools facilitating mobile lifestyles, such as mobile phones, wireless, laptops, PDAs, smart phones, pagers, GPS, etc;
- Decentralised networked intelligence embedded everywhere, in the Internet itself, including also cloud computing; and
- IP services, sensors, smart electrical supply, electronic road pricing and navigation (Mitchell, 1999)

Digital telecommunication networks are new types of urban infrastructure, following in the footsteps of water supply and waste disposal, transportation, electrical supply, telegraph and telephone networks. They often replicate the routes and nodes of earlier networks, which both fragment and recombine urban activities and spaces. New networks infrastructures selectively loosen spatial and temporal linkages among activities. Latent demands of human settlements for adjacency and proximity become reality. This produces simultaneous fragmentation and recombination of urban types and spatial patterns. Some traditional spatial types may disappear, others may transform themselves and new types and patterns emerge.

In the time of information, different combinations of local and remote interactions, together with synchronous and asynchronous modes of communication provide the "glue" that holds communities together. Many options simultaneously exist, with differing costs and advantages. Citizens are able to choose among them within an increasingly complex, so called, economy of presence.

The relationship between spatial settlement pattern and modes of communication is illustrated in Table 1.1. The emergence of the information society is demonstrated in a massive shift across the diagonal of the table, from local synchronous interaction to dispersed asynchronous communication. These shifts affect markets and organisations as well as communities, as they produce a new cycle of fragmentation and recombination of familiar spatial types and patterns.

Settlement pattern	Modes of communication		
	synchronic	Semi-synchronic	A-synchronic
local	face-to-face agora 9-5 workplace	post-it notes whiteboards	non-circulating libraries old-fashioned databases
partially dispersed	churchbells sirens loudspeakers	pedestrian and bicycle messengers	LANs Intranets
dispersed	telegraph telephone live broadcast teleconference	mailsystems voicemail email	Internet www dot-coms

Table 1.1: Information in the Urban Age, ISOCARP Congress 2002, Source: Mitchell, 2002.

1.4. Spatial Planning and ICT in Europe

In the last centuries, the consideration of spatial planning radically changed: in the past, spatial planning was more related to a traditional "own world", in balance with nature. Lewis Mumford, in his Book "The City in History: Its Origins, Its Transformations, and Its Prospects" (Mumford, 1961), had the ideal vision of the city, which can be described as an "organic city", where culture is not usurped by technological innovation but rather thrives with it. However, today the world is becoming more and more urbanised.

Globalisation and sustainability affect spatial planning today; globalisation requires new way of governing the city to take advantage of its benefits, while sustainability demands new attitudes toward the way of living as a whole. This double challenging context imposes changes and structural reforms on the countries' administrative

structures, including the traditional planning model and implementation mechanisms, which were clearly unable to respond to the existing economic, social and environmental problems.
Today, Cities in Europe are facing major challenges. The following figures are widely accepted as a raw but indicative picture of the current situation: Over 60 percent of the European population live in urban areas with more than 50,000 inhabitants. By 2020, about 80 percent will be living in urban areas. This figure could be much higher, as in Belgium or the Netherlands and the urban future of our continent is directly affected by urban land use. Also, technological progress and market globalisation are generating new challenges for European cities (Vancutsem, URBACT Projetct Lumasec 2010). Townscape and social structures are in fundamental transformation processes, and the use of land is shifting from decline in one area of a city or city-region to growth in another. (Vancutsem, Plan4all 2010)
Originally, land use planning, town or urban planning and regional planning were terms used regarding the planning of distribution of people and activities on a territory. In the early 1960s, a Consultative Assembly of the Council of Europe raised concerns, reflected in the presentation in May 1968 of a historic report on Spatial /Regional planning "A European problem". Consequently, a first European Conference of Ministers responsible for Regional Planning started in 1970 in Bonn with the Council of Europe's activities relating to spatial planning.
Spatial planning includes all levels of land use planning, including urban planning, regional planning, environmental planning, national planning and that at the EU and other international levels. Land use planning is the term used for a branch of public policy, which encompasses various disciplines seeking to order and regulate the use of land in an efficient and ethical way. When considering it as a process, urban or city planning is more related to the integration of land use and transport planning disciplines, exploring a wide range of aspects of the built and social environments. Regional planning, as a branch of land use planning, deals with the efficient placement of land use activities, infrastructure and settlement growth across a larger area of land than an individual city.
There are several definitions of the spatial planning. A reference is from the European Regional/Spatial Planning Charter adopted in 1983 by the European Conference of Ministers responsible for Regional Planning (CEMAT): "Regional/spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society. It is at the same time a scientific discipline, an administrative technique and a policy developed as an interdisciplinary and comprehensive approach directed towards a balanced regional development and the physical organisation of space according to an overall strategy."(European Regional/Spatial Planning Charter, 1983, P. 1)

Therefore, spatial planning is not a single concept, a procedure or a tool. It is a set of concepts, procedures and tools that must be tailored specific situations if desirable outcomes are to be achieved (by extension “strategic” spatial planning). Spatial planning is therefore a wider, more inclusive approach that considers the best use of land and provides greater scope for politics and other organisations to promote and manage changes on the territory. It is in contrast to traditional land use planning, which focuses on the regulation and control of land. In Europe, especially based on the 2020 Strategy of the European Union (2020 Strategy European Union, 2010), the term “territory” and “territorial cohesion” is increasingly used.
In strategic spatial planning, the planner has a role to play in:

- Assessing the environment (strengths, weaknesses, opportunities, threats), external trends, forces and the resources available;
- Identification and gathering of major stakeholders;
- Development of a realistic long-term vision and strategies taking into account the power structures, uncertainties, competing values etc.;
- Design of plan-making structures and development of content, images and a decision framework through which to influence and to manage spatial change;
- Generating mutual understanding, ways of building agreement, ways of mobilising organisations to influence different arenas;
- Preparing decisions (short- and long- term), action and implementation; and
- Monitoring and feedback.

Therefore, we can say that spatial planning is the consideration of what can and should happen and where. It investigates the interaction between different policies and practice across regional space, and sets the role of places in a wider context. It goes well beyond traditional land-use planning and sets out a strategic framework to guide future development and policy interventions, whether or not these relate to formal land use planning control.

1.5.The European Dimension of Spatial Planning

Because spatial planning contributes to a better spatial organisation in Europe and to finding solutions to problems that go beyond the national framework, its aim is to create feelings of common identity, in North-South and East-West relations. Human well-being and interactions with the environment are the central concern of spatial planning, its aims being to provide each individual with an environment and quality of life conducive to the development of their personality in surroundings planned

on a human scale.
According to the Council of Europe, spatial planning should be democratic, comprehensive, functional and long-term oriented (Council of Europe, European Charter Torremolinos, 1983):

- democratic: it should be conducted in such a way as to ensure the participation of the people concerned and their political representatives;
- comprehensive: it should ensure the co-ordination of various sectoral policies and integrate them in an overall approach;
- functional: it needs to take into account the existence of a regional consciousness based on common values, culture and interests, sometimes crossing administrative and territorial boundaries, without overlooking the institutional arrangements of different countries;
- long-term: it should analyse and take into consideration long-term trends and development. It should be oriented to address economic, social, cultural, ecological and environmental phenomena and interventions.

Spatial planning must take into consideration the existence of a multitude of individual and institutional decision-makers, who influence the organisation of space, the uncertainty of all forecasting studies, the market pressures, the special features of administrative systems and the different socio-economic and environmental conditions. It must however strive to reconcile these influences in the most harmonious way possible.
As for the implementation of spatial planning, achievement of regional/spatial planning objectives is essentially a political matter. Many private and public agencies contribute through their actions towards developing and changing the organisation of space. Spatial planning reflects the desire for interdisciplinary integration and coordination and for co-operation between the authorities involved. It must be based on active citizen participation.
In 1999, the ministers responsible for regional planning in the EU member states signed a document called the European Spatial Development Perspective (ESDP). Although the ESDP has no binding status, and the European Union has no formal authority for spatial planning, the ESDP has influenced spatial planning policy in European regions and member states, and placed the coordination of EU sectoral policies on the political agenda.
At the European level, the term “territorial cohesion”, the fundamental aspects of which are sustainable development and access to services, is becoming more widely used and is, for example, mentioned in the draft EU Treaty (Constitution) as a shared competency of the European Union; it is also included in the Treaty of Lisbon. The term was defined in a scoping document in Rotterdam in late 2004 and

is being further elaborated using empirical data from the European Spatial Observatory Network (ESPON) programme in a document entitled “The Territorial State and Perspectives of the European Union”. At the minister's conference in May 2007 in Leipzig, a political document called the "Territorial Agenda" was signed to continue the process begun in Rotterdam.

1.6. Impact of ICT on Spatial Planning

The information society represents a new economic area in the history of mankind (Castells, 1996). This is the fourth area after the agrarian, industrial and service areas. Therefore the impact of ICT on spatial change and development is to be considered as a part of the development of the information society. However, related to the interaction of spatial planning and ICT, it is important to specify the following aspects:

- The development of the information society is taking place in various ways and at a different pace across all developed countries, as well as now gradually also in the developing countries. This development will affect societies as a whole and will cause fundamental changes in economic and social life. Knowledge and skilled people will become the most important factors in production,
- The development of information and communications technology will be the main driving force in the formation of the information society,
- The emergence of information and communications technology makes it possible to create new ways of working as well as making it possible to reorganise industrial, public and personal activities and structures. Globalisation will play an increasing role in these processes,
- The change in the meaning(s) of space, place, distance and time as the determinants of location factors - with probably the best known concept of the changing role of space, place, distance and time in the information age being suggested by Castells (1996) when he introduces the concepts of space of flows, space of places and timeless time. As a result we will have a virtual world functioning side by side with that of conventional physical settings.

Such developments will profoundly affect spatial development and spatial planning. The consequences of the application of ICT in production and services will change traditional ways of running businesses in industry, services and other organisations as well as changing everyday life more generally (Mitchell, 1999 and 2003; Castells, 2001 and 1996). These developments form the basic driving force for spatial

change and have been discussed by many scientists and futurologists. Major developments are ongoing in the sectors of industry, services, business location, new working practices, housing and conventional traffic.
ICT is a significant factor affecting spatial change and consequences can often be rather surprising. This necessarily provides planners with some challenging problems. Spatial change from the point of view of urban and regional planning is always both an opportunity and a threat. However, current on-going changes offer opportunities to use the new possibilities inherent in ICT to enable regions, cities and rural areas to partake in new types of development. New development trends can also threaten the future of these areas. Therefore planners have to find ways to try to forestall such possible negative effects.
On the other side, decentralisation, multilevel governance, public participation, bottom-up approaches, empowerment, local government, regional approach, environmental policies, strategic planning, participative budgets, council of regions, public private partnerships, administrative links, local agendas 21, low carbon concepts and climate change, vertical and horizontal integration, are some of the actual topics considered today in legal bodies and planning practices.
Many expectations can be found in the early 21st century for spatial planning: scientific progress in communication technology, genetics, micro-biology, but also energy efficiency and data technology will influence the European spatial planning. But some recommendations on spatial planning remain (ISOCARP, IMPP 2009):

- Long term planning of the use and management of resources
- Achieving planning objectives independently of economic growth
- Improving public participation and implementation
- Influencing politics through planning more adapted to the needs of the public
- Nurturing robust professional ethics through on-going appraisal.

Regarding the implementation of ICT into spatial planning, we should consider the inclusion of ICT infrastructure in planning and plans more than we have today.

1.7. Conclusions

Information and Communication Technology is the main driving force of the development of the information / knowledge / network society, and should be more specifically taken into account in urban and regional planning. From the planning point of view, there is significant untapped potential in the utilisation of ICT-applications in spatial development.
The changing economic base increasingly highlights current spatial development trends, where knowledge and skilled people are becoming the most important fac-

tors in production, and new functional and organisational issues. As a consequence of this, the traditional ways of running businesses in industry, services and other organisations, as well as activities in every day life, will change. Moreover, the prerequisites for the locations of different activities will change too as they will be driven by new cultural, social, economic and technical drivers, which will also rapidly and dramatically affect the spatial modification of our territory.

The expected spatial changes are diverse. The growth of large urban areas is seen as a consequence of the development of global metropolises. Development within these areas will disperse. There are also emerging possibilities for new types of communities.

Related to the future of small towns and rural areas, small- scale developments may yet continue to be possible. New life styles and the special features of places will however play an increasingly important role in decisions on the locations of some types of activity.

If planners want to influence new spatial development they should then incorporate the impact of the development of the information society and ICT into regional and urban planning. Indicators suggest that this has not been common practice thus far. Competition, cheaper solutions, activities with improved functionality and possibilities to implement solutions that would previously not have been possible, are some of the arguments which may affect the relocation of current activities or decisions on new locations. Therefore those who are responsible for urban and regional planning should actively work for the application of the impact on development of the information society and ICT on planning practices. In these processes new types of conflicts between cities, municipalities and regions will appear. There is a significant need for further research on the spatial impact of the application of ICT in general, and in specific planning areas in particular, as well as for the development of new planning theories, methods and models. In addition, the programmes of planning education and further training should be updated, as should the legal provisions for planning. The first thing to do is to ensure that all planning authorities take the decision to incorporate ICT as a new element into planning and plans, and decide upon the actions which should be undertaken to promote the achievement of the adopted principle. The winners will be those who best understand the emerging new spatial order.

REFERENCES

Castells M, 1996 *The Rise of the Network Society, The Information Age: Economy, Society and Culture* Vol. I (Oxford, Cambridge, MA)

CEMAT, 1983 European *Conference of Ministers Responsible for Regional Planning*

Council of Europe, 1983 *European Charter Torremolinos*

ISOCARP, 2009 *International Manual of Planning Practice* (ISOCARP, The Hague)

Knaap, G A van der, Linge G J R, 1987 *Technology and industrial Change* (Croom Helm, London)

Mitchell W, 1999 *E-topia* (MIT Press, Cambridge MA)

Mitchell W, 2002 *Planning and Design for the Information Age* (ISOCARP, The Hague)

Mumford L, 1961 *The City in History: Its Origins, Its Transformations, and Its Prospects* (Mariner Books, London)

Nooteboom B, 1999 *Inter-firm Alliances, Analysis and Design* (Routledge, London)

Nooteboom B, 2009, "Evolutionaire Economie" *Economisch Statistische Berichten*, 94(4571), 655 (Tilburg University)

Rostow W W, 1960 *The Stages of Economic Growth* (Cambridge Press, London)

Plan4all D 2.1, 2009 *Clusters of Leading Organizations in SDI for Spatial planning* http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 28.07.2011)

Chapter 2

Interoperability, SDI and spatial planning

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CEIT ALANOVA

2.1. The concept of SDI and the need for interoperability

Geoinformation technologies in the planning process focus on managing and conveying information to improve the decision-making process. Some of the most basic tools for public and private organisations in spatial planning are Geographic Information Systems (GIS) as a decision support tool both for technical experts and decision makers. As the amount of spatial data available and the usage of GIS have grown, organisations have become interested in sharing data both internally and with other organisations. This trend has led to the evolution of spatial data structures that rely on web services technology and standardised data formats to allow users to access data distributed across various organisations.
Spatial Data Infrastructures (SDIs) are frameworks of spatial data, metadata, standards, tools and users that are interactively connected in order to use spatial data. Current SDI development is the combination of different kinds of stakeholders, data providers, users, data, technologies, standards, legislation and also implementation initiatives. SDI development is mainly based on Web Mapping and Service Oriented Architecture and also affected by growing Web 2.0 approaches that facilitate interactive information sharing, active participation, interoperability, user centred design and collaboration.

2.1.1. The INSPIRE Directive

The INSPIRE (INfrastructure for SPatial InfoRmation in Europe) Directive aims to establish a European Spatial Data Infrastructure and entered into force in May 2007. The Directive defines SDI as "... *metadata, spatial data sets, spatial data services; network services and technologies; agreements on sharing, access and use; coordination and monitoring mechanisms, process and procedures, established, operated or made available in accordance with this Directive* ..." (EC, 2007, art. 3.1). INSPIRE does not aim to establish new infrastructures, but it is based on infrastructures created by Member States that are made interoperable by common

Implementing Rules (IRs) and measures established at the Community level. The purpose is to align national legislation and achieve a joint result within European Member States.
Although the Directive specifically aims to support European environmental policy, INSPIRE is having a great impact on the European GI community. The correct implementation of the INSPIRE Directive could represent a big step towards effective information sharing to support problem solving. INSPIRE represents a solid foundation on which to build wider interoperability of spatial planning in Europe, since it takes into consideration current standards and practices in the field of SDIs, and summarises the point of view of most stakeholders.
Among the actions aimed at supporting the process of implementation of the INSPIRE Directive, the European Commission Programme "eContent-plus" has financed the Plan4all Project, which deals with the question of harmonisation and interoperability of spatial planning data.

2.2. An overview of the planning process

In order to understand the role of SDI in spatial planning, it is necessary to take a step backwards and look at what planning is and how it works. Different interpretations of reality lead to the fact that there is not only one theory of the spatial planning process, but several interpretations. On the one hand, spatial planning is a technical science with defined methodologies; on the other, it is also a unique and creative process with unpredictable outcomes.

2.2.1. Well-defined linear Planning Process

According to Meise and Volwahsen (1980), spatial planning can be described as a technical solution for spatial problems. Spatial planning is an ideal linear process consisting of defined steps. These steps are the collection of information; structuring the problem and fixing the goals; analysing the information; and developing the plan, prognostic assessment and evaluation. Therefore planning has a variety of steps and processes to solve spatial problems.

2.2.2. Balancing regulation and reality

Lendi (1988) described spatial planning from a juridical point of view. Spatial planning is seen as a public task and a political-administrative system that is embedded in national legislation. Lendi speaks about a certain tension between regulation and reality. If the tension is too strong, planning will become utopia and its general acceptance will decrease. If the tension is too weak, planning will only fulfil reality and become redundant. Therefore spatial planning is not an administrative performance but a political process.

2.2.3. Integrative Contemporary Planning

Fürst (1996a and 1996b) and Selle (1994 and 1996) distinguish between 'traditional planning' and 'contemporary planning'. From a temporal perspective 'traditional planning' is characterised as an inflexible linear development of a plan and its implementation without long-term sustainability of the planning activities. Spatially, 'traditional planning' refers to 'planning islands', which are thematic divisions within the administrative departments, and from an institutional perspective, planning is carried out by the responsible authority. On the other hand, 'contemporary planning' is a more flexible and less linear process. Side effects and outcomes of planning processes must be monitored in order to integrate new results into ongoing planning processes. Planning is more integrative and aims to coordinate and balancing different interests., 'Contemporary planning' has an integrative character, not only thematically, but also spatially. For these reasons planning does not follow a fixed standardised operation but is always a complex, unique process that does not involve only technical tasks and defined methods, but also a great amount of creativity. The planning process is not linear but ongoing, meaning that it gets continuous input including new developments during the planning process, changes in infrastructures, new data/information, etc.). These inputs constantly influence the stakeholders and then also the planning result (plans, explanatory reports, etc.). It can be said that the planning cycle never ends and that when one cycle is finished the next one has already started.

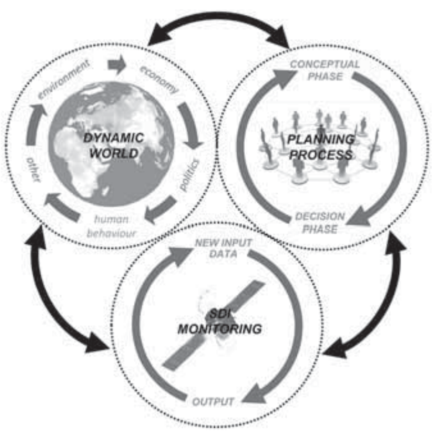

Figure 2.1: SDI as a data provider in the never-ending planning cycle

Figure 2.1 describes the spatial planning cycle as an interaction of real events from the dynamic world, several stakeholders and data inputs and outputs.

2.3. Who are the actors involved and the different planning perspectives

In the planning processes there are different players that have different backgrounds, roles, interests and intentions but are all linked to one another and therefore must come to mutual agreement. A political ecology approach (Bryant and Bailey, 1997) assumes that land is strongly influenced by the way different actors interact at a local scale and vice-versa. Interests of actors at different levels can be complementary and/or conflicting and can lead to different types of alliances (Kaiser, 1995).
Two main typologies of actors can be defined: private and public. Main public actors are politicians, planning bodies, urban administrations, local bureaucracy, civic supplies and police. Main private actors are residents, farmers, entrepreneurs and speculators, property dealers and developers. Planners often take the role of consultants, guiding and steering the process. Actors are usually on different spatial and administrative levels such as national, regional and local.

2.3.1. Actors and their role

Local bureaucracy	Economic and social development
Planning bodies	Urban design, planning, land supply and housing
Civic supplies	Provision of infrastructure (Water, Electricity, etc)
Land registration	Mapping and registration of land ownership Resolving disputes about land
Justice	Approbation on land-use policies
Police	Preservation of illegal land occupation
Media	Information, publishing
Universities, Research Institutes	Research, teaching, education
Farmers, agriculture	Farming, leasing
Residents	Buying or renting out residential space
Entrepreneurs and speculators	Buying, renting land, building Leasing

Property dealers	Mediation in transaction, information, care-taking
Developers	Financing, planning, speculation
NGOs	Representation of interests, lobbying
Other	

Table 2.1: Actors involved in the spatial planning process (edited and extended according Plan4all D2.1, 2009)

It appears important to develop a kind of "trialogue" (Engelke, 2008) between public actors, private sector and politics to integrate the emerging perceptions of a problem, and by this means, to overcome the gap between planning and implementation, and between the long-term and short-term objectives (Engelke, 2008).

2.3.2. From government to governance

With multiple public, private and political stakeholders involved in public service provision, 'policy networks' are becoming increasingly important in governance structures, comprising inter-organisational linkages and dependencies that enable the exchange of researches which are necessary for achieving common goals (Rhodes, 1996). The Commission on Global Governance defines governance as "*the sum of many ways in which individuals, institutions, public and private, manage their common affairs. It is the continuing process through which conflicting or diverse interest may be accommodated and cooperative action taken*" (Commission on Global Governance, 1995, p.2). Multi-level governance is when both vertical interactions (between levels of government) and horizontal interaction (between government and non government actors) occurs at each level (Flinders and Bache, 2004).

2.3.3. Cross-thematic interests

Spatial planning has an interdisciplinary character, meaning that it touches almost all thematic fields such as environmental, economic and social aspects. The current vision is that in the complex planning process, a unifying element is the Spatial Data Infrastructure that, as a thread, sews together the different planning themes, geographic areas, stakeholders and administrative levels.
SDI is globally recognised as a fundamental tool for the different users to achieve better information, taking into account its complexity as much as possible. Yet the challenge for spatial planning is to use and to connect data in a way that information and then knowledge can be generated, to finally reach better and more transparent decisions, as illustrated in figure 2.2.

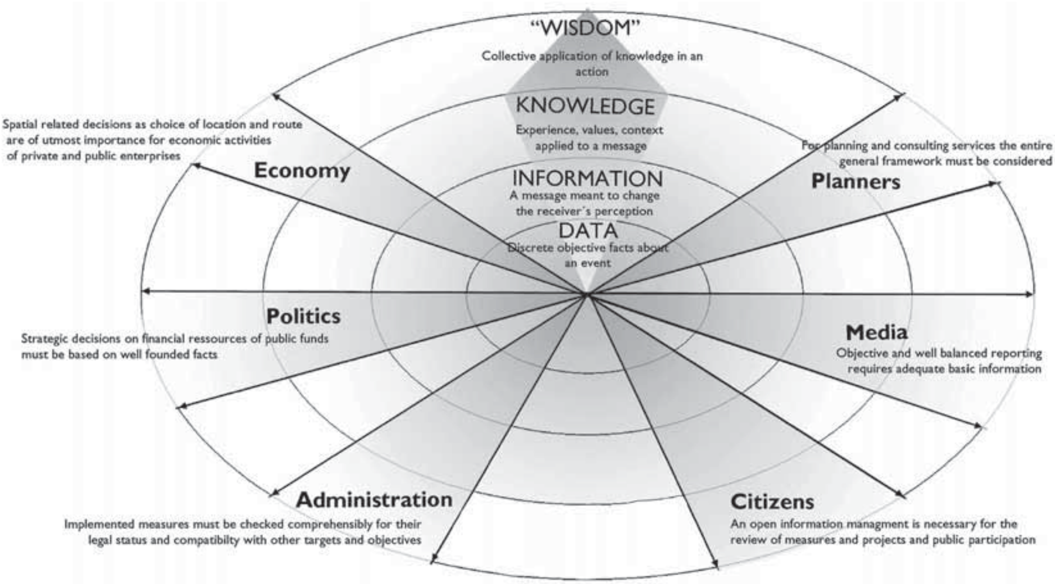

Figure 2.2: From Data to Information, Knowledge and Wisdom for better decision making (Schrenk 2001, based on Laurini 2001)

2.4. The need of up-to-date interoperable spatial data

Digital information on spatial planning has been managed on a national, regional and/or local level, which results in a suite of datasets that are not always compatible with each other. Traditionally, standardisation in spatial planning activities has been rather poor and some of the main challenges are the heterogeneity of datasets and sources, gaps in availability, lack of harmonisation between datasets in different scales, duplication of information as well as loss of time and resources in searching for needed data which have been characterised for the European situation in spatial planning (Ryser & Franchini, 2008). This situation is definitely not an adequate basis for achieving planning's purposes in a global context.

Even experts from one country might have problems in understanding the planning regulations of the neighbouring country. Especially for investors and decision makers, it is almost impossible to compare planning regulations across Europe. The INSPIRE Directive and the Plan4all Project aim towards the interoperability of spatial data in Europe because the present situation of the planning panorama is so diverse.

2.4.1. Types of heterogeneities

Fragmented planning systems, different planning results and heterogeneous data management are characteristic for the European planning landscape. The harmonisation of spatial planning data is the first required step towards the accessibility and sharing of data via SDIs. Data harmonisation and integration basically face two types of heterogeneity: data heterogeneity and semantic heterogeneity (Hakinpour and Geppert, 2001). Data heterogeneity refers to differences of data in terms of data type and data formats and could be further divided into the categories of syntax and structure. Syntax heterogeneity refers to differences in formats. With the foundation of the Open Geospatial Consortium (OGC) in 1994, solutions to overcome the problems of syntactical heterogeneity began.
Structure heterogeneity is related to differences in schemas (formalised description of conceptual data models). Semantic heterogeneity applies to the meaning of the data and is related to the different terms and meaning in a specific context. For example, a river can be seen in terms of flow intensity and flood recurrence interval by a river basin authority because they are the authority responsible for the safety of human settlements. Whereas an environmental protection agency would look at it in terms of biological quality and ecological functionality as they are responsible for nature conservation. At the same time, the same river can be seen as an energy source by an energy agency, as part of an ecological corridor by landscape designers, as a waterfront by planners designing for a municipality, or as an area for leisure and sports, shipping of goods, etc. Conceptually the same river can be seen in different ways either as a line or as a polygon, including or excluding banks or yearly flooding areas, and consequently its area can be delimited differently as illustrated in figure 2.3 (Camerata et al., 2010).

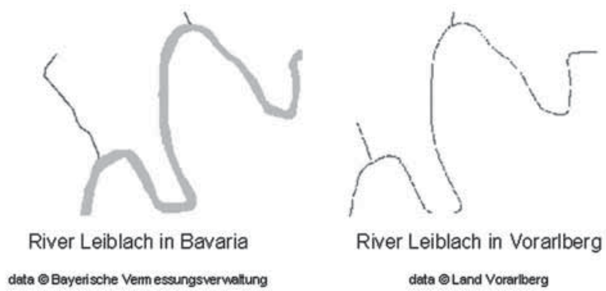

Figure 2.3: River Leiblach (Austrian-German border): different river data models across the border (HUMBOLDT Consortium 2010)

2.4.2. The multi-scalar dimension

The administrative levels responsible for planning, although not the same for all European countries, are basically the national, state/county and local levels. When referring to the purpose of planning, where supra-regional and global issues are dealt with as much as local and sub-municipal issues (Ghose and Huxhold, 2003), the current administrative levels do not completely match today's requirements. Increasingly, spatial planning does not act at national, state and local levels, but rather at in-between levels, in transnational regions, cross-border regions, metropolitan regions, neighbourhoods, etc. Issues such as transport networks, nature protection, natural hazards like floods and earthquakes, urbanisation, river basins and many more, do not all reflect and respect administrative borders. Relevant planning areas are development regions, touristic areas, industrial or nature protection zones, river basins districts, natural risk zones, etc. SDI can contribute to better integrate all levels of spatial planning and provide accessible data for those administrative levels not directly addressed by official policy making levels.

2.4.3. Dynamic planning

Dynamic planning is the ability to react to changes. The advantage of dynamic planning is that what was initially foreseen as a plan can be monitored and checked regularly in time, and when problems occur small fixes can be immediately done instead making more elaborate repairs at a later date in order to be compliant with initial planning objectives. As there is a need to make an economic use of the scarce natural resources and to promote sustainable spatial development across the whole of Europe, the inclusion of the time component in planning becomes necessary (De Amicis et at., 2011). Planning must not be seen just as a series of legally binding documents but as all the space-related planning activities. SDI is a supporting tool to make planning more dynamic and to better fulfil its purpose.

2.4.4. Cross-border planning

The relationship between time and spatial data also becomes relevant in cross-border regions. One of the geoportals within the Plan4all Project is the CentropeMAP (see figure 2.4), a cross-border initiative between Austria, the Czech Republic, Slovakia and Hungary, which follows the approach of processing spatial referenced data via OGC compliant Web Map Services (WMS). The validity of spatial plans is constricted to a certain number of years, so zoning regulations and spatial planning activities will usually be revised on a regular basis. For cross-border regions it will

Figure 2.4: The Centrope Region (Source: http://centrope.com/, July 2011)

be impossible to perform integrated spatial planning if the data, the updated plans and the activities are not visible, harmonised and comparable.

SDI activities in the cross-border region are a big step towards the modernisation of public administrations. Especially concerning environmental issues, interoperable data-infrastructures allow international long-term monitoring.

2.4.5. The benefits of SDI in Planning

Although massive investments are being made worldwide to build and harmonise Spatial Data Infrastructures, the economic benefits are still hard to quantify due to SDI's constantly evolving nature, its dynamicity and complexity. The implementation costs are known; In Europe alone, at the European, national and local levels, they are estimated to be from 202 to 273 million Euro each year (Crompvoets and Bregt, 2003). Yet the economic benefits and the parameters to calculate them are changing according to each specific situation.

Because the value of spatial data depends on numerous variables, such as the users, the time, the purpose and the interrelations, quantifying the economic value in itself is very difficult and therefore the evaluation of the benefit has to be done by looking at the service provided (Longhorn, 2011). Because SDI's benefits are not only economic, but also environmental and social, it is absolutely necessary to look at the actors involved in the planning processes and the use they make of the SDI.

2.5. Conclusions

The possession of up-to-date and interoperable data enables the modification of future visions, the connection of different actors and planning themes, cross-border planning and interactions different governance levels. All these factors enable us to reach a better knowledge of the world. SDI connects stakeholders from different spheres, such as economy, politics or administrations, to foresee and monitor changes, and therefore on the basis of this make plans for cities and regions.

Although short-term economic benefits are not presently easily quantifiable, the long-term perspective enables us to see that costs in all phases and fields of planning would be greatly reduced if up-to-date reliable SDI were available to all relevant actors. This is because the planning process depends on continuous input in order to monitor urban, regional and environmental development, to detect changes and to be able to find strategies to further steer spatial development. Spatial data infrastructure can contribute as it aims to modernise public authorities and offer wider access to geospatial data across Europe.

REFERENCES

Bryant R, Bailey S, 1997 *Third World Political Ecology* (Routledge, London)

Camerata F. et al., 2011 "Data interoperability for spatial planning: a tentative common description of European datasets concerning land use", in *28th Urban Data Management Symposium Proceedings* (CRC Press/ Taylor&Francis Group, London)

Commission on Global Governance, 1995 *Our Global Neighborhood: The Report of the Commission on Global Governance* (Oxford University Press, Oxford)

Crompvoets J, Bregt A, 2003 "World Status of National Spatial Data Clearinghouses" *URISA Journa*l http://www.urisa.org/Journal/protect/APANo1/crompvoets.pdf (accessed 25.07.2011)

De Amicis R et al., 2011 "Time dimension in e-goverment GI driven services" *Proceedings 14th AGILE International Conference on Geographic Information Science* (Utrecht)

EC, art. 3.1, 2007, "Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)" *Official Journal of the European Communities L108 25 April* (European Commission, Brussels)
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF (accessed 09.08. 2011)

Engelke D, 2008 "FLAIR Project reference" in Land Use Management for Sustainable European Cities (LUMASEC) Baseline study
http://urbact.eu/fileadmin/Projects/LUMASEC/outputs_media/LUMASEC_Baseline_Study.pdf (accessed 09.08. 2011)

Flinders M, Bache I, 2004 "Theme and Issues in Multi-level Governance" in *Multi-level Governance Eds I. Bache, M. Flinders* (Oxford University Press, Oxford)

Fürst D, 1996a "Regionalplanung im System gesellschaftlicher Steuerung" *Zukunftsaufgabe Regionalplanung. ARL Arbeitsmaterialien* (ARL, Hannover) 221, 157-172.

Fürst D, 1996b “Komplexitätsverarbeitung in der Planung (Stadt-, Regional- und Landesplanung)” *Beispiel der Regionalplanung. Archiv für Kommunalwissenschaften* (DIFU, Berlin) 35, 20-37

Ghose R, Huxhold W, 2003, “The Role of Multi-scalar GIS-based Indicators Studies in Formulating Neighborhood Planning Policy” *URISA Journal* https://www.urisa.org/files/GhoseVol14No2.pdf

Hakinpour F, Geppert A, 2001, “Resolving semantic heterogeneity in schema integration” *2nd International Conference on Formal Ontology in Information Systems,* FOIS 2001 (USA)

Kaiser E, 1995, *Urban Land Use Planning* (University of Illinois Press, Illinois)

Laurini R, 2001, “Groupware and Public Participation for Urban Planning” in *REAL CORP Conference 2001*(Vienna)

Lendi M, 1988, *Grundriss einer Theorie der Raumplanung. Einführung in die raumplanerische Problematik* 140 (Zürich)

Longhorn R, 2011, “Conveying Geospatial Data Value to Decision Makers: How Do You Value the Invaluable?” *INSPIRE Conference* (Edinburgh)

Meise J, Volwahsen A, 1980 *Stadt- und Regionalplanung. Ein Methodenhandbuch*. (Friederick Vieweg & Sohn Verlagsgesellschaft, Wiesbaden)

Rhodes R, 1996 “The New Governance: Governing without Government” *Political Studies* (Political Studies Association and Blackwell Publishing, USA)

Ryser J, Franchini T (Eds), 2008 *International Manual of Planning Practice (IMPP)* (ISOCARP / Sitges)

Schrenk M, 1996 “Rule Based Dynamic Planning” *Proceedings of AGIT 1996* (Salzburg)

Schrenk M, 2001, “From data to wisdom” *RAPIS-Newsletter* (Vienna)

Selle K, 1994 “Was ist bloß mit der Planung los? Erkundungen auf dem Weg zum kooperativen Handeln. Ein Werkbuch” *Dortmunder Beiträge zur Raumplanung* (IRPUD, Dortmund) 69, 363.

Selle K (Ed), 1996 *Planung und Kommunikation. Gestaltung von Planungsprozessen in Quartier, Stadt und Landschaft. Grundlagen, Methoden, Praxiserfahrungen* (EPFL, Lausanne)

Plan4all D 2.1, 2009 *Cluster of leading organisations in SDI for spatial planning*, http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 26.07.2011)

Chapter 3

The Plan4all Project

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3.1. Introduction

The main focus of the eContentplus project Plan4all was the harmonisation of spatial planning data according to the INSPIRE Directive and based on existing best practices in EU regions and municipalities and the results of current research projects. This chapter introduces the objectives, consortium, work-plan and the target users of the Plan4all project. The chapter is concluded with a summary of the project's impact and sustainability.

3.2. The Plan4all Objectives

Plan4all was a European project co-funded by the Community programme eContentplus. The main aim of the project was to harmonise spatial planning data and related metadata according to the INSPIRE principles.

Spatial planning acts between all levels of government both in bottom-up and top-down directions. Every day, national, regional and local authorities face important challenges in the development of territorial frameworks and concepts. The situation is complicated by the diversity and overall complexity of spatial planning.

Spatial planning is a holistic activity. All the tasks and processes must be solved comprehensively with input from various sources. It is necessary to make the inputs interoperable. This allows the user to search the data, view them, download them and use them with help of information technologies.

Plan4all significantly contributed to make spatial planning data more accessible, usable and exploitable. These are also the main goals of the Community eContentplus programme.

The Plan4all project helped to standardise spatial data from a spatial planning point of view. Its activities and results will became a reference material for the INSPIRE initiative and other related projects. Plan4all was focused on the following 7 spatial data themes as outlined in Annexes II and III of the INSPIRE Directive (EC,2007):

• Land cover
• Land use
• Utility and Government services
• Production and industrial facilities
• Agricultural and aquaculture facilities
• Area management/restriction/regulation zones and reporting units
• Natural risk zones

Plan4all was a Best Practice Network. It profited from orchestration of available solutions (best practices) in the field of spatial planning and SDI (Spatial Data Infrastructure). The main project aims are to:

• Promote Plan4all and INSPIRE in countries, regions and municipalities;
• Design the spatial planning metadata profile;
• Design the data models (application schemas[1] in the INSPIRE terminology) for selected spatial data themes related to spatial planning;
• Design the networking architecture for sharing data and services in spatial planning;
• Validate the metadata profile, data models and networking architecture on local and regional levels;
• Establish a European portal for spatial planning data;
• Deploy spatial planning data and metadata on local and regional level.

Figure 3.1 depicts the initial stage of the project, where the core of all the activities was the INSPIRE Directive and its principles. Metadata profiles and data models were drafted for each spatial data theme based on user requirements, national legislation, leading organisations in SDI and spatial planning and availability of best practices.

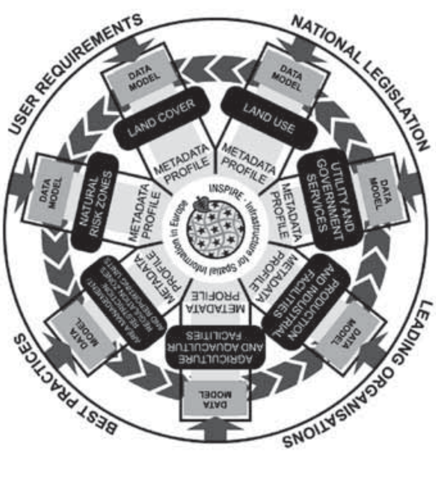

Figure 3.1: Overall schema of the Plan4all activities.

3.3. The Plan4all Consortium

Plan4all was a consortium of 24 partners including universities, private companies, international organisations, data providers and public administrations. The consortium covered 15 European countries (see Figure 3.2).

Figure 3.2: The Plan4all partners.

None of the Plan4all participants had the critical mass in human or financial terms to undertake the work alone. European collaboration increases access to pooled resources and technology transfer and emulates the 'global' marketplace. Table 3.1 shows the Plan4all partners, short descriptions and the roles in the project.

Partners	Short name	Country	Short description and the role in the project
University of West Bohemia	UWB	CZ	The Section of Geomatics at the UWB in Pilsen focuses on collecting, distributing, storing, analysing, processing and presenting geographical data or geographical information. **Coordination, research, standardisation**

Partners	Short name	Country	Short description and the role in the project
International Society of City and Regional Planners	ISOCARP	NL	ISOCARP is a global association of experienced, professional planners, and was founded in 1965 with the vision of bringing together recognised and highly qualified planners as well as other stakeholders involved in the development and maintenance of the built environment in an international network. **Evaluation, standardisation, dissemination, analyzing**
City of Olomouc	OLOMOUC	CZ	The City of Olomouc is a local authority creating a land-use plan on the level of municipality as well as settlement plans. Content provider, testing, validating **Evaluation, standardisation, dissemination, analyzing**
Technology Development Forum	TDF	LV	The mission of TDF is to facilitate the development of high-tech innovation according to the national and EU programming documents, and to promote the implementation of innovations and development of high value added production. **Analysing, testing, content provider, validating**
Help service remote sensing s.r.o.	HSRS	CZ	HSRS has vast experience with SDI for Urban Planning. It is responsible for the management of systems, and in some cases also for Web hosting, for 20 municipalities. HSRS is responsible for the Czech national metadata and catalogue system. It cooperates on definitions of the Czech national INSPIRE profile and also on the profile for Urban Planning. **Content provider, technology provider, standardisation**
Landesbetrieb Geoinformation und Vermessung	LGV Hamburg	DE	LGV Hamburg, an agency under the supervision of the Ministry of Urban Development and Environment, is responsible for the production and publication of official maps and for keeping the official land register of the Free and Hanseatic City of Hamburg. **Content provider, standardisation, testing, validating**
European Umbrella Organisation for Geographic Information	EUROGI	NL	In order to ensure good governance, economic and social development, environmental protection and sustainability, and informed public participation, the mission of EUROGI is to maximise the availability and effective use of Geographic Information throughout Europe. **Evaluation, standardisation, dissemination, analyzing**
Zemgale Planning Region	ZPR	LV	The Section of Geomatics at the UWB in Pilsen focuses on collecting, distributing, storing, analysing, processing and presenting geographical data or geographical information. **Coordination, research, standardisation**

Partners	Short name	Country	Short description and the role in the project
Provincia di Roma	PROVROMA	IT	The Province of Rome is a second tier local authority in the Italian decentralized government (NUTS 3). It is an intermediate authority between municipalities and regions. The Province of Rome has taken over many functions that concern the environment, cultural heritage, transport, education, hunting, fishing, technical and administrative assistance to local authorities, professional training. **Content provider, analysing, testing, validating**
Fondazzjoni Temi Zammit	FTZ	MT	Based at the University of Malta, the Fondazzjoni Temi Zammit (FTZ) is Malta's leading local development agency. **Content provider, analysing, testing, validating**
GEORAMA	GEORAMA	GR	Greek Development organisation focused on EU integration and international development co-operation. **Content provider, analysing, testing, validating**
Navarra de Suelo Residencial S.A.	NASURSA	ES	NASURSA is a public enterprise attached to the Spatial Planning and Housing Department of the Regional Government of Navarre. Its main aim is to consolidate sustainable territorial development in Navarre. **Content provider, analysing, testing, validating**
Hyperborea s.c.	HYPER	IT	The company is well situated in the public administration market sector with many public administration customers (Local and Regional authorities), supplying products and services including waste management procedures, CMS, automated procedures and workflow management systems. **Standardisation, implementation, validating, testing**
AYUNTAMIENTO DE GIJON	GIJON	ES	Gijón is a local authority with 275,000 inhabitants and occupies an area of 181.7 square kilometres, which lies on the coastline in the north of Spain. **Content provider, analysing, testing, validating**
CEIT ALANOVA gemeinnützige GmbH	CEIT ALANOVA	AT	The Central European Institute of Technology (CEIT) is an Applied Research and Development Establishment founded in 2006 and located in the City of Schwechat, next to Vienna International Airport. **Technology provider, standardisation**

Partners	Short name	Country	Short description and the role in the project
Asplan Viak Internet AS	AVINET	NO	Avinet is a consultancy company specialised in Internet based map and database solutions. **Technology provider, standardisation**
Dipartimento di Studi Urbani - Università degli Studi di Roma Tre	DIPSU	IT	The Department of Urban Studies of Rome III University conducts research on urban contemporary development and design, spatial organisation and policies. **Designing, research, standardisation**
Euro Perspectives Foundation	EPF	BG	The Euro Perspectives Foundation is an institutional structure able to address public interest in an enlarged Europe and to bring endogenous capacities to cross fertilise through Territorial Cooperation with Regional stakeholders in the EU and outside for added value Regional polices and EU Integration. **Content provider, analysing, testing, validating**
Agentia de Dezvoltare Regionala Nord-Vest.	ADR Nord-Vest	RO	The North-West Regional Development Agency (NW RDA) is a non-government, non-profit organisation of public utility that operates in the field of regional development, representing the executive body of the Regional Development Council of the North-West Development Region. **Content provider, analysing, testing, validating**
Regione Lazio - Direzione Regionale Territorio e Urbanistica	Lazio	IT	Lazio Region is a local autonomous authority involving health sector, social welfare, training, vocational education, town planning, public housing, economic development, tourism and cultural activities, agriculture, forestry, mining, regional public transport, public works, environment, and implementation of EU regulations and policies. **Content provider, analysing, testing, validating**
Help forest s.r.o.	HF	CZ	The company focused its activities on agriculture, forestry, ecology and on municipal collaboration. Help forest provides data collection directly in the terrain, support for forest management planning and geo-data management for agriculture. **Content provider, testing, technology provide**r
AMFM GIS ITALIA	AMFM	IT	AM/FM GIS Italy is a non-profit organisation created to promote the exchange of knowledge and experience between the public and private sectors of Geographic Information Systems and Geographic Information and promote the development of applications for the governance of land use and the management of services and infrastructure. **Content providing facilitator, analysing, dissemination, validating, capacity builder**

Partners	Short name	Country	Short description and the role in the project
The National Microelectronics Applications Centre Ltd	MAC	IE	The National Microelectronics Applications Centre (MAC) provides consultancy and complete innovative electronic, software and e-business/e-government technological solutions. **Content provider, technology provider, standardisation**
Ministry of Ecology, Sustainable Development, Transports and Housing	MEDDTL	FR	The Ministry of Ecology, Energy, Sustainable Development and Town and Country Planning is in charge of the French policies related to its field of competence. Among other things, the Planning, Housing and Nature General Directorate deals with matters related to planning and with the development of the usage of geographical information in the area of land and town planning. **Content provider, analysing, testing, validating**

Table 3.1: Plan4all partners, their descriptions and roles in the project.

3.4. Project Work-plan

The Plan4all work-plan was divided into nine work packages (WP):

WP1 Project management and coordination.

WP2 State of the art analysis
- the identification of leading regional and local administrations in spatial planning and SDI;
- the identification of innovation challenges and the framework structure for analysing relevant technology developments and trends;
- the INSPIRE requirements; and
- the analysis of standard metadata, data models, networking technologies and user requirements for planning systems.

WP3 Design of Plan4all metadata profiles – defines metadata profiles for selected INSPIRE spatial data themes (listed below) as a combination of national legislation for spatial planning and the INSPIRE profile.

WP4 Plan4all data model definition – focuses on the national models and their combinations and translations into common models.

WP5 Networking architecture – extends the INSPIRE networking principles for the purpose of European Spatial Planning.

WP6 Large scale test-bed - aims to demonstrate the technological feasibility of the models designed in WP3, WP4 and WP5.

WP7 Content deployment - populates the Plan4all spatial data repositories using semantically rich, multilingual metadata.

WP8 Validation – provides the quality framework for the evaluation of the outputs.

WP9 Dissemination, clustering, consensus building and sustainability planning – includes activities to promote and valorise the project results. A major aim is to achieve wide dissemination at multiple levels.

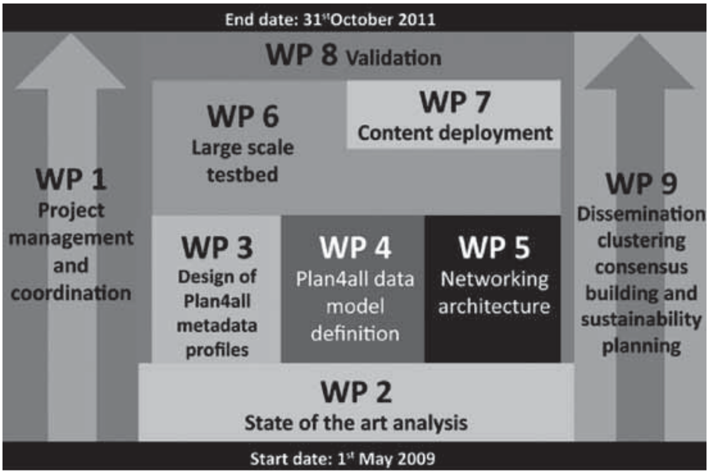

Figure 3.3: Work package and work-flow overview.

3.5. Target Users and Related Projects

The Plan4all user groups can be defined according to the level that they primarily act on:

- On the local level - politicians and decision makers in the field of SDI and for relevant land use requirements, e.g. risk prevention, investors, regional and local governments, local agents, architects or city councils.
- On the regional and interregional level - public authorities, stakeholders and private companies, associations, trades unions, universities, emergency services, technical experts, surveyors, regional consortiums, public companies, private companies, real estate business.
- On the national and European levels - the European Commission and its projects, including INSPIRE, GMES, GEOSS and SEIS (see the reference list for URLs), expert panels on basic issues of spatial planning, professional associations, universities and other relevant research centres and managing authorities and security and defence organisations.

As Plan4all is based on a bottom-up approach, a very important part of the project was the involvement and feedback of target groups to define their requirements and to validate the project results. The Plan4all consortium has created a network of affiliated partners with more than 100 members. These contributed to the Plan4all objectives by providing feedback on the results.

3.6. Impact and sustainability

The problems of spatial planning, its governance, participation of all stakeholders and open decision processes are very important in Europe. With EU enlargement, their importance increases. There exist many cases where low levels of participation at all levels of government and low levels of involvement by NGOs, stakeholders and citizens lead to non transparent processes. In the future phases of implementation, this can effectively block important investment opportunities.

The concept of planning is an interaction both between various levels of government in a region and between public authorities, businesses and citizens. A specific regional framework allows parties to weigh up the influence of investment or administrative control by public agencies. At the same time, there are the benefits of legitimacy, transparency and public participation.

On the other hand, Spatial Data Infrastructures (SDIs) are being created thanks to the INSPIRE Directive. These SDIs are opening doors to the release and exploitation of key Public Sector Information (PSI). Common spatial data catalogues can be queried from multiple locations and thus provide a consistent coverage and availability of spatial data to all relevant decision makers, even if linked virtually. Spatial data duplication is minimised and decision contexts are harmonised.

Plan4all can be considered as a test-bed for INSPIRE. Bottom-up approaches showed the feasibility of spatial planning data harmonisation using common standards with various technologies and platforms. The results create a significant role for follow-up activities focused on the interoperability of spatial data.

[1] Application schema - conceptual schema for data required by one or more applications

REFERENCES

EC, 2007, "Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)" *Official Journal of the European Communities* L108 25 April (European Commission, Brussels) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF (accessed 09.08. 2011)

INSPIRE (http://inspire.jrc.ec.europa.eu/)

GMES (http://www.gmes.info/)

GEOSS (http://www.earthobservations.org/geoss.shtml)

SEIS (http://www.eea.europa.eu/about-us/what/shared-environmental-information-system)

Chapter 4

Planning systems in Europe and SDIs

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CEIT ALANOVA

4.1. Introduction

An analysis of the current European situation of spatial planning systems, spatial planning data harmonisation and sharing shows that planning systems in Europe are very fragmented. Nevertheless, the aims of data harmonisation and building of Spatial Data Infrastructures (SDI) are becoming increasing pertinent, especially in the frame of the INSPIRE Directive. SDI brings changes and potentials so that the concept has found its way into spatial planning processes. The analysis is presented in this chapter, and starts with the collection and description of the different planning systems in Europe. It then further presents the development of spatial data infrastructures with respect to the requirements of the users as well as INSPIRE. The results are based on the collection and analysis of relevant literature, experiences and recommendations from best practice projects and extensive European-wide e-surveys, and are groundwork for further activities on data harmonisation and sharing.

4.2. Planning systems across Europe

In general, many European countries have complex planning systems, sometimes with over-complicated related administrative structures. All countries have different legislations. Spatial plans have different legal definitions and binding aspects, they are established on different scales and administrative levels, their updates vary, and they have different representations. For example, whereas plans are more schematic in France, they are very precise in Germany. Depending on the country/state, content as well as the legal binding of plans differ. On top of all not all regions or municipalities in Europe do have plans (Ryser and Franchini, 2008; Plan4all D 2.1, 2009).
European countries were surveyed online in 2009 for the following issues: their political and administrative organisation, administrative competence for planning, main planning legislation, planning and implementation instruments, development con-

trol, planning system in practice, short facts and settlement structure. Surveyed countries were: Austria, Bulgaria, Czech Republic, France, Germany, Greece, Ireland, Italy, Latvia, Malta, the Netherlands, Portugal, Romania and Spain (Plan4all D 2.1, 2009).

4.2.1. Administrative organisations and competences

In terms of political and administrative processes, European countries are organised on the national level; on the level of federal states/regions, which then can be further subdivided into counties/provinces; and on the local level. Some countries, like Germany and Austria, distribute competencies and functions between three levels of government. Others, like Italy, have four levels. Other countries have administrative regions and prefectures, such as Greece, or planning regions such as Bulgaria. However, in general the ministry is the leading institution in the elaboration of regional policy. An example exception is Austria because it has a federal political and administrative structure. Basically spatial planning systems can either be more hierarchic and centralised (as they are for the majority of European countries, e. g. France, Romania), or decentralised and federal (Austria, Germany, Italy, Spain). Top-down regulation through the three or four levels is often the case for European countries. The linking element all over Europe is the autonomy of municipalities, which are responsible for spatial planning in their territory, carried out according to the principles and guidelines defined by higher levels. There are attempts to introduce and practice the principle of subsidiarity in planning, where decisions are taken by the lowest competent authority – in general the local level – and upper levels do not take action, except in the areas that fall within their exclusive competence or where higher-level action is more effective.

4.2.2. Main planning legislation

Contemporary planning legislation can be found in the Netherlands (legislation came into force in 2008), whereas other countries still stick to older planning legislation following a long-term tradition (e. g. Italian planning legislation from 1942). Generally, it can be observed that new EU member states renewed their main planning legislation: for instance, the Bulgarian legislation was established in 2001 (Spatial Planning Act), and the new Building Act in the Czech Republic was established in 2007. Also the French legislation was actualised in 1999; the German legislation was amended in 1990; and the Greek legislation was actualised in 1999 and 2006. The planning legislation's date of approval indicates the extent to which it reflects current planning philosophies. For example climate change, energy consumption and mobilisation of brownfield sites are relatively new topics of the 21st century, whereas environmental impact assessment relates back to the 1980s and 1990s.

4.2.3. Planning and implementation instruments

Different frameworks and instruments for planning can be distinguished between countries. On the upper levels, plans and/or strategic visions can either be legally binding or can have the status of a recommendation. Relations and binding forces among plans and instruments on different levels are in some countries more and in others less strictly defined. Regulations at lower levels have to be consistent to regulations at upper levels. The most common instrument in European planning systems is the local land use plan (sometimes with different denominations), followed by the regional plan, which focuses on regional development and regional structure. All over Europe, the planning documents on the local level include at least one legally binding plan which can be a zoning plan or land use plan on different scales, and which either covers the whole municipality or only parts, such as just the built-up land.

4.2.4. Multilingualism and terminology

Multilingualism requires the exact translation of building law denominations. Regardless, several building regulations can hardly be translated into one common language because of the different legal basis in different countries. Even between countries/states that have the same official language, terminology is not automatically consistent. This generally produces problems in terms of semantic interoperability. The best examples are Germany and Austria with their various legislations in each federal state; on the one hand, the same term in the same language can mean something different, and on the other hand, there are different terms for one item. For instance a "zoning plan" is called a "*Flächenwidmungsplan*" in Austria but a "*Flächennutzungsplan*" in Germany. Green- or grassland is called "*Grünland*" in some Austrian federal states (e. g. upper Austria, lower Austria) but "*Freiland*" in other Austrian federal states (e. g. Tyrol, Styria). A standardised terminology is important for spatial planning data harmonisation but it is also hard to achieve because this would require legal amendments.

4.2.5. Development control

Planning instruments are controlled differently in all European countries; they are either submitted to the ministry for approval, or to the federal state, the region or province. Procedures of approval are also different depending on the country/state. Time of updates vary; sometimes the update of the planning instruments correspond with the political elections, sometimes there are reports that describe the status quo whether a plan has to be renewed or not.

4.2.6. Planning systems in practice

In practice, most planning systems are organised hierarchically and function in a top-down manner. Local plans have to take into account spatial development frameworks and regional plans have to respect national plans, if they exist. Figures 4.1 to 4.3 show planning systems from selected countries[1] : France is shown as an example of a centralised planning system, Austria because of its federal structure, and the Netherlands as an example of a contemporary planning system. An important issue is the legal binding status of online plans, which has already been introduced in the Netherlands, but is a long way from existence in many other countries where the stamped paper plan in the city administration is still the only legally binding plan.

As a pioneer in Europe, the Netherlands started to solve this key issue (Duindam et al., 2009). In 2008 the new Spatial Planning Act of the Netherlands came into force. Fewer rules, less central control and an implementation-oriented approach are the guiding principles behind the Act. The document is closely connected to the National Spatial Strategy, which contains the most important principles of the spatial planning policy for the period up to 2020 and follows the principles of decentralisation, deregulation and direct implementation. On all levels (national, province and local), governments are required to set out their policy in a structural vision that replaces the former key planning decisions (national), regional plans (provincial), and structural plans (local level). The structural vision can be characterised as a strategic policy document involving citizens and social organisations in its development. The zoning plans on the local level are compulsory for all municipalities. All new spatial plans must be in digital form and are legally binding. With the new Act more responsibility was given to the municipal level, and national and provincial levels are only responsible when national or provincial issues are concerned. Another point of the new Act was to simplify and shorten procedures to make administrations and governments more effective.
In France, planning is undertaken either by the state or the local governments. Several ministries have competence in the spatial planning system and mainly define the applicable laws and the roles of the bodies in charge of implementing the law (e. g. ministry in charge of town and country planning, ministry in charge of the en-

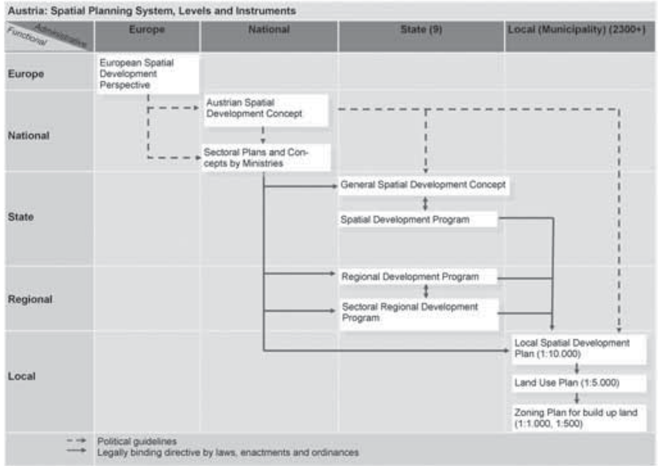

Figure 4.1: The Dutch spatial planning system: levels and instruments

vironment, ministry in charge of agriculture, etc.). The national government has decentralised offices at regional (Nuts 2) and departmental level (Nuts 3), which report to the ministry. The French State uses multiple instruments on three levels: spatial planning documents (territorial directives), strategic spatial planning document (SCOT), and local land use plans (PLU).

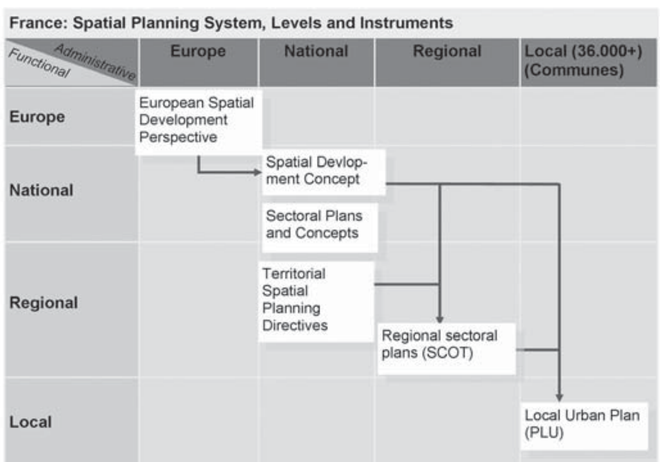

Figure 4.2: The French spatial planning system: levels and instruments

Austria is a federal republic. In this case the role of the national level in spatial planning is limited. Austria has different legislations in each of the nine federal states. Even though the competence of spatial planning on the national level is limited, there is the Austrian Conference on Spatial Planning, which is a federation of all nine federal states that coordinates spatial planning on the national level. It functions especially for the growing importance of EU policies. Sectoral plans and concepts are made by individual authorities (ministries). Austria uses land use and zoning plans, which are both made by the municipalities and are based on the development plans and concepts of the federal states and also include sectoral inputs from the national level.

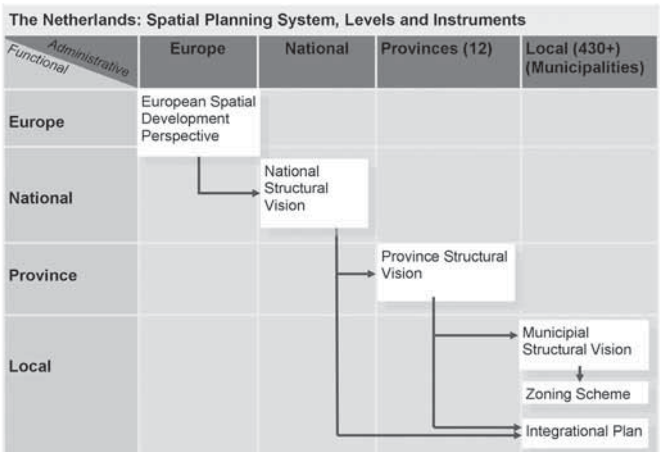

Figure 4.3: The Austrian spatial planning system: levels and instruments

4.3. SDI finding its way into Spatial Planning

4.3.1. SDIs in European countries

Spatial planning systems, processes and outcomes (such as plans) are very fragmented throughout Europe. Nevertheless, SDIs are becoming increasingly present in spatial planning procedures on European, national, regional and local levels. The past years have been characterised by a change of paradigm concerning accessibility and sharing of geodata. Whereas traditionally data has hardly been accessible for the public, nowadays there are several initiatives that support data accessibility and sharing. INSPIRE fosters SDI building, data and metadata documentation and

harmonisation, providing a robust framework. In addition, many municipalities in Europe have started their Open Government Data Initiatives, by sharing geodata via web services. Moreover, there is a broad Open Data Community and user generated content (Web 2.0) that is constantly growing and gaining importance for planning.
There are a high number of existing European best practice projects in the context of spatial data harmonisation and SDI[2] . The majority of analysed best practice projects have a European dimension, and integrate public authorities, private companies and researchers. Projects on a national and regional level can also be identified. Moreover, almost all of the projects deal with planning relevant data, are compatible to the standards of the Open Geospatial Consortium (OGC) and follow the aims of the INSPIRE Directive. In Europe best practice SDI building projects are mainly:

- (transnational) thematic activities for sectoral themes such as soil, environment, land use, geology, addresses, etc.;
- national activities such as the development of national land information and monitoring systems;
- regional activities such as cross-border mapping;
- activities emphasising the collection and creation of metadata; and
- network and capacity building activities.

An important question to discuss in planning is the legal binding status of online plans, as in many cases the stamped paper plan in the city administration is still the only legal binding plan. This implies that the information coming from SDIs needs to be checked against paper documents before they can be used. Therefore the question of the value of the information that is stored in an SDI rises. If information stored in an SDI has no defined legal value, what is its value? Digital spatial planning, like in the Netherlands (Duindam et al., 2009), covers all aspects of an SDI, including stakeholders, data, access networks, policies and standards. It has a very strong foundation because of its sound legal basis and is specially equipped to replace the analogue plan with a digital one with immediate effect, both in the existing planning process and the legal process.

4.3.2. What INSPIRE requires

To ensure that the multiple spatial data infrastructures of the EU member states are compatible and usable in a community and transboundary context, INSPIRE (EC, 2007) requires that common Implementing Rules (IR) are adopted in a number of specific areas, including metadata, data specifications, network services, data and service sharing, monitoring and reporting. These IRs are adopted by the Commission as decisions or regulations, and are binding in their entirety. The Commission is assisted in the process of adopting such rules by a regulatory committee composed of representatives of the member states and chaired by a representative of the Commission.

INSPIRE (EC, 2007)[3] does not require the collection of new spatial data and it does not establish new infrastructures. Moreover it is based on already existing data and infrastructures created by member states that should be made compatible. It must be taken into consideration that INSPIRE is a long-term process, especially as far as technical implementing rules are concerned.

One main requirement is to provide correct data via SDIs. Cross-border accuracy is an important issue when datasets from different national geodatabases are brought together. For example, border-lines between countries are usually not surveyed once per border-line, but twice: once by the country on the one side of the border and another time by the neighbouring country. As these datasets are surveyed by different institutions and stored in different cartographic projections, there may be (and often are) differences between two datasets representing the same real life object. Therefore it is recommended to explicitly express topological relationships. For example, polygons such as administrative units at the same level of hierarchy must not overlap; gaps between polygons such as administrative units in principle should not be allowed; and boundaries of neighbouring administrative units must have the same set of coordinates (INSPIRE Thematic Working Group Administrative Units, 2009; Plan4all D 2.3, 2009).

In practice datasets are sometimes not used, either because of their poor quality or because hardly anyone knows of their existence. Metadata are required to search and find existing data. Therefore metadata quality is as important as the actual data quality. The user working with geodata needs to know the origin, for which scale the data is suited, how data has been processed and much more. As the overall quality of a product is always dependent on the weakest link, a dataset is only as good as its metadata documentation. INSPIRE requires the definition of metadata elements for all the data and services related to the INSPIRE themes from Annexes II and III (EC, 2007).

Further INSPIRE addresses data modelling and application schemas; specifically, trying to find a sound balance between keeping models simple enough to be agreed on, and detailed enough to be usable by the wider audience of stakeholders in the spatial planning domain. It should be "possible for spatial data sets to be combined and for services to interact without repetitive manual intervention in a way that the result is coherent and the added value of the data sets and services is enhanced" (EC, 2007, Article 3). There is the need to distinguish between 'data of spatial planning', which is in fact land use data, and 'data for spatial planning', which is any space related thematic data. The seven themes treated by Plan4all may be considered together with other themes from the INSPIRE Annexes for sufficient coverage of the domain of spatial planning.

4.3.3. From the users' perspective

The analysis of user requirements (Plan4all D 2.4, 2009) is completed by the following user groups: spatial planning authorities, other civil service authorities, owners of transport and technical infrastructure, planning engineers and city planners, private companies, NGOs, investors and real estate owners, real estate agents, public, researchers and students. Because of the big differences between individual countries in spatial planning systems, planning habits as well as technological, financial and human capacity, the user requirements vary by country as well as by actor.

Some common requirements for data harmonisation are the vertical and horizontal interoperability of tools and methods; the possibility to publish own data and to use services from other data providers; the definition of a spatial data legend for data presentation; INSPIRE compliance; the possibility of metadata profile extension; free access to spatial planning data; and the possibility to make physical data accessible in electronic format together with ensuring digital rights management. Moreover, the following issues should be covered: implementation of an explanatory dictionary for spatial planning (glossary); a multilingual thesaurus for spatial planning; a referential geographical system and projection; descriptions of the data transformation process and of tools for data transformation.

Additional user requirements regarding technological aspects are to overcome technical hurdles with software that makes data management and sharing possible and easy, without having specialised IT skills and investments. There are OGC conform Web Services (WMS, WFS) and a variety of software (open source as well as commercial software) available that are being continuously developed. Requirements might be to upgrade some map servers to fully functional Web GIS servers, to make use of web mapping standards, to develop new services and to optimise data visualisation, automation, updating, etc.

There is also a need for more transparent accessibility of plans that are still in the phase of preparation. Better availability allows both administrations and society to participate pro-actively in the elaboration of plans. However, this requires changes in some planning cultures from hierarchical, bureaucratic practices to an open-minded, transparent and participative way of planning.

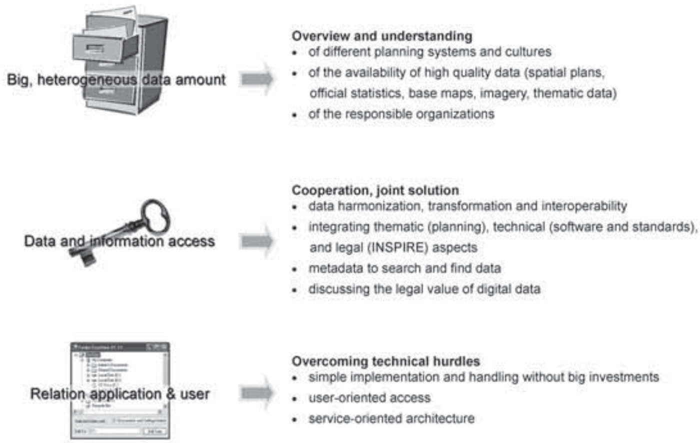

Figure 4.4: General requirements on data management in planning

4.4 Conclusion and Outlook

Planning systems are fragmented and spatial plans are difficult to compare. Traditionally spatial planning data sharing has been poor. However, due to several initiatives, standards and changes in planning culture, the harmonisation, interoperability, sharing and accessibility of data are increasing. The leading driving forces are INSPIRE as the legal framework on the European level (top-down), in combination with rising capacity and awareness of stakeholders in regard to the topic on all levels, from European to local and vice versa (bottom-up).

The implementation of SDIs in spatial planning faces several challenges. For future developments in SDI, bigger efforts are necessary in data collection (quantity and quality) as there are still big disparities between different European regions. In particular, much metadata information is still incomplete and is not collected according to the required standards. Accurate metadata collection clears the way for data networking and SDI building in a European context. Further, interregional, cross-border and transnational cooperation (horizontally) as well as cooperation between the state and regional or local governments (vertically) are key factors for SDI. A challenge for further development is also to work more towards the implementation of the INSPIRE principles. It is of high importance to strengthen awareness of data providers as well as data users that SDIs and data harmonisation are necessary for integrated planning, and to point out the benefits of data harmonisation initiatives in order to keep networks stable and to gain new partners for the future. SDI aims to integrate data providers and users from different organisations on different levels who do not have the same capacity in terms of data, data harmonisation, GIS technologies etc. Besides promoting the idea of data sharing within the circle of SDI experts, a challenge is to promote SDIs, their value for planning, new services and technology to a wider group of planning stakeholders in the simplest way. In spatial planning these particularly include actors from public administrations, including the several ten thousands of planning related public administrations in Europe. Plan4all contributes to the process of SDI development in Europe, and aims to integrate SDI, technology and planning processes in the best way.

[1] The schemas were provided empty and filled by partners. They are available for the following surveyed countries: Austria, Bulgaria, Czech Republic, France, Germany, Greece, Ireland, Italy, Latvia, the Netherlands, Romania and Spain (Plan4all D 2.1, 2009).
[2] 44 best practice projects were collected in the frame of Plan4all in 2009 (Plan4all D 2.2, 2009).
[3] In addition to the INSPIRE Directive (EC, 2007), several INSPIRE documents were analysed with a standardised format composed of some descriptive items and of a SWOT table for the evaluation of the document (Plan4all D 2.3, 2009).

REFERENCES

Duindam A et al., 2009 “State of Play of the Operational and Legally Bound Spatial Planning SDI in The Netherlands” in *Proceedings of GSDI 11 World Conference Spatial Data Infrastructure Gonvergence*, 15-19 June, Rotterdam http://gsditest.opengeospatial.org/gsdiconf/gsdi11/papers/pdf/129.pdf (accessed 30.09.2011)

EC, 2007, “Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)“ *Official Journal of the European Communities* L108 25 April (European Commission, Brussels)
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF (accessed 09.08. 2011)

INSPIRE Thematic Working Group Administrative Units, 2009, *D2.8.1.4 INSPIRE Data Specification on Administrative Units – Guidelines*, http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_AU_v3.0.pdf (accessed 09.08.2011)

Plan4all D 2.1, 2009 *Clusters of leading organizations in SDI for spatial planning* http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 28.07.2011)

Plan4all D 2.2, 2009 *Analysis of innovative challenges*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 28.07.2011)

Plan4all D 2.3, 2009 *Analysis of INSPIRE requirements*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 28.07.2011)

Plan4all D 2.4, 2009 *Analysis of user requirements*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 28.07.2011)

Ryser J, Franchini T, 2008 *International Manual of Planning Practice (IMPP)* (Sitges)

Chapter 5

The role of metadata and GI in spatial planning and SDI

Štěpán Kafka, Karel Charvát
Help Service Remote Sensing

5.1 Introduction

Spatial planning acts between all levels of government, meaning that every day planners face important challenges in the development of territorial frameworks and concepts (Schrenk et al., 2011). Planning is a holistic activity and all tasks and processes must be comprehensively solved with input from various sources. It is necessary to make inputs interoperable because it allows the user to search data from different sources, view them, download them and use them with help of geoinformation technologies. Spatial planning is not directly addressed by the INSPIRE Annexes; nevertheless it is one of the activities that is primarily driven by spatial data (EUROGI, 2009). Due to the massive use of digital data for producing plans at different scales, in recent years public authorities at national and sub-national (local) levels have demonstrated interest and effort in harmonising data in order to compare different policies and planning maps. Nevertheless, planning legislation varies between countries and sometimes even within countries there are significant differences in the terminology associated with planning acts. The methods used for harmonisation and interoperability vary between countries and between regions of the same country. Such methods range from the use of a common legend and a unique base cartography to the use of common data models and neutral exchange formats. It is worth noting that most of the initiatives for harmonising spatial planning data have taken place in the framework of e-government applications. Today's spatial planning practises face major challenges such as decentralisation (following regionalisation on the one hand and globalisation on the other), cross-border and transnational planning, vertical and horizontal integration, bottom-up approaches and the involvement of multiple actors on different levels with different interests and intentions.
Spatial plans are very important sources of information about the future evolution of the world around us. The most common instruments in European planning systems are land use local plans for regulating local land use and regional plans focused on regional development and structure. From this point of view such

information should be considered by INSPIRE. Some of the INSPIRE themes directly deal with information about future changes, for example, land use. However, many more themes may also be affected by changes over time, including the transport network, hydrography, production and industrial facilities. Such evolution is currently not considered by the INSPIRE directive.

5.2 Role of Metadata in the spatial plan lifecycle

Metadata are defined in the INSPIRE Directive as "information describing spatial data sets and spatial data services and making it possible to discover, inventory and use them" (Directive 2007/2/EC). In other words, to facilitate the finding of spatial data sets and services and decisions over how they may be used and for what purposes, the providers of spatial data sets and services secure their descriptions in the form of metadata. Plan4all considered two roles of metadata in the lifecycle of a spatial plan (Figure 5.1):

- Evidence of all relevant documents and their status during the plan's preparation and acceptation phases
- Discovery functionality

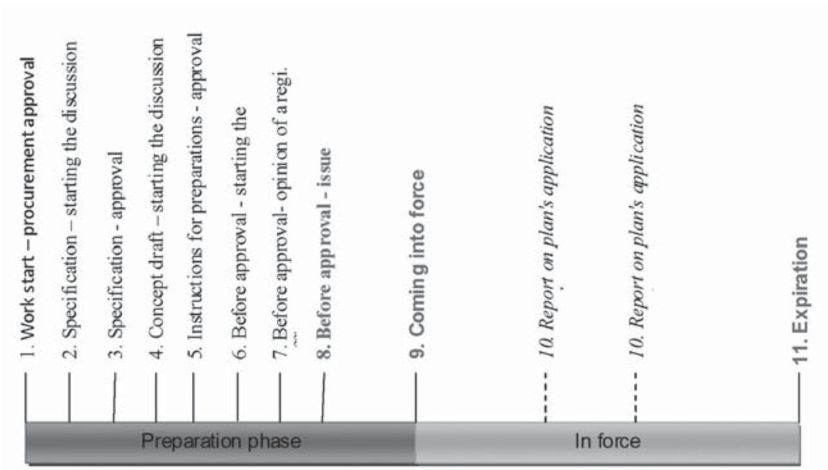

Figure 5.1: Spatial plan life cycle events and time aspects according to Czech legislation

Metadata have to support both of these functionalities to help the administration to manage planning processes, but also in later stages to support access to planning documentation.

Discrete units of metadata are metadata elements, for example the resource title, keyword, spatial resolution or responsible organisation. Spatial plan metadata contains metadata of the spatial plan as a whole and can catalogue spatial plans on any level (regional, state, European). Because one spatial plan consists of many components, e.g. textual documents or maps in paper and digital form, individual components may be optionally described by independent metadata records with links to the corresponding spatial plan. In order to have metadata that is compatible and usable in trans-boundary contexts, the INSPIRE Metadata Regulation sets out a core set of metadata elements. This is referred to as the INSPIRE metadata profile.

The Plan4all metadata profile is compliant with the INSPIRE metadata profile and aims to make spatial plans comprehensible and comparable. In addition to spatial plan metadata, the Plan4all metadata profile consists of dataset metadata and service metadata. The Plan4all metadata profile fulfils the requirements of national metadata regulations, national spatial planning legislation, user requirements for spatial planning metadata and the INSPIRE directive. National and user requirements for metadata were collected using questionnaires. The goal was to compare national metadata regulations and to define common sets of items that will be used for common metadata sharing. The metadata profile also supports the international standards ISO 19115 (core metadata for geographic datasets), other ISO standards and the standards of the Open Geospatial Consortium (OGC).

The problem with spatial plan data is that they refer to future situations that may, or may not, be realised. The Plan4all proposal is to add to metadata status information (e.g. existing/planed/under construction/for demolition) to all considered INSPIRE themes, along with some additional information about the terms for realisation.

5.3. Using metadata profile for cataloguing spatial plans

ISO 19115/19139 metadata standards are widely used for spatial data documentation, cataloguing and discovery. The INSPIRE Metadata Regulation introduces metadata that are based on these standards. Metadata catalogues are applications that are used to manage and discover metadata records and are based on OGC Catalogue Service for web (CSW 2.0.2). They are considered to be the most important part of INSPIRE and other Spatial Data Infrastructures across world (Beyer et al., 2009).

The Plan4all team experience provides opportunities for the reuse of these standards and infrastructure for cataloguing spatial plans in the same way. The spatial plan may be seen as a complex dataset composed not only from digital data but also some documents or map compositions and with some legal aspects (Figure 5.2). Spatial representations of the spatial plan are crucial and are comprised of:

- Data with some legal influence (e.g. land use)
- Data with an informative character, introduced to the spatial plan as updates of existing datasets during the process of spatial plan design or created with informative status (e.g. view points, tourist routes, infrastructure etc.)

These data may be good sources of inputs or upgrades for other datasets or information systems (HSRS, 2010).

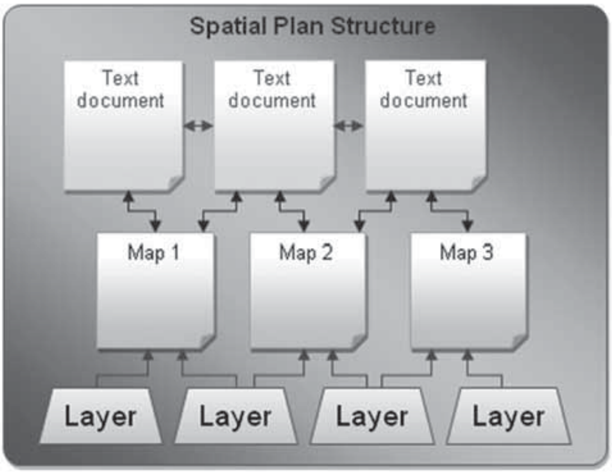

Figure 5.2: Spatial plan structure, from HSRS (2010).

Similar to other datasets, the spatial plan metadata may offer different levels of detail with regards to application scope (see Figure 5.3).

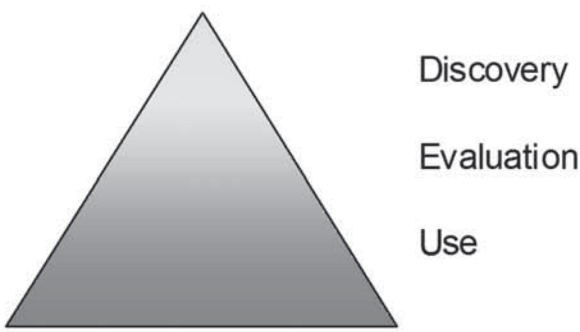

Figure 5.3: Metadata detail, from HSRS (2010).

The basic metadata level of discovery may be used for evidence and catalogue searching. It provides basic information about the spatial plan as a whole. No structural description is required at this level. The spatial plan may be described as one MD_Metadata record with the structure not much wider than the INSPIRE metadata profile.
If the spatial plan is considered as a data source for other applications (e.g. the INSPIRE themes), the detailed description should be available to facilitate a good interpretation of the contained data. Detail description should cover these areas:

- Metadata of each dataset contained in spatial plan. Because the data incorporated into spatial plans are very different, quality parameters, scales and time aspects are very important for correct interpretation and reuse.
- Application schema in some modelling language. The application schema represents formalized description of dataset inner structure. Depending of the application it may be provided separately for each dataset or for spatial plan as a whole. The description should include:
    - Feature types
    - Attributes
    - Domains
- Relations between features. This description is not part of the metadata profile itself, but should be provided together with spatial plan data and the metadata record should link to this file. This model may be the starting point for automatic data conversion to other schemas e.g. INSPIRE theme.

According to these requirements the spatial plan should be described in a more complex way (see Figure 5.4).

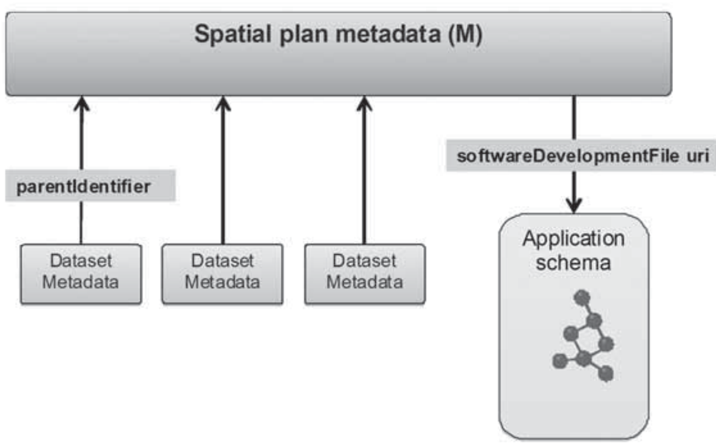

Figure 5.4: Possible components of spatial plan, from Kafka & Fiala (2010).

There are a number of possible options for achieving full spatial plan metadata:

1. Set of "independent" files consisting of

a) Spatial plan metadata file (or catalogue record)

b) Individual metadata files (or catalogue record). The link to parent file is set by parentIdentifier

c) Application Schema binary file (or an optional graphic representation of the schema)

2. One complex metadata file (record) containing aggregation of all metadata elements in one file (catalogue record) and/or application schema binary file (see example 1).

3. Hybrid approach, including a set of independent metadata records as described in 1, but with some additional features (see example 2).

Due to the possible problems with implementation we would recommend the use of option 1 or 3 with an optional "Overview file".

Example 1: Complex metadata record

```
<gmd:DS_DataSet xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss"
xmlns:gts="http://www.isotc211.org/2005/gts" xmlns:gml="http://www.open-
gis.net/gml/3.2" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca-
tion="http://www.isotc211.org/2005/gmd://schemas.opengis.net/iso/19139/20
070417/gmd/metadataApplication.xsd">
      <gmd:has>
        <gmd:MD_Metadata>
                   ...
        </gmd:MD_Metadata>
      </gmd:has>
      <gmd:has>
        <gmd:MD_Metadata>
            ...
        </gmd:MD_Metadata>
      </gmd:has>
</gmd:DS_DataSet>
```

Example 2.: Hybrid approach

```
<gmd:DS_DataSet xmlns:gmd="http://www.isotc211.org/2005/gmd"
xmlns:gco="http://www.isotc211.org/2005/gco"
xmlns:gsr="http://www.isotc211.org/2005/gsr"
xmlns:gss="http://www.isotc211.org/2005/gss"
xmlns:gts="http://www.isotc211.org/2005/gts" xmlns:gml="http://www.open-
gis.net/gml/3.2" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLoca-
tion="http://www.isotc211.org/2005/gmd://schemas.opengis.net/iso/19139/20
070417/gmd/metadataApplication.xsd">

  <gmd:has
       xlink:href="metadata1.xml"
       xlink:type="simple"
       xlink:actuate="onLoad"
       xlink:show="embed"
       xlink:title="My metadata"/>

  <gmd:has
       xlink:href="metadata2.xml"
       xlink:type="simple"
       xlink:actuate="onLoad"
       xlink:show="embed"
       xlink:title="My metadata 2"/>
</gmd:DS_DataSet>
```

5.4. Feature level metadata

If the spatial plan plays a role as the source for other datasets (e.g. INSPIRE land use theme), traceability issues are very important for handling and interpreting the resulting dataset. For example, if a member country provides a layer that is harmonised both vertically (schema transformation) and horizontally (combining data from different sources and regions - see Figure 5.5), the feature-level metadata (metadata related to single features of the dataset) would be the only way of keeping the required information (Janecka & Kafka, 2010).From a practical point of view, the metadata should be stored as a reference (using xlink:href attribute) rather than as embedded elements in GML (Geographic Markup Language). In the INSPIRE data specification, the gml:StandardObjectProperties/gml:metaDataProperty element may be used to address data without any changes to the schema. The number of source datasets is unlimited and the number of metadata records must correspond to the number of source datasets, providing that there have been no feature-level metadata introduced to the source metadata. These records are linked by reference from the feature (see Figure 5.6).

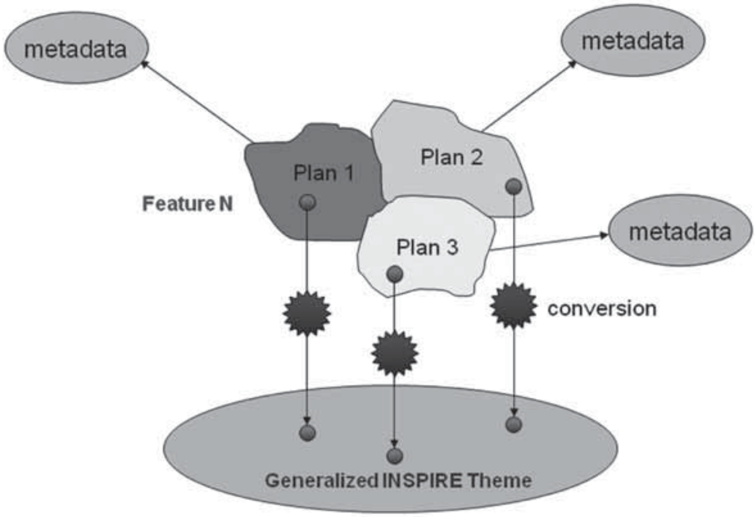

Figure 5.5: Inheritance of metadata during schema conversion , from HSRS (2010).

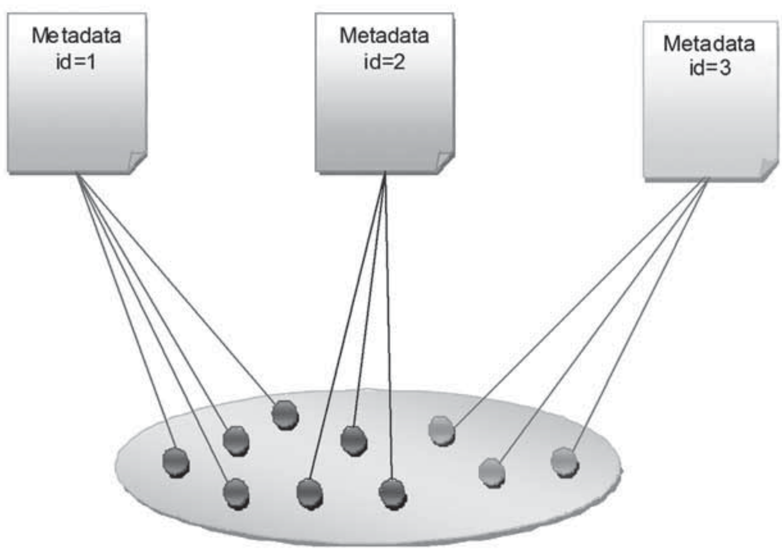

Figure 5.6: Features coming from three different sources are described by three metadata records that are part of the dataset, from HSRS (2010).

5.5. Specific Metadata Elements for Spatial Plan

The Plan4all metadata profile introduces some elements needed for spatial planning that are not part of the INSPIRE metadata profile, but that are part of the ISO 19115/19119/19139 standards. The mandatory ISO 19115/19119 metadata elements omitted by INSPIRE were included into the spatial planning metadata profile. The profile is shown in Tables 5.1 and 5.2.

Element name	Cardinality	Description
Metadata standard name	1	Name of the metadata standard.
Metadata standard version	1	Name of the metadata standard version.
Presentation form	1..*	Mode in which the resource is presented.
Application schema	0..*	Provides information about the conceptual schema of a Spatial plan data.
Data quality scope	1	Level to which data quality information apply.
Reference system information	0..*	Information on reference system
Maintenance and update frequency	0..1	Information on updates frequency.
Purpose	0..1	Summary of the intentions with which the resource(s) was developed
Status	1..1	Represents the status of the resource described by metadata. Possible values are in the ISO 19115 code list 'MD_ProgressCode'.
Legal relevance	0..1	Legal character.

Table 5.1: For spatial plan metadata

Element name	Cardinality	Description
File identifier	1	Metadata file identifier.
Parent identifier	0..1	File identifier of the metadata to which a metadata is a child. It is used for identification of Spatial Plan which the dataset is part of.
Metadata standard name	1	Name of the metadata standard.
Metadata standard version	1	Name of the metadata standard version.
Spatial representation type	1..*	Method used to spatially represent geographic information (e.g. vector)
Geometry type	0..*	Represents the geometrical type of a spatial dataset whose spatial representation type is 'Vector', and it may assume 3 possible values: Point, Polyline or Polygon.
Image	0..*	An image to illustrate the data that has been returned.
Character set	0..*	Character coding used for the dataset.
Application schema	0..*	Provides information about the conceptual schema of a dataset
Data quality scope	1	Level to which data quality information apply.
Reference system info	1..*	Information on reference system.
Distribution format	1..*	Information on distribution format.
Transfer options	0..*	Number of volumes, data carriers etc...
Maintenance and update frequency	0..1	Information on updates frequency.
Source	0..*	Represents the description of the dataset from which the present dataset is derived through the production process described within the metadata element 'Lineage'.
Process step	0..*	Description of process step of data acquisition or processing.

Table 5.2: For single dataset metadata

For catalogue services, the following query able metadata elements were introduced:

1. Spatial Plan type (corresponds to Hierarchy level name)
2. ProcessStep (composition of Process Step Description, Process Step Date, Process Step Processor)

For a detailed description, see the Spatial plan metadata profile published in the scope of the Plan4all project (Kafka & Fiala, 2010).

5.6. Implementation

To demonstrate the feasibility of the solution and to provide a possibility to practically test the existing model, the designed metadata profile was implemented as part of the Plan4all Geoportal. Four independent services were implemented:

- Metadata creation
- Metadata import
- Metadata management
- Discovery services

Metadata creation services support the creation of metadata records according to the Plan4all profile (see Figure 5.7).

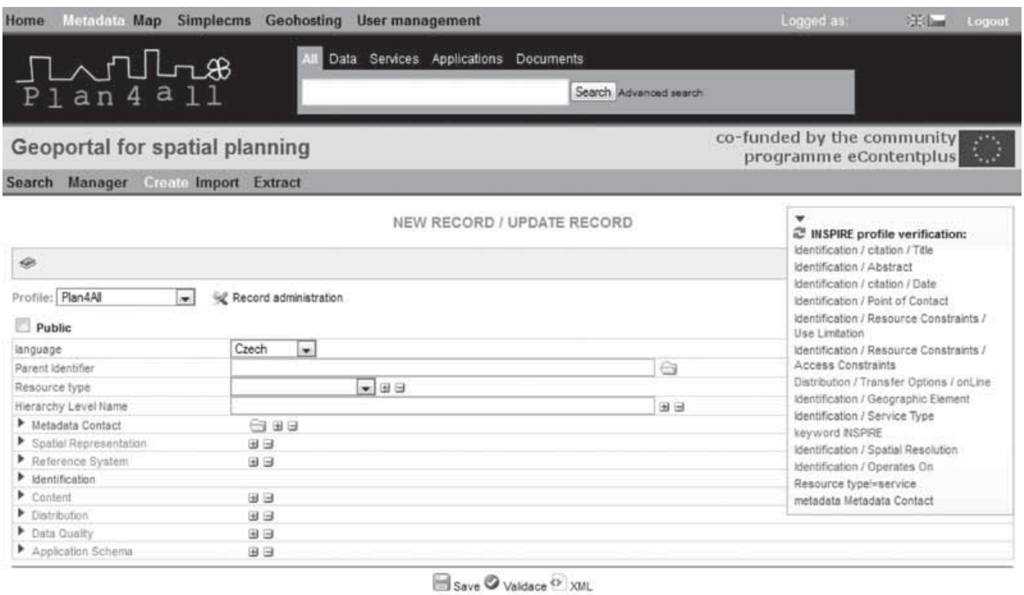

Figure 5.7: Metadata record creation.

The creator also supports the search of parent metadata using catalogue services (see Figure 5.8).

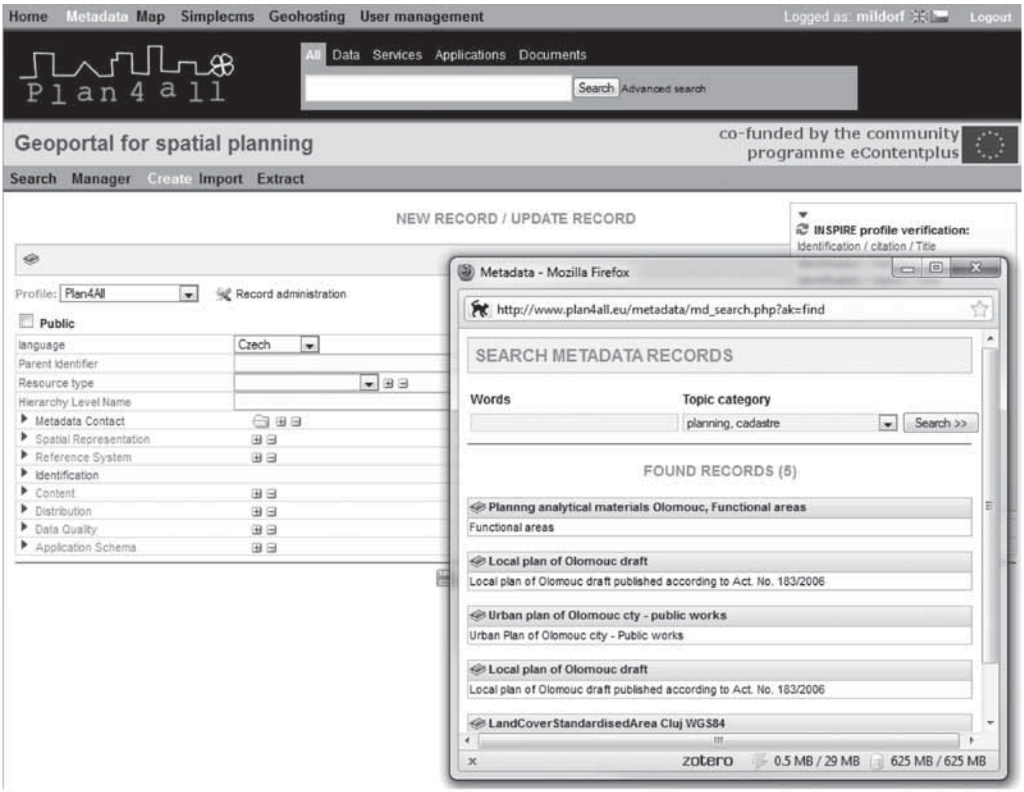

Figure 5.8: Search of parent metadata.

The created metadata could be saved on a portal, validated against a Plan4all profile or downloaded as an XML file.
Metadata import offers the possibility to upload metadata from existing files or to harvest metadata from GetCapabilities of existing services (see Figure 5.9).
This metadata could also be interlinked, validated, saved or uploaded.
The metadata manager (Figure 5.10) supports the management and editing of existing records.

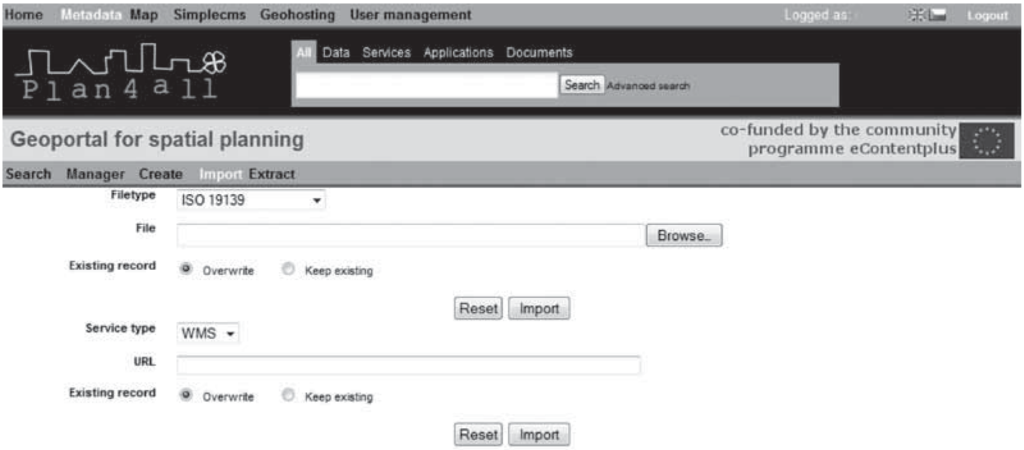

Figure 5.9: Metadata import.

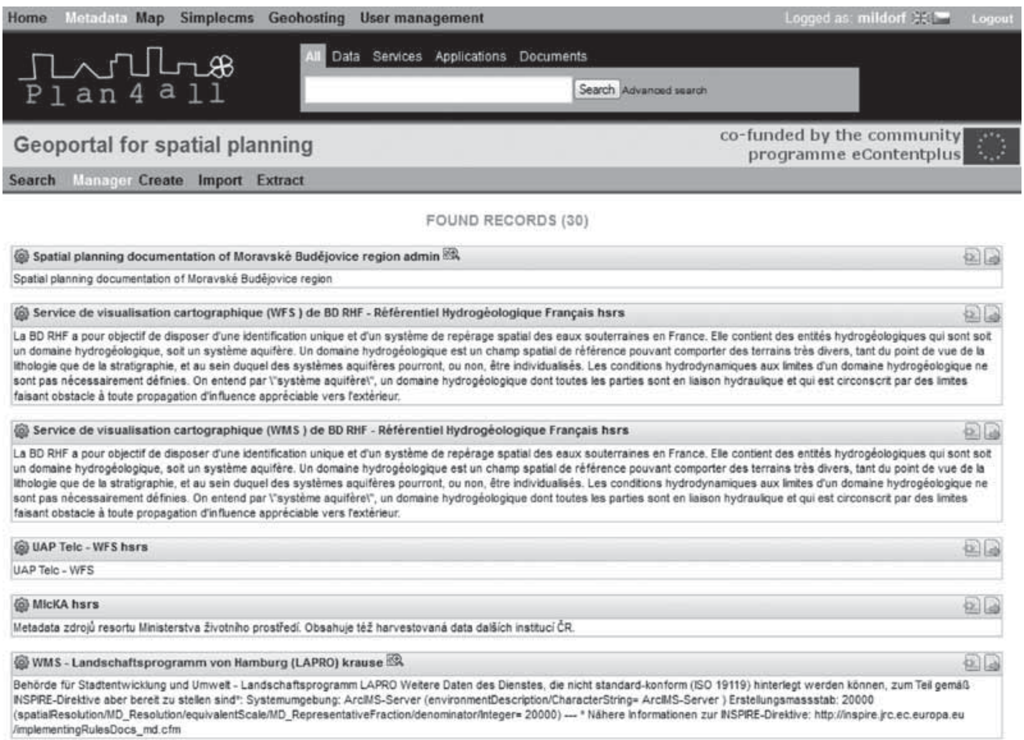

Figure 5.10: Metadata manager.

The discovery client (Figure 5.11) supports discoveries based on the INSPIRE discovery services specification with extended functionality for the Plan4all profile (Charvát et al., 2011).

Figure 5.11: Advanced search.

REFERENCES

Beyer, C., Wolfgang, W., Wasserburger, Bergheim, R., Brūns, P., Charvát, K., Dvorak, M., Horak, P., Neuschmid, J., Stelian, D., Zanetti, N., 2009, "*Analysis of Innovative Challenges*", Plan4all deliverable to the European Commission.

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

EUROGI, 2009, "*INSPIRE Requirements Analysis*", Plan4all deliverable to the European Commission.

HSRS, 2010, "*Plan4all Metadata Profile -Final version*", Plan4all deliverable to the European Commission.

Janecka, K., Kafka, S., 2010, "*Analysis of National Requirements on Spatial Planning Metadata*" Plan4all deliverable to the European Commission.

Kafka, S., Fiala, R., 2010, "*European Spatial Planning Metadata Profile - First Version*" Plan4all deliverable to the European Commission.

Charvát , K., 2011, "*Pan European Plan4all Platform*" Plan4all deliverable to the European Commission.

Schrenk, M., Mildorf, T., Neuschmid, J., 2011, "*Plan4all – Spatial Planning Data Harmonisation According to the INSPIRE Directive*", Proceedings of the GIS Ostrava Conference, Ostrava, Czech Republic, 24th to 26th January.

Chapter 6

Plan4all data models definitions

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6.1. Modelling Plan4all themes: Languages and techniques

When modelling a mini-world, a number of steps are typically carried out whose goal is to determine self-contained schemas capable of expressing properties, relationships and behaviour of objects featuring the domain of interest. The initial phase, named conceptual design, is meant to derive a conceptual schema in agreement with a conceptual data model, which represents a map of concepts assembling semantics of the mini-world under investigation. Starting from a requirement analysis, which should extract facts about the nature of the mini-world, a conceptual schema describes things of interest, their properties and associations by using a data definition language, syntactic rules and a possible graphic notation. The resulting schema can be expressed through different levels of abstraction/detail, i.e., it is possible to simplify it through a generalisation process, as well as further refine it by adding details which do not alter the abstract perspective. This allows users to zoom in or out of portions of the schema and query underlying data through the available languages. Phases subsequent to the conceptual design should then produce logical and physical schemas in order to develop a database for managing mini-world content.

Literature provides designers with different data models, each devoted to handling the domain of interest through a data definition language and a data manipulation language. Depending on the available systems and tools, designers can choose the most appropriate data model, thus benefiting from its languages. In particular, when adopting a standard data model, several advantages can be gained, which guarantee the goodness of the result. Among other advantages, a schema can be both partitioned in subschemas and enhanced by integrating additional subschemas, semantics can be univocally interpreted due to the well-established syntactic rules, and syntactic rules allow for the univocal specification of transformation rules for (harmonising) pre-existing data.

The models proposed in Plan4all D4.2 (2010) have been described through UML (Unified Modeling Language) diagrams, a standard notation that allows for the conceptual modelling of real-world objects during the first step of an object-oriented methodology (Fowler, 2003). In particular, UML can be used to describe the whole software development life cycle by integrating techniques from data modelling (entity relationship diagrams), business modelling (work flows), object modelling, and component modelling.

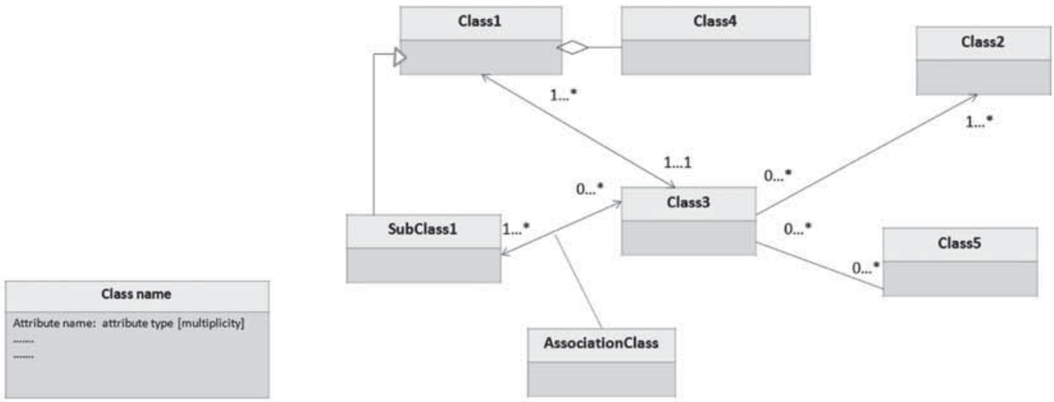
Among the modelling concepts that UML specifies, the models proposed in Plan4all exploit those referring to classes (of objects), objects, associations, use cases and packages. In particular, the Plan4all themes have been modelled through class diagrams characterised by a set of attributes (with multiplicity) and methods, and are related through different typologies of associations, namely aggregations (part-of), specialisations, and relationships with multiplicity. Moreover, pre-defined lists of domain values are included, namely enumerations and code lists. The former corresponds to a frozen, no-empty list and the latter refers to a list of domain values that can be extended, depending on users' requirements. It may initially be empty. An extensive usage of voidable attributes has been also done in order to handle situations when a characteristic of a spatial object may be not present in a spatial dataset, but may be present or applicable in the real world.

Finally, in terms of geometry properties, they have been managed by adopting the ISO international standard for geographic information embedded within UML. This approach also allows the automatic generation of topological relationships when deploying databases. In particular, connectivity and contiguity are handled through the topology and other relationships are established by performing a calculation on (x, y) coordinates.

6.2. UML schemas: generalities

UML includes a set of graphic notation techniques to create visual models of object-oriented software-intensive systems, and derived models can be exchanged among UML tools by using the XMI interchange format. Figures 6.1(a) and 1(b) show the graphic notation for basic elements of a UML class diagram.

- A class is depicted as a box consisting of a list of typed attributes along with a multiplicity (Figure 6.1 (a)).
- Associations are always assumed to be bi-directional; this means that both classes are aware of each other and their relationship, unless a uni-directional association is qualified. In this case, two classes are related, but only one class knows that the relationship exists. Moreover, the uni-directional association includes a role name and a multiplicity value, but unlike the stan-



(a) (b)

Figure 6.1: Some basic graphic notations from UML: (a) class notation, (b) diagram notation

dard bi-directional association, the uni-directional association only contains the role name and multiplicity value for the known class. See the association between Class1 and Class3 in Figure 6.1(b) as an example of bi-directional association. Also multiplicity is associated.

• An association with an aggregation relationship indicates that one class is a part of another class. In an aggregation relationship, the child class instance can outlive its parent class. An aggregation is represented through an unfilled diamond shape on the parent class's association end. See the association between Class1 and Class4 in Figure 6.1(b) as an example of aggregation.

• The composition relationship is a kind of aggregation relationship, but the child class's instance lifecycle is dependent on the parent class's instance lifecycle. It is represented by a filled diamond shape.

• An association class includes valuable information about the primary association it is tied to. The association line between the primary classes intersects a dotted line connected to the association class. See the AssociationClass in Figure 6.1(b) as an example of association class.

• Even if it is not a UML basic characteristic, it may be useful to specify properties for specialisation or generalisation. See the association between Class1 and SubClass1 in Figure 6.1(b) as an example of a specialization. A specialization can be partial / total and overlapping / disjoint, thus allowing four different combinations. In cases where a subset has been specified, it represents a partial and disjointed specialisation. In cases where two or more subclasses have been associated with a superclass, the specialisation can be:

- either total (each instance of the superclass is always an instance of one or more subclasses) or partial (an instance of the superclass may not belong to any subclasses), and
- either disjointed (an instance can be a member of at most one of the subclasses of the specialisation) or overlapping (the same in stance may be a member of more than one subclass).

A specialisation is graphically represented by either an annotation tree or by single arrowed associations.

6.3. Some Plan4all data models

6.3.1. Introduction

As mentioned in Chapter 3, the Plan4all Project was focused on the following 7 spatial data themes included in Annex II and III of the INSPIRE Directive (INSPIRE, 2007):

- Land cover
- Land use
- Utility and Government services
- Production and industrial facilities
- Agricultural and aquaculture facilities
- Area management/restriction/regulation zones and reporting units
- Natural risk zones

The Plan4all Project was submitted as a proposal in June 2008, started in May 2009 and ended in October 2011. Meanwhile, in order to develop the data specifications of the Annex II and III themes, INSPIRE decided to establish specific Thematic Working Groups (TWGs) including GI experts and domain experts. They started their work in June 2010 and will end in April 2012. Of course TWGs covering the 7 Plan4all themes were created as well.

Plan4all, as an SDIC of INSPIRE, submitted reference materials and proposed experts for TWGs. Although no formal agreements amongst Plan4all and TWGs were defined, strong relations and interactions were developed. Chapter 7 explains these interactions as far as the Land Use theme is concerned.

There are differences among Plan4all data models and INSPIRE TWGs data specifications; they are the result of some temporal shifts and mainly of the different points of view involved. While Plan4all has worked on data models from the spatial planning point of view, the TWGs had different approaches and aspects to consider.

Because of the size of this volume, in the following sections only three out of the seven Plan4all data models are presented and quickly compared with the corresponding data specifications drafted by the INSPIRE TWGs: Land Use, Land Cover and Natural Risk Zones. Land Use refers to data **of** spatial planning, and is the most specific and therefore detailed. Land Cover and Natural Risk Zones, are less detailed: they are examples of themes referring to data **for** spatial planning. All Plan4all data models are described in Plan4all D4.2 (2010).

6.3.2. Land Use theme

Definitions

In the INSPIRE Annex III, Land Use is defined as "*Territory characterised according to its current and future planned functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational")* (EC, 2007).

Plan4all Land Use data model

Figure 6.2 shows a simplified UML view of the Plan4all Land Use data model.

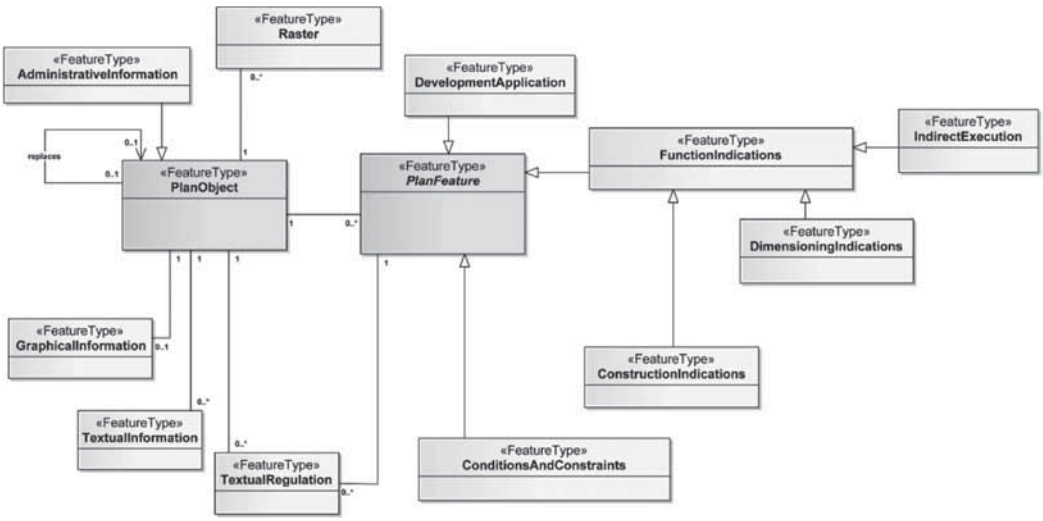


Figure 6.2: Simplified view of the Plan4all Land Use data model

The two "core" classes of the model are "PlanObject" and "PlanFeature"; all other pieces of information are related to these classes. "PlanObject" represents the plan itself from a geometric point of view (the boundary of the entire area over which the

plan is effective), while “PlanFeature” represents the single provisions of the plan, each with its geometry, which are considered a subset of the “PlanObject” geometry.
With regards to the association between “PlanObject” and “PlanFeature”, the cardinality shows that each Plan Object can have from zero to many Plan Features. In the case, for example, of a regional plan that intends to limit urban sprawl, giving generic provision to be applied by the municipal plans, no specific portions of land are indicated; the plan will have no Plan Feature, because there is no information of a geographic kind, but only textual information. On the other hand, in the case of a municipal plan, there will be more Plan Features; each of them will provide information on the land uses of each portion of the municipal land.
The “PlanFeature” class generalises a series of child classes and each adds further information to that provided by the parent class.
Other classes, such as those providing textual information, or information about the administrative process, are related to the “PlanObject” class.
The area of a Plan Feature doesn’t necessarily correspond to the single cadastral parcel, even if the latter is the minimum spatial unit on which spatial plans have effect. A single plan provision can encompass more cadastral parcels. Also, since spatial planning works by overlaying thematic data and specific provisions, plan provisions can, totally or partially, overlap. Therefore, Plan Features are not mutually exclusive. So, according to the authors of the model, it makes no sense to define a minimum spatial unit for land use datasets; the smallest unit will be the smallest portion of land resulting from the intersection of more overlapping land use features (Figure 6.3).

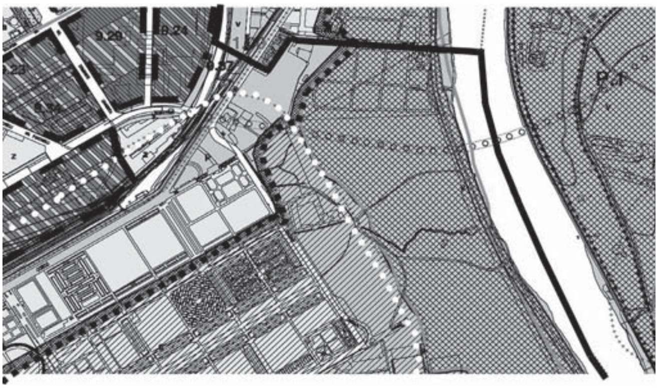


Figure 6.3: Examples of land use features overlapping from Torino (Italy) municipal plan 2009 (only some overlapping features are highlighted): black line - long-established urban areas; dashed line - urban transformation zones with specific rules; black square dotted line - geomorphologic hazard zones boundary; white round dotted line - cemetery restriction zone

The following is a detailed description of the complete model, which can be found in the Plan4all D4.2 (2010). In this deliverable, the model, with all its classes, attributes, code lists and enumerations, is described both through a UML diagram and a feature catalogue.

- "PlanObject" provides information about the plan itself, including the geometry of the plan borders. Related to this class are the following:
  - "AdministrativeInformation": information on the administrative situation and the planning process, for example the name of the responsible authority, date of adoption of the plan, legal validity of the plan, step of the planning process (i.e. if the plan is being drafted, if it is adopted, approved, obsolete, etc.);
  - "GraphicalInformation" - graphical specifications for the paper-based outputs, if existing;
  - "TextualInformation" and "TextualRegulation" - files containing the textual parts of the plan; and
  - "Raster" - raster files referring to old plans in paper form.
- "PlanFeature" contains the specific land use indications. It gives information such as the status of the land use indication (whether it refers to an already existing land use, or to planned land use), the type of regulation (for whom the land use indication is binding), the reference to any specific norm it refers to, etc. It contains also the geometry of the land use indication (the land area that the specific indication refers to). Specialisations of this class are the following:
  - "FunctionIndications", comprising all kinds of land use indications, from the most general classification of the municipal land (e.g. urbanised / to be urbanised / rural / natural), down to the specific function for the single land parcel. These indications can be also about dimensions ("DimensioningIndications" including indexes, volume ratios, maximum heights), type of construction ("ConstructionIndications" including type of building or roof shape allowed), and / or indirectly executable ("IndirectExecution", in the case that the task of specifying in detail the function of a certain area is entrusted to other plans);
  - "ConditionsAndConstraints" acting on urban development, coming both from outside the plan and generated by the plan itself. In order to use code lists that have already been defined, some connections to other themes have been attempted whether developed by INSPIRE TWGs ("Protected Sites"), or by other Plan4all partners ("Area Management, Restriction, Regulation Zones and Reporting

Units” and “Natural Risk Zones”); and

- “DevelopmentApplications”, which are administrative information regarding the procedures for issuing building permits and other kinds of authorisations referring to the same plan.

Comparison between Plan4all Land Use data model and INSPIRE Data Specification on Land Use

At a first glance, there are many differences but also similarities between the Plan4all Land Use data model and the Data Specification on Land Use elaborated by the INSPIRE Land Use Thematic Working Group (TWG-LU) (INSPIRE D2.8.III.4_V2.0, 2011).

First of all, the INSPIRE model is divided into three parts:

• the Core Land Use model, containing classes which are generalisations of the classes of the other parts of the model;

• the Existing Land Use model; and

• the Planned Land Use model.

The Plan4all model considers only Planned Land Use. Its authors assumed that “existing land use” and “planned land use” are two completely different issues, and modelling both of them with a unique model would lead to misinterpretations and misunderstandings. The same TWG-LU highlighted “*the confusion between land use and land cover in existing datasets*” (INSPIRE D2.8.III.4_V2.0, 2011, p 11). Therefore, the Existing Land Use part of the INSPIRE model is not comparable to any part of the Plan4all model. For this reason, the tables below only compare the Core Land Use and Planned Land Use parts of the INSPIRE model with the Plan4all model.

There are some general differences between the two models:

• the use of the coverage (“CoverageByDomainAndRange”) feature type. For unknown reasons, INSPIRE chose this type of geometry for the land use information. In contrast, Plan4all chose the GM_Aggregate type in order to be able to support multi-point, multi-line and multi-polygon geometries;

• the INSPIRE model is more simple and generic in regards to the general structure, classes and attributes. Some kinds of more specific information, supported by the Plan4all model, are not supported by the INSPIRE model. Other kinds of information are supported by the INSPIRE model by means of generic attributes referring to open code lists or described by free character strings.

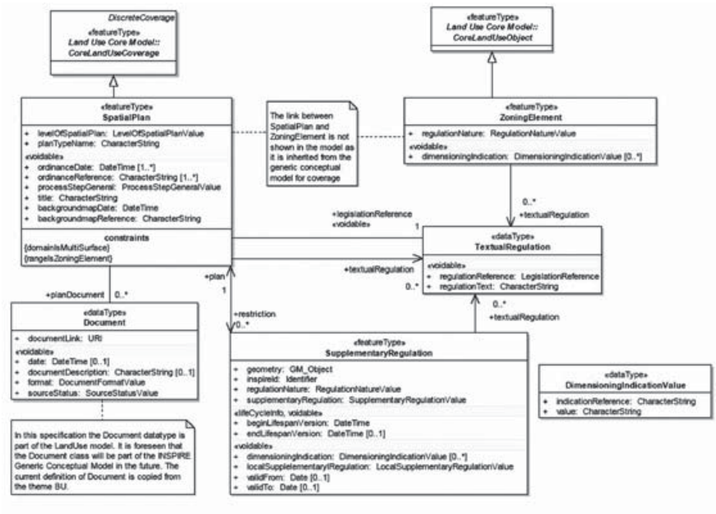


Figure 6.4: UML overview of the INSPIRE Planned Land Use application schema (INSPIRE D2.8.III.4_V2.0_v2.0, 2011, p. 18)

The following tables (6.1, 6.2, 6.3 and 6.4) visually compare single parts of the two data models. Classes (or groups of classes) that have the same colours or hatches are classes (or groups of classes) that are conceptually similar, or that support the same kind of information.
Table 6.1 shows how the two core classes of the models, and their mutual association,, are very similar in the two models. Therefore, it can be said that the two models are conceptually very similar in their basic structures.
Table 6.2 compares the actual land use/zoning information contained by the models, i.e. the most important information. The Plan4all model contains more specific information about land use/zoning, while the INSPIRE model is more generic, the main information about zoning being entrusted to the attribute dominantLandUse and its proposed standard Hierarchical INSPIRE Land Use Classification Systems (HILUCS). Trying to cope with the complexity of contemporary planning, the Plan4all model contains additional information, including LUCAS_Code, macroClassificationOfLand, otherTerritorialClassification and interventionCategory,.
The two classes in Table 6.3 are similar, with the exception that the INSPIRE class has been conceived in order to contain also, for example, the "high-level" plans that cannot be georeferenced because they only show general "drawings" illustrating a strategic vision for a wide territory.
As regards Table 6.4, SupplementaryRegulation (INSPIRE) and ConditionsAndConstraints (Plan4all) are conceptually very similar despite their different names. A "sup-

plementary regulation" (INSPIRE) is a feature that overlaps the zoning elements, providing additional information and/or limitations to land use; "conditions and constraints" (Plan4all) are all those norms limiting land use, deriving from other plans or generated by the plan itself. As shown in the table, while in the INSPIRE model SupplementaryRegulation is associated to the whole plan, in the Plan4all model ConditionsAndConstraints is connected to the single plan feature, i.e. a part of the plan. The concept is almost the same; both information about zoning and information about supplementary regulations (i.e. constraints etc.) are two types of information that are part of the same plan. However, from a geometric point of view, the choice made by INSPIRE seems to be due to the fact that the zoning elements cannot overlap, therefore the supplementary regulations have their own geometry and can overlap with the zoning elements as additional information layers. In the Plan4all model, plan features can overlap; therefore the conditions and constraints are simple specialisations of the PlanFeature class.
As a conclusion, it can be said that, from a conceptual point of view, the two models are quite similar; however, INSPIRE tries to be more generic (fewer classes and attributes) whilst at the same time managing to contain many kinds of information. For more detailed comparisons between the two models, the complete text illustrating the comparison can be found at http://www.plan4all.eu/simplecms/?menuID=29&action=article&presenter=Article.

INSPIRE	Plan4all
<featureType> SpatialPlan - - - - - <featureType> ZoningElement	<featureType> PlanObject 1 —— 0..* <featureType> *PlanFeature*
The association between SpatialPlan and ZoningElement is not clearly defined (there is a reference to the INSPIRE specifications about "coverage by domain and range"), however it can be said that ZoningElement is a partition of SpatialPlan: each Zoning Element gives information on a part of the land encompassed by a Spatial Plan.	For each Plan Object there can be 0 or more Plan Features: each Plan Feature gives information on a part of the land encompassed by a Plan Object.

Table 6.1

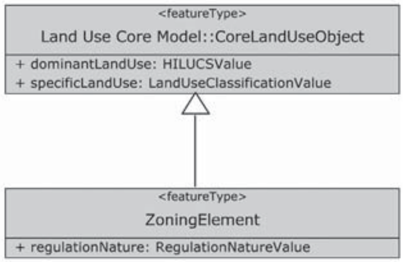
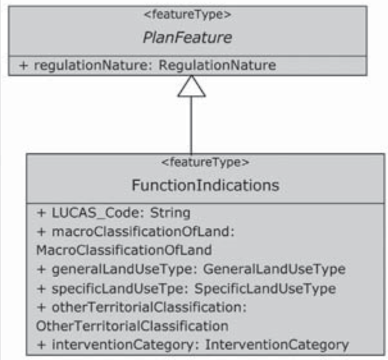
<table>
<tr><th>INSPIRE</th><th>Plan4all</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>The actual information about zoning is given by the following attributes, divided between the parent class CoreLandUseObject and the child class ZoningElement:
- dominantLandUse;
- specificLandUse;
- regulationNature.</td><td>The actual information about zoning is given by the following attributes, divided between the parent class PlanFeature and the child class FunctionIndications:
- generalLandUseType;
- specificLandUseType;
- regulationNature;
- LUCAS_Code;
- macroClassificationOfLand;
- otherTerritorialClassification;
- interventionCategory</td></tr>
</table>

Table 6.2

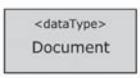
<table>
<tr><th>INSPIRE</th><th>Plan4all</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>The Document data type contains all non-spatial information such as scanned plans or "structural drawings" which cannot be spatially referenced.</td><td>The Raster class contains plans in raster form, such as old paper-based plans that have been scanned.</td></tr>
</table>

Table 6.3

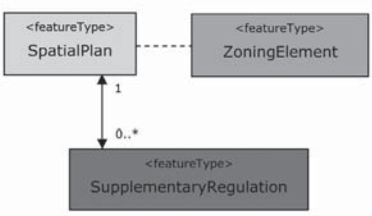
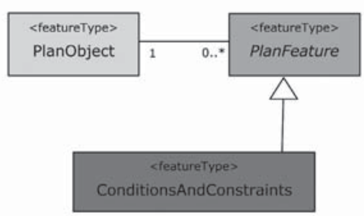
<table>
<tr><th>INSPIRE</th><th>Plan4all</th></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>SupplementaryRegulation is associated to the whole spatial plan and has its own geometry.</td><td>ConditionsAndConstraints is child of PlanFeature, therefore it inherits its geometry.</td></tr>
</table>

Table 6.3

6.3.3. Land Cover theme

Definitions

In the INSPIRE Annex II Land cover theme is defined as “Physical and biological cover of earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies” (EC, 2007).
Land cover data represent a (bio)physical description of the earth surface. It has broad applications in many fields of human activity where the goal is in nature conservation, monitoring the impact of industrial and agricultural processes and planning and implementing activities. Land cover typology includes features such as artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies. In this way it is different from the land use data dedicated to the description of the use of the Earth’s surface.

The typologies of the above elements are divided into separate subgroups in order to describe all the features that are useful for environmental matters that exist in Europe, and are produced with an adequate minimum area threshold (“Minimum Mapping Unit”). Land cover is described by the hierarchical nomenclature system, and classes must be defined and kept in time in order to identify land cover changes within time series. Land cover information has to be homogenous and comparable between different locations in Europe, based on the infrastructures for Land Cover information created by the Member States (if they exist), and made available and maintained at the most appropriate level. Classification should be consistent with the Land Cover Classification Systems (LCCS) and CORINE.

Land cover is linked and overlaps with other themes including Orthoimagery and Land use. There are strong links with themes that can be considered elements of land cover, such as Transport Networks, Hydrography, Buildings, Production and industrial facilities, Agricultural and aquaculture facilities and Oceanographic geographical features.

Plan4all Land Cover data model

When analysing the semantic content of the data model proposed by Plan4all, the following statements have been extracted:

- A LandCoverArea **is adjacent to** one or more LandCoverArea(s);
- A LandCoverStandardisedArea **is a kind of** LandCoverArea;
- A LandCoverOriginalArea **is a kind of** LandCoverArea; and

• A LandCoverStandardisedArea is an aggregation of LandCoverOriginalArea(s).

A set of enumerations and codelists are provided to complete data specification.

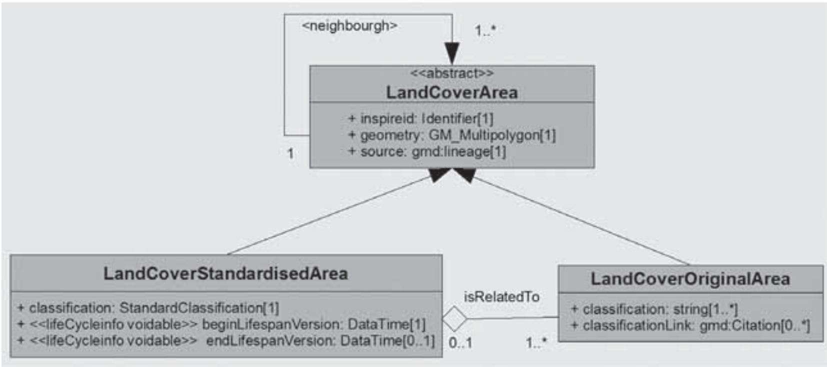


Figure 6.5: Feature types as defined by Plan4All

Comparison between Plan4all and INSPIRE Land Cover data model

Plan4all and INSPIRE Land Cover data models are based on the same goal, namely to guarantee (as much as possible) the simplicity of the model and the harmonisation between different LC classification systems and original data (and classification), but they use different approaches to achieve this goal. The INSPIRE data model (see INSPIRE D2.8.II/III.4_v2.0, 2011) is general rather than specific and supports many different LCCS and LC measurements, because the model has to be useful in describing all data of the land cover theme. While the LC Plan4all model is very simple, the INSPIRE model is more complex and wider. It contains more descriptive attributes. In INSPIRE LC data specification the harmonisation is undertaken by requesting data providers to document their classification systems in a systematic manner. In the Plan4all data model, this aspect is not addressed in detail. The INSPIRE model does not explicitly specify the geometry of a vector object. The Plan4all model works with polygons described as GM_Multipolygon, because the majority of land cover data sets are composed from polygon geometry types. But for a description of all possibilities, the use of some more general types, for instance GM_Object, would be more appropriate.
Unlike the Plan4all model the INSPIRE data model contains a part that is focused on raster data (coverage).

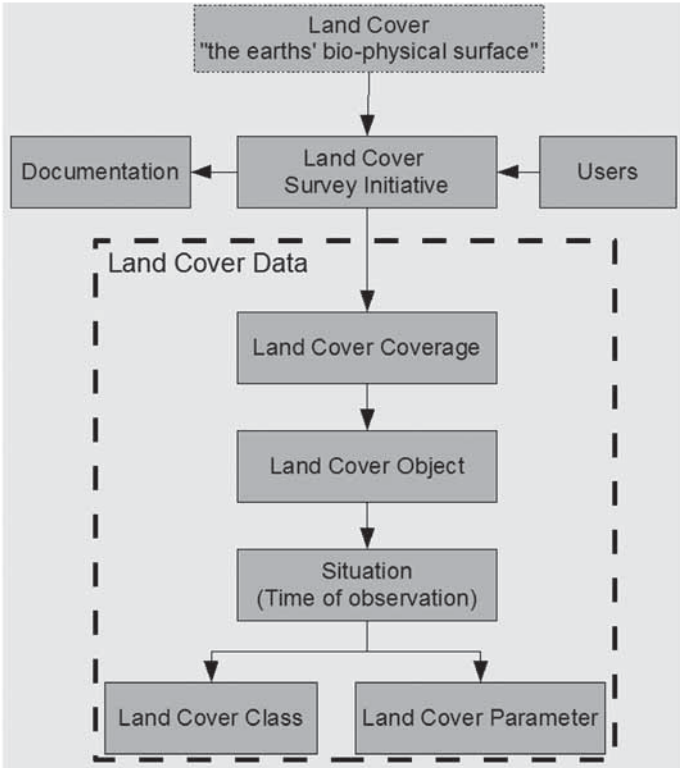


Figure 6.6: INSPIRE Land Cover Survey Initiative and Land Cover Data (see INSPIRE D2.8.II/III.4_v2.0, 2011 p 8 and p 12)

Both data models try to make a connection to the original data (and classifications), but there are different approaches. The Plan4all data model prefers a specific class (class LandCoverOriginalArea). This class is connected to the abstract class LandCoverArea and contains two attributes: classification (text description of original / local classification system) and classificationLink (optional attribute provided link to the original / local classification system through the standardised metadata type gmd:Citation). INSPIRE data specification allows the linking of more taxonomies to one Land cover area (class LandCoverObject).

Area items in the INSPIRE model can include more than one different type of land cover classes: it is possible to declare the percentage of each type of coverage. Instead, the Plan4all model works with homogeneous land cover areas. The INSPIRE model does not contain any standard land cover classification. The Plan4all model uses the taxonomy defined for CORINE Land Cover (CLC) data. This classification system represents the fundamental European taxonomy and it is the most popular

in European data sets. Moreover, many countries have developed transformation processes between their national or local taxonomies and CLC.
Other issues, which were highlighted during the Plan4all validation phase, seem better framed in the INSPIRE data model than in that of Plan4All: one of them is the suitability of using an object-oriented approach for designing a data model that is inherently hierarchical. But, according to ISO feature-geometry-model, Land cover model is instead a description of single land features.

6.3.4 Natural Risk Zones theme

Definitions

In the INSPIRE Annex III definition, Natural risk zones are: "Vulnerable areas characterised according to natural hazards *(all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions"* (EC, 2007). "Natural risk zones" are zones where natural hazards areas intersect with highly populated areas and/or areas of particular environmental/ cultural/ economic value. Risk of the exposed populations and of the environmental, cultural and economic assets in the zone considered, is defined as:

$$Risk = Hazard \times Vulnerability \times Exposure \qquad (6.a)$$

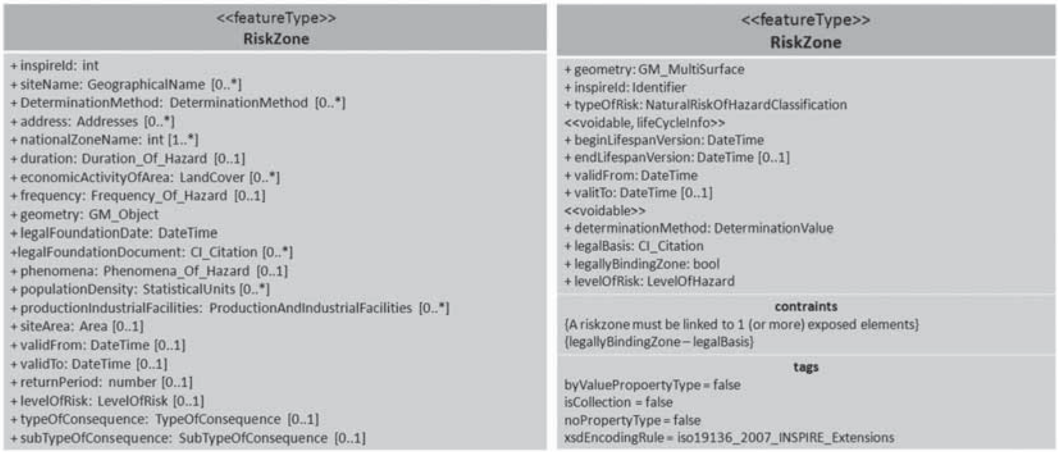
In particular:

- *Risk* is the combination of the consequences of an event (hazard) and the associated likelihood/probability of its occurrence (ISO 31010);
- *Hazard* is a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UNISDR 2009);
- *Vulnerability* is the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR 2009);
- *Exposure* is people, property, systems, or other elements present in hazard zones that are thereby subject to potential losses (UNISDR 2009).

The broad field of natural risks may link and overlap many other themes, mostly concerning physical environment, such as land use, elevation, hydrography, land cover, geology, area management, environmental protection facilities, meteorological geographical features, oceanographic geographical features. In particular, it is of upmost importance to manage such connections, because they are crucial when assessing the level of threat that a certain hazard may cause on life, health, property or environment. Knowledge deriving from implicit interrelationships among different themes can help decision-makers better face specific hazards.

Data models presented by Plan4all (Plan4all D4.2, 2010) and INSPIRE Natural Risk Zones Thematic Working Group (TWG-NZ) (INSPIRE D2.8.III.12_V2.0, 2011) represent two complementary views of a complex domain. Both adopt a general description provided by INSPIRE (2008) and describe essential elements which characterise a natural risk zone. Indeed, within both application schemas, the RiskZone feature type represents the core element that everything else is related to. However, each of them focuses on a specific issue of the whole theme and models it by specifying all the relevant items that characterise it. In particular, Plan4all has faced aspects concerning the natural risk zone classification by providing users with an organisation of zones according to their nature and in agreement with the directives of European Parliament and Council on related issues, such as flood risks and protection of soil. In contrast, TWG-NZ has managed aspects more strongly related to the definition of Risk. Namely, INSPIRE TWG-NZ has modelled relationships given in the equation at 6.a, thus emphasising how a factor may affect the others, how a hazard area can be specialised, and finally which relationships should be established with respect to the Area Management and Planned Land Use feature types.

The choice of two different approaches in defining the application schemas derives from the multifaceted nature of the theme under investigation. The theme consists of several aspects ranging from hazard/risk typologies, such as natural and technological, to their international standardisation from processes to scientific models used in the area identification. However, both models are extensible in many directions, to cover theme aspects that are partially handled. In particular, although the RiskZone feature types defined in schemas differ for some attributes (see Figure 6.7), due to the aim and scope of their specification, it is possible to integrate them by selecting common elements and specialising differences in one or more subclasses according to their purpose. Moreover, the use of code lists in both application schemas gives users the option of extending general schemas by adding values that may be applicable to a different level. Indeed, there is no currently available list or classification of natural hazards or risks that can be considered as an international standard. The use of codelists and enumerations are also meant to create interoperable lists which may contribute to data harmonisation.



(a) (b)

Figure 6.7: The RiskZone feature type as defined by Plan4All (a) and by INSPIRE TWG (b)

Plan4All Natural Risk Zones data model

In Figure 6.8 a simplified version of the application schema proposed by Plan4all is given.
When analysing the semantic content of the application schema proposed by Plan4all, the RiskZone feature type represents the schema core and it specialises in six further feature types, as follows:

- An *InundatedRiskZone* **is a kind of** *RiskZone*
- An *InundatedRiskZone* **is composed of** *Embankment*
- A *StormRiskZone* **is a kind of** *RiskZone*
- A *DroughtRiskZone* **is a kind of** *RiskZone*
- An *AvalanchesRiskZone* **is a kind of** *RiskZone*
- A *VolcanicActivityRiskZone* **is a kind of** *RiskZone*
- An *EarthmovesRiskZone* **is a kind of** *RiskZone*
- An *OtherHazardsRiskZone* **is a kind of** *RiskZone*

A set of enumerations and codelists are provided to complete data specification.

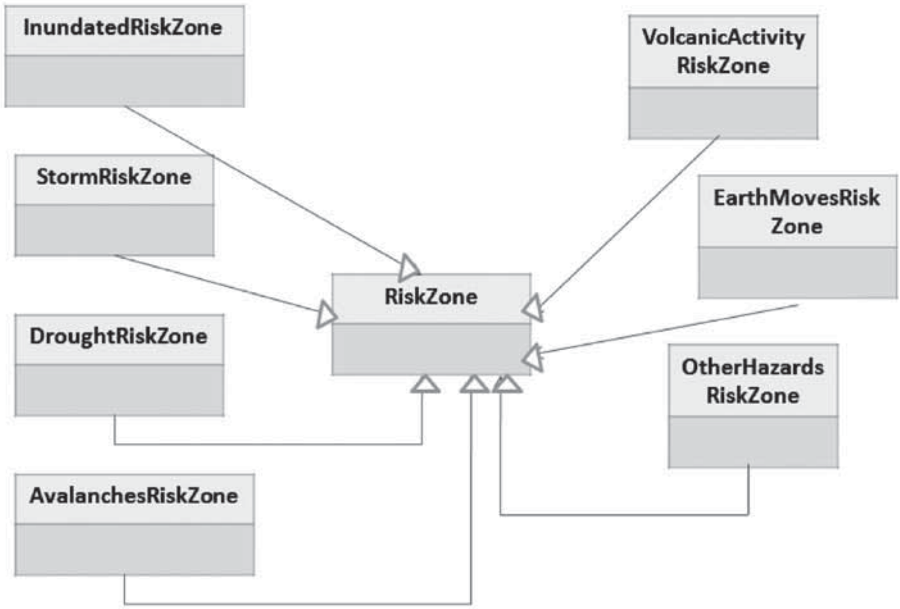


Figure 6.8: A simplified version of Plan4all Natural Risk Zones data model

INSPIRE TWG-NZ data model

Figure 6.9 depicts a simplified version of the application schema proposed by the INSPIRE TWG-NZ (INSPIRE D2.8.III.12_v2.0, 2011). The *RiskZone* feature type represents the schema core and it is related to four further feature types. A *HazardArea* specialisation is also specified. Besides relationships with Planned Land Use and Area Management, the following statements can be extracted:

- One or more *HazardArea* **is related to** zero or more *RiskZones*
- *ModelledOrDeterminedHazard* **is a kind of** *HazardArea*
- *ObservedHazard* **is a kind of** *HazardArea*
- One or more *ExposedElements* **is related to** zero or more *RiskZone* with the associated class *VulnerabilityOfElements*
- Zero or more *ObservedHazard* **is related to** zero or more *ExposedElements*

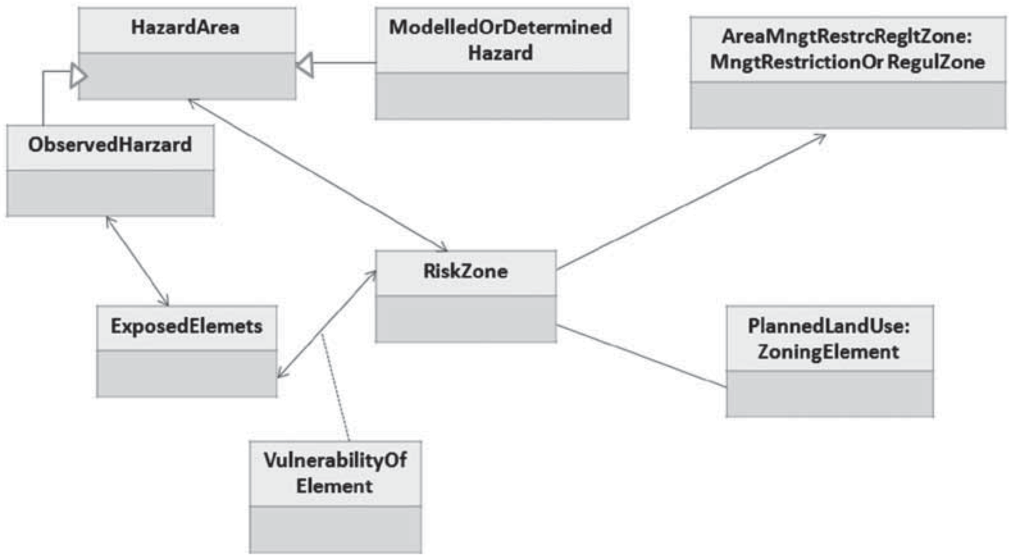


Figure 6.9: A simplified version of INSPIRE TWG Natural Risk Zones application schema (see INSPIRE D2.8.III.12_v2.0, 2011)

6.4 Final considerations

Some comments presented in the previous sections derive from the Plan4all data model validation phase, which took place in Winter-Spring 2011 (Plan4all D8.2, 2011). In particular, involved stakeholders pointed out that spatial planning management strongly depends on the organisation or institution in charge of it, whose task also consists of binding the scope and establishing the appropriate threshold of detail. Then, data modelling, and the goal of data harmonisation, strongly depend on the achievement of a shared global view of the topic under investigation by all subjects involved.

Data models have to be "*as simple as possible but not simpler*" (Albert Einstein). Details have to be "*as little as possible*" and "*as much as needed*" (INSPIRE JRC team, but with reference to metadata). These two meaningful quotations effectively synthesise the "balance challenge" that is behind defining data models. In particular, as far as the Land Use theme is concerned, some of the mentioned differences between the Plan4all and the INSPIRE data models deal with this issue.

At the time of writing this chapter, INSPIRE Annex II and III data specifications were at the draft stage. The INSPIRE team launched testing activities for the further development of these draft data specifications, starting in June 2011 and ending in October 2011. After this testing phase, the TWGs will deal with the comments received and elaborate the final versions of the data specifications by April 2012 (see Chapter 7). Therefore, the INSPIRE data specifications will probably change again in the future.

While the INSPIRE data specification testing is mainly focussed on transformation feasibility, i.e. on transforming existing data into INSPIRE-compliant data, a second logical step is foreseen. This step is "*fitness for purpose*" testing, which "*aims at demonstrating the usefulness of spatial data compliant with the INSPIRE data specifications when addressing real applications*" (INSPIRE Consolidation Team, 2011, p. 10). This step necessarily includes stakeholders and data end-users, and it is the key way to understand if the elaborated data models are going to work and be used.

REFERENCES

EC, 2007 "Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)" *Official Journal of the European Communities* L108 25 April (European Commission, Brussels)
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF (accessed 09.08. 2011)

Fowler M, 2003 *UML Distilled: A Brief Guide to the Standard Object Modeling Language* (Addison-Wesley. Boston)

INSPIRE Consolidation Team, 2011 *INSPIRE Annex II+III Data Specifications Testing Call for Participation*
http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/Call_4_testing_participation_Annex_II_III_final.pdf (accessed 07.09.2011)

INSPIRE D2.8.II/III.4_v2.0, 2011 *Data Specification on Land Cover – Draft Guidelines*
http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_LC_v2.0.pdf

INSPIRE D2.8.III.12_v2.0, 2011 *Data Specification on Natural Risk Zones – Draft Guidelines*
http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_NZ_v2.0.pdf (accessed 07.09.2011)

INSPIRE D2.8.III.4_v2.0, 2011 *Data Specification on Land Use – Draft Guidelines*
http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_LU_v2.0.pdf

INSPIRE, Drafting Team "Data Specifications", 2008 *Definition of Annex Themes and Scope*
http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf
(accessed 31.08.2011)

ISO 31010, 2009 ISO/IEC 31010:2009, *Risk management – Risk assessment techniques*

Plan4all D4.2, 2010 *Conceptual Data Models for Selected Themes*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 07.09.2011)

Plan4all D8.2, 2011 *Assessment of Project Solutions*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 07.09.2011)

UNISDR (UN International Strategy for Disaster Reduction), 2009 *Terminology on disaster risk reduction*
http://www.unisdr.org/we/inform/publications/7817 (accessed 05.09.2011)

Chapter 7

A collateral experience: the INSPIRE Thematic Working Group on Land Use

François Salgé
MEEDDAT

7.1. Land Use in the Context of INSPIRE

The Land Use (LU) spatial data theme is included in Annex III of the INSPIRE Directive.
In the INSPIRE Directive, Land Use is defined as "*Territory characterised according to its current and future planned functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreationa*l") (EC, 2007 p 13).
Land Use may be split into two different types:

1. The Existing Land Use (ELU: "*current*" Land Use in the above definition), which objectively depicts the use and functions of a territory as it has been and effectively still is in real life.
2. The Planned Land Use (PLU: "*future planned*" Land Use in the above definition), which is composed of spatial plans, defined by spatial planning authorities, depicting the possible utilisation of land in the future. PLU is regulated by spatial planning documents elaborated at various levels of administration. Land use regulation over a geographical area may be composed of an overall strategic orientation, a textual regulation and a cartographic representation. Spatial planning documents result from the spatial planning process, and therefore, once adopted, third parties must conform with them.

PLU incorporate elements that in the real world can be related to other INSPIRE spatial data themes such as *Area management / restriction / regulation zones and reporting units or Natural Risk Zones*. These will be seen as supplementary regulations related to Land Use as soon as this information is incorporated in the legal spatial plan.

7.2. Thematic working group context

The process of developing an INSPIRE data specification in a Thematic Working Group involved the following areas of expertise:

- Domain expertise - expertise about the thematic domain and the data to be used in the application;
- GI expertise - expertise about geographic information specifications (ISO 19100 series, OGC standards) and information modelling as well as network services used to provide access to the spatial data sets;
- INSPIRE expertise - expertise about the Generic Conceptual Model, data encoding guidelines, the INSPIRE architecture including the service architecture, the methodology to develop INSPIRE data specifications and other INSPIRE documents;
- Software expertise - expertise about implementation and deployment aspects of the relevant specifications.

The Land Use Thematic Working Group is composed of 12 experts from Belgium, Finland, France, Germany, the Netherlands, Poland, Spain, and the European Commission (INSPIRE TWG, 2010). Its working period is June 2010 – April 2012. Connexions with other TWGs were organised via both direct bilateral contacts and cross TWG meetings organised by the Joint Research Centre (JRC).

7.3. Development process of Land Use data specification

The data specification on Land Use was prepared according to the methodology elaborated for INSPIRE (see INSPIRE DT "Data Specification", 2008) respecting the requirements and the recommendations of the INSPIRE Generic Conceptual Model (see INSPIRE DT "Data Specification", 2010), which ensures a coherent approach and cross-theme consistency with other themes in the Directive.

7.3.1. Use case development

The use cases and application scenarios to be supported by the INSPIRE data specification were analysed. 47 use cases were submitted by the Spatial Data Interest Communities (SDIC) and Legally dated Organisations (LMO). Half of these were further investigated via interviews of the submitting organisation in order to ascertain the user requirements. The use cases section of the LU data specification (see INSPIRE D2.8.III.4_v2.0) documents the TWG-LU understanding after this process. The aim of the use case section is to describe situations where land use datasets

are required to perform a given task. These use cases are documented in order to understand how the requirements have been filtered in view of designing a conceptual model that is generic enough to cover potential use cases and simple enough to minimise the burden on data producers and users.
Eight use cases have been selected as representative of those reported to the land use thematic working group :

- Land planning,
- Analysis of land consumption,
- Ecological network mapping,
- Greenhouse inventory reporting,
- Land use for environmental impact assessment,
- Land use for the flood directive,
- Statistics for Land Use,
- Land use for soil management.

7.3.2. Identification of user requirements and spatial object types

The theme-specific requirements regarding data were extracted from the use cases and application scenarios. This included the identification of the required levels of detail. The result was a description of the relevant universe of discourse for the theme including a candidate list of spatial object types with definitions and descriptions.
The data requirements as they result from the use case analysis are presented for both existing and planned land use in the LU data specification. They express the main requirements regarding the features that need to be taken into consideration, the nomenclature to be used, the temporal dimension, identifiers, portrayal, metadata and requirements for consistency with other themes. They also identify requirements that have been omitted mainly due to the expected difficulties in meeting them.
The key aspects that have enabled the shaping of the LU data model and the relations with other themes are also presented.

7.3.3. As-is analysis

An *as-is* analysis of the current situation regarding spatial data sets for the theme was carried out in parallel with the previous steps. Based on a checklist, the analysis of the 36 reference materials submitted by the SDICs and LMOs enabled the identification of the relevant data interoperability aspects.

7.3.4. Gap analysis

The gap analysis identified user requirements that cannot be met by the current data offerings. For each gap, a data interoperability approach – which may also include a conclusion that specific user requirements cannot be met – have been identified and agreed upon.

7.3.5. Data specification development

Three application schemas are described in the LU data specification and specify the spatial object types with their properties, range of valid property values and constraints. The data specification itself has been documented according to ISO 19131, the International Standard specifying the contents of data product specifications in the field of geographic information. The application schema, accompanied by a corresponding feature catalogue derived from the application schema, constitutes the core component of the data specification.
Two versions of the LU data specification have been submitted to the other TWGs and to the INSPIRE drafting teams for an internal review. The first one (version 1.0), delivered in October 2010, concentrated on the scope description and the main object types. About 100 comments were delivered during that stage and were taken into consideration. The second version (version 1,9), delivered in April 2011, covered all the requested chapters. 36 comments where provided. The result of the data specification development is version 2.0, provided in June 2011 for SDICs and LMOs comments and testing (INSPIRE D2.8.III.4_v2.0).

7.3.6. Implementation, test and validation

The LU data specification as well as the other theme data specifications were reviewed by the stakeholders and tested within one or more pilots under real world conditions using the use cases to test the proposed specification for consistency, completeness, feasibility and implementability. This step started in June 2011 and ended in October 2011.

7.3.7. Cost-benefit considerations

Incremental costs and benefits of the data interoperability and harmonisation efforts require tracking and documentation.
The development and establishment of the European spatial data infrastructure is a challenge, which requires not only the consideration of the technical feasibility,

but also the proper assessment of the related costs and benefits. Such considerations are a core part of the process of establishing the regulation related to the interoperability of spatial data sets and services. The qualitative aspects of community feedback, together with the quantitative results of SDI studies and testing provide a solid basis for drawing conclusions about the feasibility and proportionality.

7.4. Plan4all and TWG relationships

The Plan4all Project was proposed when neither a thematic working group nor a drafting team was established for the seven themes considered by the Plan4all Project.

7.4.1. From INSPIRE to Plan4all

The Plan4all analysis of INSPIRE requirements (Plan4all D2.3, 2009) provides an implementation-neutral and INSPIRE-oriented set of recommendations for the modelling concepts for geographic data and metadata that are further developed in the Plan4all project.
The analysis provides short annotated readings of INSPIRE, and recommendations for metadata profiles and data models coming from INSPIRE. Some hints and recommendations coming from the analysis of other relevant documents (INSPIRE related projects and/or spatial planning projects and initiatives), and some thoughts about terminology were also provided to the Consortium.

7.4.2. From Plan4all to INSPIRE

As a result of the Plan4all activities, several documents were provided as reference material to the TWG-LU; namely the Analysis of National Requirements on Spatial Planning (Plan4all D3.1, 2010), the Analysis of Conceptual Data Models (Plan4all D4.1, 2010) and the Conceptual Data Models for Selected Themes including the “Land use” feature catalogue (Plan4all D4.2, 2010) as well as the analysis of User Requirements (Plan4all D2.4,2009). In the course of the TWG-LU work, the Plan4all Metadata Profile - Final version (Plan4all D3.2.2, 2010) was also provided.
All these documents were key in the design of the LU data specification as they resulted from a multi-national analysis. Many of the concepts of the planned land use data model are directly derived from the Plan4all work as well as the metadata section of the LU data specification.

7.4.3. From INSPIRE to Plan4all

The JRC of the EC has requested SDICs and LMOs to participate in two types of testing activities: “feasibility testing” and “fitness for purpose testing”.The testing should mainly focus on transformation feasibility. However, where possible, transformed data (compliant with the proposed schemas) should be made available for subsequent fitness for purpose testing.
The objective of the feasibility testing is to measure the technical feasibility and the efforts related to transforming existing data into data that is compliant with the requirements and schemas proposed in the data specification documents. The Plan4all Consortium agreed to perform feasibility testing for land use and other themes.
Feasibility testing included the development of mapping tables, transformation rules or workflows, their implementation in a transformation tool or service and the validation of the transformed data, which are provided through the Plan4all portal.

7.5. Land Use Data Specification

The June 2011 version as documented in INSPIRE D2.8.III.4_v2.0 (2011) is presented in the following sections.

7.5.1. Main characteristics of the data specification

The main value of the INSPIRE Land Use model is its simple, yet flexible structure that allows data providers to publish their existing data in the most convenient way. In order to ensure consistency between data sets containing ELU information and PLU information, a core model was first designed.
The core model for Land Use corresponds to a Land Use dataset that covers an area and provides a partition of that area with polygons (vector mode) or pixels (raster mode) that are mutually exclusive and collectively exhaustive, i.e. they cover the whole area. The area covered by a Land Use dataset may differ from the area managed by an authority for multiple reasons, including the data capture method (e.g. from imagery) or the legal context. The core model also corresponds to a Land Use dataset that provides Land use information attached to a discrete set of locations. These polygons and locations are named CoreLandUseObject in the UML model. Each of them is described by a dominant land use category. The covered area can be irregularly shaped and multipart.
The core model enables the assignment of a land use category from the Hierarchical INSPIRE Land Use Classification System (HILUCS) to each polygon or location.

HILUCS will evolve gradually in a consistent way. The responsible body guiding this evolution is yet to be defined. The objective is to move towards a stable classification system at the European level. In order to ensure a minimum level of interoperability, it is mandatory to use the first level of HILUCS.
The core model also enables the assignment of a land use category from at least one classification system that is stable and well-defined, either at an international (such as SEEA from the UN, LUCAS from Eurostat), national or local level. Mapping such a specific land use classification system with HILUCS will improve interoperability.
The ELU model corresponds to a dataset that depicts the reality of the land surface at a certain point or period in time. Usage of a dataset depicting existing land use may require providing information on the same piece of land at different time. The model does not implement this requirement. It means that the existing land use on the same area at two different times will be provided as two different datasets.
The ELU model enables the provision of information on other land uses, besides the dominant land use, inside one land use object. Doing so will not indicate the location of these other land uses, but it will enable the provision of percentages. The opportunity to provide land uses other than the dominant one, alongside their respective percentages enables calculations of the surface of each land use inside one area.
The PLU model matches a dataset that corresponds to a spatial planning document. Only the spatial planning documents that contain geographical information are taken into consideration in the Land Use data model. Only the spatial planning documents, that are legally adopted by an authority and thus opposable to third parties, are considered within INSPIRE.
The concept of zoning is part of PLU in many countries. The zoning is composed of polygons that are mutually exclusive and collectively exhaustive. Zoning provides regulations for the evolution of Land Use. Zoning elements allow for the expression of land use that is planned by the administrative authority. It has several specific attributes such as the nature of the regulation, indications about dimension rules that apply to the use of the land and reference to the applicable regulation.
Supplementary information is often present in spatial planning documents in order to delimit locations where a specific regulation applies and to supplements the regulations of the zoning. These supplementary regulations may be seen as a buffer around an object in the real world. A point or a line can also bear the regulation. This supplementary information is implemented in the model.
A specific nomenclature indicates the types of supplementary regulations that may exist in the spatial plan. It is country-dependant as it directly links to legal articles. The model enables the documentation of the fact that a supplementary regulation

exists at a certain location and allows for connection to a description about how it affects the land use via a country-dependant mechanism. There is no agreed European code list for supplementary regulations. Nonetheless, the LU data specification proposes a first level for a future harmonised European code list for supplementary regulations.
Planned land use datasets are specific as they correspond to legal documents containing the regulations. The model implements the requirement to include the regulation inside the dataset or via a link to the digital facsimile.
The scanned version of any maps included in spatial planning documents may also be associated with the spatial plan.
The hierarchical nature of HILUCS has been devised on two dimensions: the land perspective, and the economic perspective. The objective is to provide a list of generic classes that every country could implement in their Land Use datasets at costs that are as marginal as possible, enabling a basic level of semantic interoperability between datasets from all countries. Level 1 can be extended to more levels, but only the level 1 is mandatory.
Comparable data on top of harmonised specification elements create additional value for achieving interoperability in INSPIRE. For this finality the data specification on Land Use includes recommendations on reporting data quality parameters.
Regardless of whether or not these recommendations on data quality are met, the actual values of data quality elements should be published as metadata. These elements usually have to be published at the dataset level.
For visualisation purposes, simple rules for default portrayal are given by specifying the colour attached to each class of HILUCS at level 1.

7.6. Conclusion

The TWG-LU largely benefited from the existence of the Plan4all Consortium , its members and their achievements. The overlap of the respective timetables or May 2009 – October 2011 for Plan4all and June 2010 – April 2012 for TWG-LU, was appropriate for the involvement of spatial planners in the land use data specification development. It is worth mentioning that the number of spatial planners being aware of the LU data specification requirements needs to increase beyond the Plan4all partners. The INSPIRE implementing rules will be adopted late 2012 regarding the annex III themes, thus including spatial plans. Almost any local governments will have to conform to them by the end of 2014 for any new spatial plans in digital form and by the end of 2019 for any existing datasets. Because the number of local governments in Europe exceeds 100,000 entities, raising awareness, identifying and promoting best practices and ensuring networking between local governments are challenging.

REFERENCES

EC, 2007, “Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)“ *Official Journal of the European Communities* L108 25 April (European Commission, Brussels)
http://eur-ex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF (accessed 09.08.2011)

INSPIRE DT “Data Specification”, 2010 D2.5 *Generic Conceptual Model* v3.3 http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.5_v3_3.pdf (accessed 03.09.2011)

INSPIRE DT “Data Specification”, 2008 D2.6 *Methodology for the development of data specifications*
http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf (accessed 03.09.2011)

INSPIRE D2.8.III.4_v2.0, 2011 *Data Specification on Land Use – Draft Guidelines* http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_LU_v2.0.pdf (accessed 03.09.2011)

INSPIRE TWG, 2010 *Data Specifications. Thematic Working Groups for Annex II & III*
http://inspire.ec.europa.eu/index.cfm/pageid/2/list/30 (accessed 03.09.2011)

Plan4all D2.3, 2009 *INSPIRE Requirements Analysis*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 03.09.2011)

Plan4all D2.4, 2009 *User Analysis Report*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 03.09.2011)

Plan4all D3.1, 2010 *Analysis of National Requirements on Spatial Planning Metadata*
http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 03.09.2011)

Plan4all D3.2.2, 2010 *Plan4all Metadata Profile - Final version* http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 03.09.2011)

Plan4all D4.1, 2010 *Analysis of Conceptual Data Models for Selected Schemes Used in Single Countries* http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 03.09.2011)

Plan4all D4.2, 2010 *Conceptual Data Models for Selected Themes* http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article (accessed 03.09.2011)

Chapter 8

The role of SDI Networking Architectures for Spatial Planning

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Asplan Viak Internet as

8.1. Introduction

Spatial and societal planning are disciplines that require access to all available data on the past and present of a jurisdiction, in order to shape and propose solutions for its future development.
Traditionally, gaining access to data has involved identifying and approaching all stakeholders with a vested interest in the planning area, including but not limited to land tenure, infrastructure provision, industry, commerce, residences, transportation, economy and demography, in order to understand opportunities and constraints.
The process has largely been manual, whereby phone calls are made; meetings are held; letters are exchanged; terms are agreed; and finally, data are made available, though often only for the area under the jurisdiction of the plan and not uncommonly subject to costs.
In short, the process is comprehensive, time-consuming and requires extensive manual after-work. Such work consumes precious planning resources that would be better used analysing data, developing planning alternatives and proposing actions and policies in support of the overall goals of the plan.
This chapter discusses the current and future role of Spatial Data Infrastructures in data management and dissemination processes related to spatial planning.

8.2. Actors, policies, processes and data

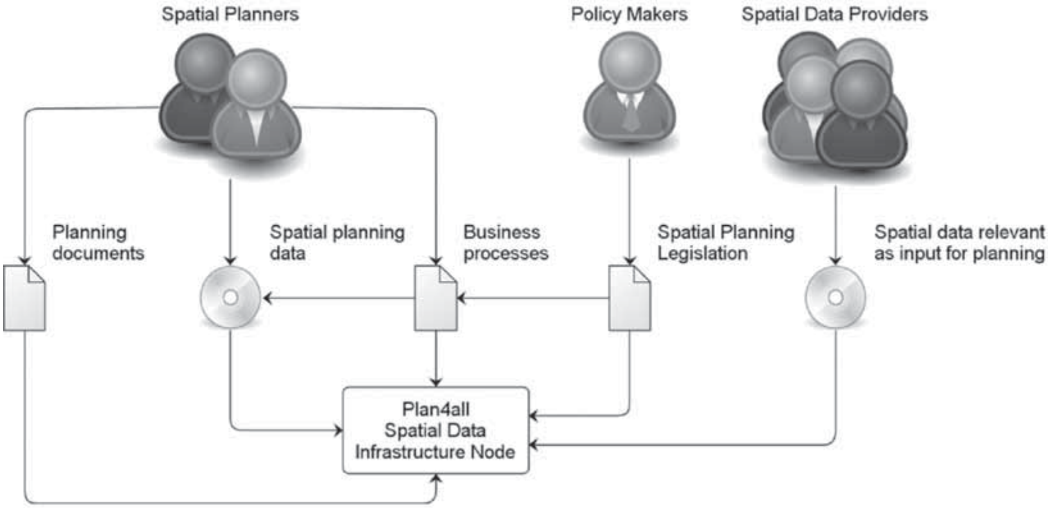

Figure 8.1: The business of spatial planning is not only a question of maps – spatial planning is about legislation, processes, data, documents and all available information about of a planning area, making spatial planning not only a provider but also a consumer of spatial data.

The INSPIRE Directive approaches the disciplines of planning from a GIS centric perspective. However, in order to understand the role that spatial data infrastructures and their standardised networking services may play in the future, it is first necessary to understand the role of GIS in planning. Four key observations are important to contextualise SDIs within spatial planning as illustrated in figure 8.1 above.

The first observation that must be made is that in data terms, a plan does not equal a map. All plans have a textual document, many of which have an associated map. Looking at planning data from the perspective of GIS alone will therefore often not provide sufficient contextual information to interpret and understand the information being presented.

Secondly, more than being a provider of spatial data, spatial planning is a discipline that consumes spatial data originating from all over the public sector. This means that we must look at the capacity of SDIs to provide access to data that may be used as an input to planning processes.

Thirdly, spatial planning is a discipline carried out on a local level and by a multitude of public and private sector actors. There are no international standards for land-use planning and even within single national or local legislations, there is great va-

riance in the way guidelines are interpreted and put into action. We must therefore be able to handle the heterogeneity of policies, processes, skills, data and tools present across European spatial planning authorities.
Fourth and finally, spatial planners are not GIS professionals. While INSPIRE Annex I themes are generally produced and maintained by domain professionals residing in national mapping agencies or authorities with strong GIS skills, many planners are relating to the data only after these have been visualised in maps. For this reason, thirty years into the GIS era, many planning processes are only supported by GIS through the constraining and limited medium of printed maps.

8.3. Services required for planning

Having understood the specific conditions prevalent in spatial planning, the next step is to look at how an SDI might serve to support spatial planning and make the existing business process more efficient; and how, in the longer term, SDIs may contribute to transform the way spatial plans are developed.
In order to explore this topic we must consider three aspects: The current set of INSPIRE services; additional web services required to satisfy the requirements of the professional domain of spatial planning; and emerging and future services that may support the transformation of current business processes and practices.

8.3.1. The present set of INSPIRE services

At the heart of the INSPIRE networking services infrastructure (Network Services Drafting Team, 2007) lies the Open Geospatial Consortium family of web mapping standards. The services are named according to their principal function in the infrastructure as shown in figure 8.2 and are described briefly below.

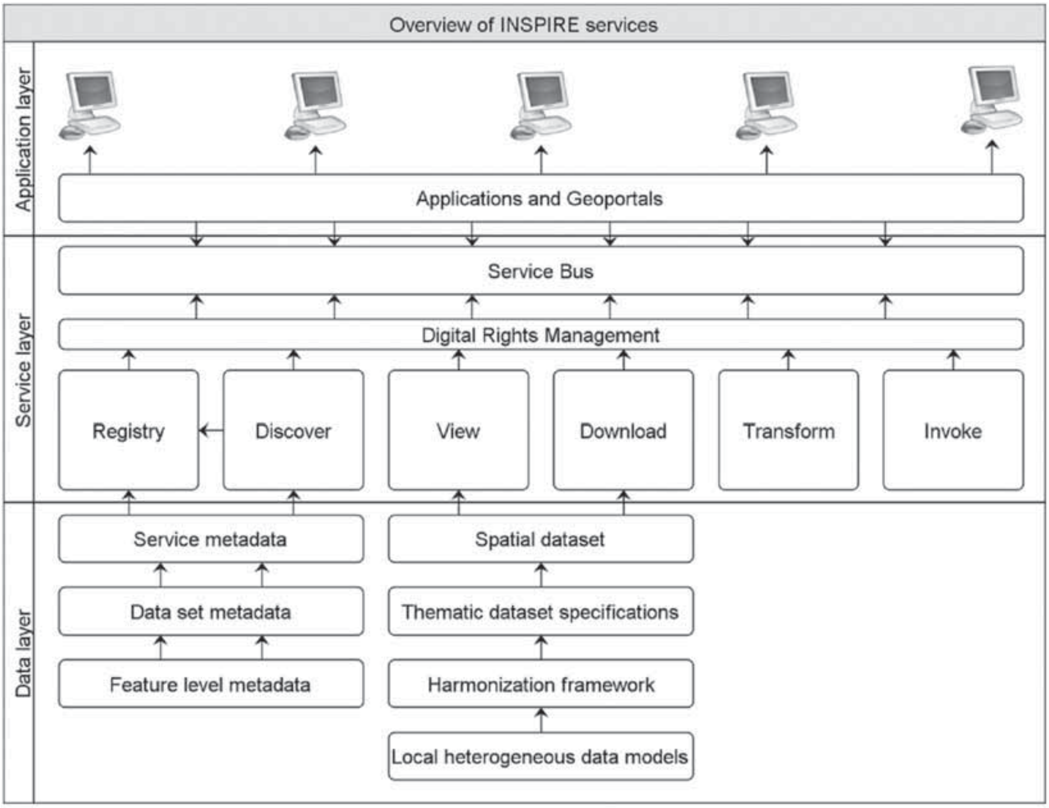

Figure 8.2: The core INSPIRE networking service architecture defines seven types of services which (may) be present in an INSPIRE compliant spatial data infrastructure: a registry/discovery service; a view service; a download service; a transform service; and an invoke service.

Discovery services

Discovery services enable users to identify what spatial data are available through free-text, attribute-specific and spatial searches towards standardised metadata. Discovery services conform to the OGC Web Catalog Service (CS-W) standard (OpenGIS, 2007), a protocol that describes request and response formats for querying, downloading and updating metadata catalogues over the Internet, enabling both publishing and subsequent harvesting of metadata between catalogues.
Discovery services will typically be implemented by data providers only as publishing services. SDIs will implement discovery services as both harvesting and publishing services, enabling harvesting of metadata originating from multiple sources and subsequent cross-searches. The latter is the case for the INSPIRE registry,

which is the top-level SDI for accessing information about available spatial datasets on national and regional levels throughout Europe.
Well managed discovery services are essential to identify which data are available and play a key role towards ensuring that the spatial planning process is aware of, and has access to, all available data for the concerned area.

Digital rights management (DRM)

DRM is a collective term for mechanisms used to protect copyrighted digital content such as spatial data. Due to the complexity of managing the diversity of digital rights associated with spatial data, as defined by EU, national and regional legislation and practice, INSPIRE has omitted to specify a protocol or standard by which DRM for spatial data may be handled in a consistent manner (Janssen & Dumortier, 2007). The rights management practices for spatial planning data varies from no licensing via public domain to costly commercial licenses. Whatever the license, in no circumstances is it permissible to modify spatial planning data as they are considered legal documents in most jurisdictions.
Spatial planning data are included under the INSPIRE Annex III themes and will, at least for public use, be made available in accordance with the regulations of the directive. Any licensing and or restrictions to follow the data will have to be embedded in the accompanying metadata.

View services

While the INSPIRE metadata are harvested from source metadata catalogue services into centralised repositories to facilitate cross-searches, the services providing access to the actual data are decentralised.
The most fundamental of these services are the View services, which allow users to access digital cartographic visualisations of individual spatial data layers or ready-made maps. View services conform to the OGC Web Map Server (WMS) protocol (OpenGIS, 2006). Through this standard it is possible to compose maps based on source data residing on different servers across the Internet.
Situations in which a View service may be useful include creating a map mosaic based on identical data from different data providers (e.g. a seamless map of land-use for a portion of Europe), or creating a map showing all the data available for a certain area (e.g. identifying all relevant data available from any data providers for a specific planning area).
While WMS is a simple protocol, View services fit well into the traditional business process of spatial planning, whereby domain experts in the field of spatial planning

are analysing and correlating information about their planning area based on paper maps and visual analysis. View services will not remove the need for studying and interpreting the maps on screen. Instead they will greatly improve the process of obtaining and combining data from a multitude of sources and speed up the overall planning process. Where a planner would previously have had to relate to many different data providers, write letters requesting data, collect and harmonise data before combining them using a GIS tool, all of these steps are now made redundant by the capabilities of the View services.
In addition, WMS is a pragmatic first-level integration that allows for sharing and use of digital map images in joint geographic space.
The prime limitation of WMS is that the underlying data structure is not exposed in a manner that makes it possible query the dataset as a whole; it is only possible to query individual points in the map.
It is also important to note that GIS is still a discipline that is not exploited to its full extent and that the current prime function of GIS in supporting the spatial planning process is still the production of paper maps. WMS also has a limitation on the size of images that may be generated (pixel size) in order to limit the load on web servers. This imposes a limitation on the size of paper maps that may be printed using WMS data sources as the underlying data for maps. Desktop GIS software is however implementing automatic tiling solutions that seek to circumvent this limitation and View services alone offer a significant contribution to the spatial planning process.

Download services

Download services bridge the gap left by View services in that they provide the end-user with access to the underlying data. This is necessary when you want to do analysis working against datasets and not merely “click around” in the map to see what is there.
Download services conform to the OGC Web Feature Server (WFS) protocol (OpenGIS, 2005) and enable the same set of features as WMS. However, instead of transferring digital map images, the data returned to the client is Geography Mark-up Language (GML) vector data embedded in a WFS XML envelope.
The transfer of vector data to the client enables a user to perform any operations on the dataset as if it was a spatial dataset residing on their own computers. However, Download services introduce a number of challenges compared to View services:

- The transfer time increases greatly as high-precision vector data encoded in GML produces large XML-files

• The data must be rendered on the Client which means that a GIS application is preferable to a simple web application that is likely to result in poor performance
• If combining a number of decentralised data sources into a mosaic that may be queried, the underlying data models must be harmonised.

The above limitations aside, Download services bring a lot of useful features into the hands of planners in the digital era. Using OGC filter encoding expressions, it is, for example, possible to execute sophisticated spatial queries to a remote WFS server, in effect enabling users to “lend” processing power from the “Cloud”.
Also, with vector data available on the Client, map sizes are no longer restricted by pixel size concerns and it is possible to execute any attribute or spatial queries across different datasets.

Transformation services

A service that is primarily transparently accessed through WMS or WFS services is the Transformation service. While transparent to the user this is probably the greatest “revolution” in the way networking service infrastructures facilitate the combination of information from different sources.
GIS professionals or spatial planners who have been executing cross-border or inter-regional projects involving different spatial reference systems (SRS), often find that metadata do not express information that is considered implicit, and so it is a lot of manual work (and in some cases guess-work) to identify the relevant source SRS of the concerned data.
Transform services enable transformation-on-the-fly between different coordinate systems (Cadcorp Ltd., 2001) so that one WMS service is capable of offering data in multiple coordinate systems. The user determines which target system data should be returned by specifying an SRS code, which corresponds to a set of transformation parameters originally defined by the European Petroleum Survey Group (EPSG), now evolved under a set of different regimes.
A dataset originally stored in WGS84 geographical coordinates (epsg:4326) may be rendered on the Client according to the ID ETRS LAEA (epsg:3035) parameters or as UTM Zone 32N (epsg:32632).
The server configuration determines which projections will be available for the user to choose from and INSPIRE dictates those that are mandatory.

Processing services

INSPIRE Processing services may be considered to be a placeholder for potential future services that expose sophisticated processing capabilities to remote users via the OGC Web Processing Service protocol (WPS) (OpenGIS, 2007).
WPS is currently only specified as a wrapper format around server side functionality and there are no defined formal semantics that standardise the instructions accepted by a service.
It is possible that complex analysis capabilities, which are currently not available through WFS filter encoding queries, may in the future be implemented as Processing services. Types of spatial processing functionality and services which could be made available as processing services could for an example be network problem resolvers such as shortest distance, travelling salesman and many others.
Another potentially important service that might be implemented as a WPS service would be a format translation service, allowing download of INSPIRE datasets in formats other than GML, with CAD drawings being the most important target format. As described in section *"Spatial data repositories and upload services"* below, CAD environments constitute the most important production platform for spatial planning data.

8.3.2. Additional services required

As mentioned in chapter 2 above, the fundamental observation which must be made when studying the potential role of INSPIRE networking services in the professional domain of spatial planning is that planning is more than maps and spatial data.
While arguably most plans have a spatial component that is expressed through maps, the meaning of the maps or data may not be accurately appreciated unless it is given in the context of the plan itself, usually via a text document.
This section discusses services capable of closing the gaps left by the INSPIRE services in order to cover the information flow requirements when accessing and using spatial planning data through SDIs and INSPIRE networking services. The extended features of a Plan4all SDI node compared to a baseline INSPIRE compliant SDI node is shown in figure 8.3 above.
It is important to be aware that the services discussed are not requirements for using data accessed through INSPIRE services as input to the planning process. They are only required when publishing spatial planning data for unambiguous interpretation and re-use.

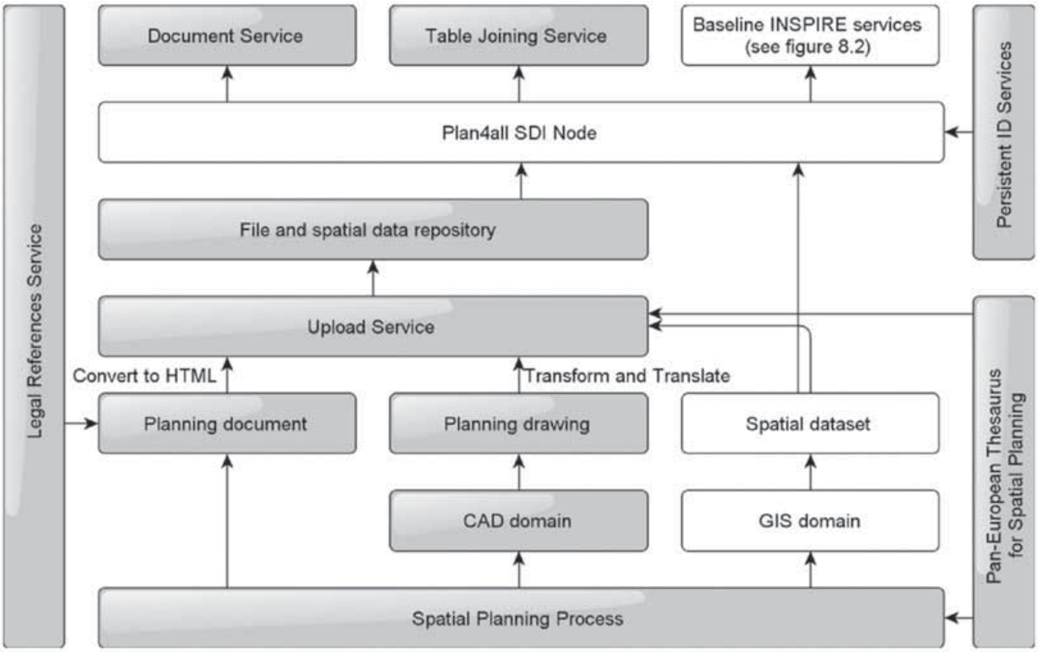

Figure 8.3: The INSPIRE networking service infrastructure is designed from a GIS centric perspective and does not meet the all the requirements of a functional Spatial Data Infrastructure for spatial planning. Grey boxes show additional elements to be considered in the Plan4all infrastructure whereas white boxes show, simplified, the core INSPIRE architecture.

Document service

In order to understand the meaning of spatial planning data the user may study the associated INSPIRE metadata. However, metadata are typically centred on the spatial characteristics of the data and omit details specific to the formal, legal meaning of the data.

A spatial plan commonly defines a set of polygon, line and point features, which are assigned a land-use category gathered from the legislation governing spatial planning in the planning area. This land-use category often has an high-level description which defines the land-use restrictions on an abstract level with additional details and regulations specific to the current planning area described by the planning document.

The dataset level metadata of the spatial plan should therefore include a reference to the planning document in the form of a Uniform Resource Identifier (URI). By en-

tering this URI into the address line in a web browser, the document must be shown in human readable form to the user. No specialised protocol beyond the regular Hyper Text Transfer Protocol (HTTP) is envisaged to be needed for this purpose.
If the planning document would be formatted according to the DocBook standard (Walsh, 2011), it would not only be possible to reference the document as a whole but also to reference individual sections and paragraphs inside the document. This feature would be particularly useful to link individual polygon, line or point features in the spatial planning data to their corresponding descriptions in the textual document.
This is however likely to be a very time-consuming and complex process and not likely to be a practice which will materialise across European planning authorities any time soon. The short-term pragmatic solution would therefore be to make the planning document available as free-form Hyper Text Mark-up Language (HTML) or Portable Document Format (PDF) documents.

Legal references service

The legal frameworks governing spatial planning vary from country to country, from region to region and, in some countries, even between local municipalities. The same combination of words, e.g. the land-use category “residential area”, may have different meanings in different legislations and in order to understand the meaning of the data, it is necessary that the metadata provides a link to the relevant law or regulation by which the plan is mandated. As for the documents, the legal reference should be provided as an URI.
In some countries, Public Sector Information (PSI) directories that publish all laws with persistent identifiers have been put into place and may be linked from INSPIRE spatial planning metadata. In areas where this is not possible, the legal reference must be made available by the planning authority. The latter practice is potentially problematic as it leads to duplication of documents that should be considered authoritative data. This which may be the cause of inconsistencies if a law is changed and different versions flourish across the Internet.

Spatial data repositories and upload services

The INSPIRE infrastructure is specified for authorities that have strong technical skills and resources capable of implementing and running comprehensive spatial data infrastructures (SDIs), consisting of streamlined business processes for GIS data creation and maintenance, web servers, application servers and database servers.

The bulk of European spatial planning authorities do not fit this description. For this reason, it is necessary to devise a strategy that will enable these data providers to also publish their data without putting too great a strain on their human and financial resources.
The typical scenario in the smaller European spatial planning authorities is a very limited number of resources; they are predominantly planning professionals who use CAD as their data creation environment and data are maintained as drawings rather than GIS data. Unless the infrastructure observes this characteristic, it is likely to exclude a significant number of spatial planning data providers.
A model emerging all over Europe is that of regional IT co-operations, where a province takes responsibility for hosting joint IT-systems for a set of underlying municipalities, or where one larger municipality services a set of smaller surrounding municipalities. The introduction of remotely managed spatial data repositories would be consistent with the development observed above and would allow small institutions with limited resources to publish their data without investing in the establishment of their own SDI.
A managed repository would allow users to upload and manage spatial data files to a server, edit corresponding metadata and publish the metadata and spatial data through Discovery, View and Download services. No protocols or standards currently exist for Upload services, but big commercial actors such as ESRI and Google are developing spatial data hosting services which are likely to become benchmarks for the future standardisation of this type of service.

Pan-European thesaurus for spatial planning

Having successfully equipped the spatial planning data with the necessary metadata for its unambiguous interpretation as well as uploaded the data to a spatial data repository, one challenge still remains; Using the data in combination with data from other sources.
Because of the different understandings of land-use categories defined by the respective legislations, if a user wishes to combine land-use data from three different data providers in a cross-border scenario it will be difficult to classify the data in such a way as to give meaning.
It will be difficult, but ultimately rewarding, to establish a pan-European thesaurus for spatial planning which will allow the generalisation of content values from different data sources to a least-common denominator. For example, for visualisation purposes, this would enable consistent cartographic representation of similar spatial planning features.
At present, no thesaurus exists and it is left to the discretion of the user to correlate the different terminologies used in classifying the spatial data.

8.3.3. Future services

Plan4all has not yet experimented with Table Joining or Linked Data services, but they may potentially have an impact on the way SDIs contribute to the spatial planning process and are therefore discussed below.

Table Joining Service

A new OGC standard, Table Joining Service (TJS) (OpenGIS, 2010) allows the real-time joining of tabular data to spatial datasets. As input to spatial planning processes, statistics (predominantly tabular data) are equally important as spatial datasets. TJS allows statistical data to be linked to spatial datasets if a common key exists in both the source and target tables. This will typically be the case in regional planning when linking e.g. demographical data to municipalities or census tracts.

Persistent ID services and Linked Data

While not a problem that is specific to the domain of spatial planning, it is appropriate to mention the importance of Linked Data as the underlying substance of the Semantic Web, a digital eco-system that SDIs and INSPIRE networking services form a part of.
The value of INSPIRE datasets increase substantially if a feature has a persistently managed ID that may be referenced or linked to by external parties. Currently, the INSPIRE IDs are structured, created and managed by individual data providers in a variety of ways and persistence is guaranteed neither by process nor standard.
This means that between two versions of a dataset, a user may not rely on the IDs remaining persistent; hence, object referencing between two INSPIRE datasets, or between INSPIRE datasets and external data through (for example) TJS services, may lead to orphaned records as IDs change either at the source or target tables.

8.4. Business processes

The role and impact of SDIs on spatial planning is not only determined by the possibilities posed by the technology. More important is the willingness of planners to adapt their business processes in such a manner as to efficiently exploit the technology.
While this chapter has so far centred on how INSPIRE technology requirements support spatial planning, this section discusses how spatial planners have to evolve their processes to exploit the potential of the technology. An example of a simplified

planning process including interfaces towards the Plan4all and INSPIRE SDI infrastructure is shown in figure 8.4 above.

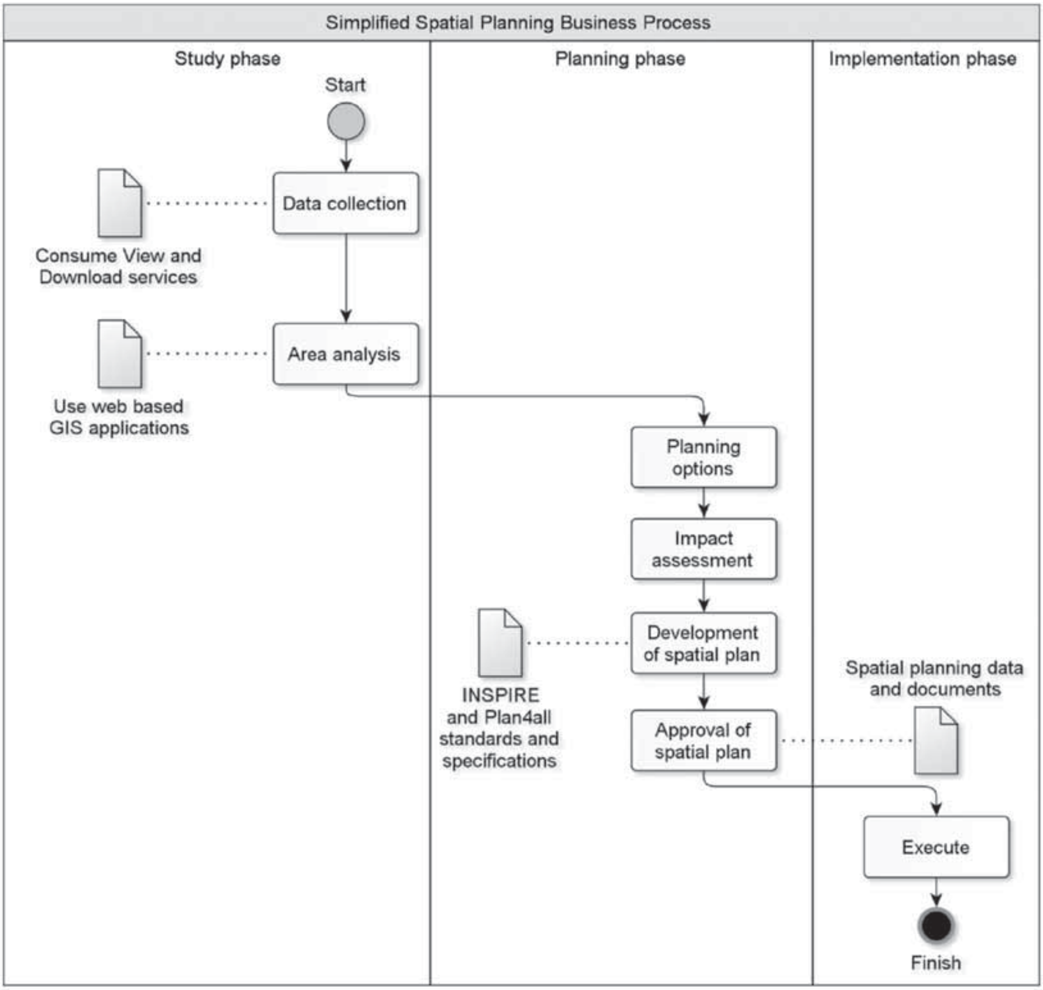

Figure 8.4: In order to benefit from a pan-European SDI for planning data technology alone is not sufficient, the "business" of spatial planning must also evolve to utilize the possibilities offered by the technology throughout the planning process as shown in a simplified manner above

8.4.1. The business of spatial planning

Spatial planning has been around for hundreds of years, while the World Wide Web is a relatively fresh arrival that has yet to celebrate its 20th birthday. As a consequence, the predominant practices within spatial planning have evolved out of a non-technological environment.

Spatial planners are concerned about spatial features such as residential, commercial, mixed use and industrial areas; about traffic, transportation, and utilities infrastructure; about community facilities; and about all information that impacts the distribution and suitability of the aforementioned areas. The only way to get an overview of and correlate this type of information is through maps. Due to the long traditions of spatial planning, this very often means paper maps.

Spatial planners like to draw and conceptualise on maps and, as many are not oriented towards abstract concepts of GIS, express their professional capabilities much more effectively using pen on paper than they would working directly in a digital environment.

While, from a GIS perspective, information resulting from the spatial planning process is considered data, the spatial planner will often consider the same information as sketches or drawings. As a result, the often rich by-products of the planning process will not be shareable because they do not conform to any standards interpretable by third parties.

The logical next step for a spatial planner who is used to drawing on a paper map is to shift into a CAD environment, which effectively replicates the drawing board in a software environment. In CAD scale, micro-accuracy is of great significance, whereas spatial location and orientation is often not observed. The output is also self-contained drawings that print well, but often do not conform to any form of standard, making it impossible to transform the drawing into data that is shareable and reusable in a GIS environment.

8.4.2. Acquiring data

The most promising feature offered to spatial planners by SDIs is the ability to quickly identify all available spatial data for a planning area. As opposed to the business process changes required to create spatial data, the changes required to efficiently use spatial data as input to the planning process are considerably less.

The prime enabler for efficient data retrieval is the data format translation service, discussed in section “*Processing services*” above, as well as increased awareness of discovery services among spatial planners and other domain professionals at the fringe of the GIS community.

It is also to be noted that whereas GIS used to be an expert discipline reserved for domain professionals, the art of digital map making, combining information from a multitude of sources and browsing it on the computer screen is now at the fingertips of any contemporary computer user. This may facilitate a behavioural change whereby less of the map information will have to be printed and more may be accessed directly online from decentralised View and Download services.

8.4.3. Online publishing and maintenance of spatial planning data

The first impediment to publishing spatial data on the Internet is the fact that in most planning laws, the paper map, including its map scale, cartography and underlying base map, is what is adopted as the legal spatial plan. This means that publishing the spatial plan as data will not constitute legal data. It may not be desirable from the perspective of the planning authority because it may cause dissent due to the use of the data at larger scales and with different cartography, which may render boundaries extended or contracted compared to the legal plan.

The second impediment is that introducing static pre-defined data models, controlled vocabularies and GIS software into the equation of spatial planning is a major paradigm shift for the traditional planner.

It is also a shift that may consume a disproportionate share of the spatial planner's professional resource in resolving technical obstacles and which may curb her or his ability to produce high quality professional work. It must therefore be assumed that the transition from drawings to data will take a significant amount of time.

Such a transition is, however, necessary if we want to effectively enable not only the use of spatial data as input to planning processes, but also to get spatial data as output from the planning processes.

The big software actors in the CAD domain, such as Autodesk, are currently enabling more comprehensive data intelligence to be embedded into drawings. In doing so, they are gradually bringing the universes of CAD and GIS closer together, therefore facilitating the INSPIRE Directive objectives of enabling the efficient use of spatial data across professional disciplines.

A key enabler to achieve this end is the upload service briefly discussed in section "*Spatial data repositories and upload services*" above.

8.5. Conclusions

SDI Networking architectures have great potential to improve the quality of spatial planning, enabling quick overviews of, and access to, all spatial data available for a certain planning area, thus ensuring quality input to the spatial planning process. However, it is necessary to understand that spatial planning is not only maps and spatial data, but is also planning documents and planning laws, which need to be available in order to unambiguously interpret the planning data.

Furthermore, a bridge between the mapping and digital cartography environments of CAD and GIS is needed in order to support the flow of information between homogeneously GIS oriented SDI infrastructures and highly the heterogeneous mixes of CAD and GIS that are being used in spatial planning authorities across Europe. In addition to the possibilities offered by the technology, behavioural change is required among spatial planners in order to effectively exploit the possibilities of the SDI Networking architectures in their day-to-day operations.

REFERENCES

Cadcorp Ltd., 2001 *Coordinate Transformation Services* (1.00 ed.), (M. Daly, Ed.) Open Geospatial Consortium Inc.

Janssen K, Dumortier J, 2007 "Legal framework for a European union spatial data infrastructure: uncrossing the wires" in H Onsrud (Ed.) *Research and Theory in Advancing Spatial Data Infrastructure Concepts.*

Network Services Drafting Team, 2007 *INSPIRE Network Services Architecture* INSPIRE - Infrastructure for Spatial Information in Europe.

OpenGIS, 2005 *Web Feature Service Implementation Specification* (1.1.0 ed.) (P. A. Vretanos, Ed.) Open Geospatial Consortium Inc.

OpenGIS, 2006 *Web Map Server Implementation Specification* (1.3.0 ed.). (J. d. Beaujardiere, Ed.) Open Geospatial Consortium Inc.

OpenGIS, 2007 *Catalogue Services Specification* (2.0.2 ed.) (D. Nebert, A. Whiteside, & P. Vretanos, Eds.) Open Geospatial Consortium Inc.

OpenGIS, 2007 *Web Processing Service* (1.0.0 ed.) (P. Schut, Ed.) Open Geospatial Consortium Inc.

OpenGIS 2010 *Georeferenced Table Joining Service* (TJS) (1.0.0 ed.) (P. Schut, Ed.) Open Geospatial Consortium Inc.

Walsh N, 2011 *DocBook 5: The Definitive Guide*. (R. Hamilton, Ed.) (O'Reilly).

Chapter 9

Plan4all pilots on data harmonisation and interoperability

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9.1. Spatial planning data challenges

European countries have various spatial planning systems with different legislation, administrative structures, hierarchic planning systems and different methodologies for the spatial planning process as well as diverse spatial planning data structures. Moreover, many countries have no standards or rules for spatial planning data. These facts lead to a situation where the spatial planning data from different cities or regions are not comparable on either national or European levels.

Nevertheless, things have moved forward during recent years. Thanks to the building of Spatial Data Infrastructures (SDI) and the progressive implementation of national and international standards and/or common rules for data in European countries, there are many more possibilities for data publication, sharing and exploitation, though limits still exist. On the one hand, a lack of SDI products or an incompatibility between planning instruments and SDI structure can be found; for example in Bulgaria or Latvia, where SDI is not available on a regional level; or in France, where SDI exists on the regional level, but still does not correspond to planning instruments. On the other hand, some municipalities across Europe that are managing land use and zoning plans can be overstrained by duties to use SDI and publish these plans. The availability of this data on the internet is a logical requirement for current times, but unfortunately there is still a lack of common awareness regarding common rules and data standards (such as INSPIRE, OGC, etc.) among end users, data providers and the public bodies responsible for spatial planning data. The questions are how to overcome all of these problems; how to get relevant and comparable data from different areas and sources; and how to offer better services for spatial planning data stakeholders and end-users. Answers to these questions are not as simple as they may appear, and the practical realization will be much more difficult than theoretical replies. Nevertheless, the way forwards should include the definition of a common framework for data rules and standards, the development of interoperable systems and the preparation of harmonised data sets or transformation services.

9.2. Interoperability & data harmonisation

What do the terms „Interoperability“ and „Data Harmonisation“ mean? There are lot of definitions available on the Internet, but the INSPIRE definition will be the most relevant and accepted in terms of relevance to the Spatial Planning data theme.
INSPIRE defines Interoperability as a “possibility for spatial data sets to be combined, and for services to interact, without repetitive manual intervention, in such a way that the result is coherent and the added value of the data sets and services is enhanced” [INSPIRE Directive: DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2007, Article 3, page L108/5].
Interoperability should provide access to spatial data sets through network services (e.g. Internet) and may be achieved by either harmonising and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure.
Data harmonisation, one from two Interoperability options, is specified as a “process providing access to spatial data through network services in a representation that allows for combining it with other harmonised data in a coherent way by using a common set of data product specifications. This includes agreements about coordinate reference systems, classification systems, application schemas, etc.” [JRC glossary: http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY/items/10]
A typical task of interoperability is the combining of spatial planning data and services from different sources across the European Community. Regarding spatial planning data, but also generally, we can distinguish horizontal interoperability from vertical interoperability.
By the term horizontal interoperability we understand the data interoperability processes at the same level of the hierarchic structure of spatial planning. These processes should reflect all types of used data models at the appropriate level. The goal is to get the same presentation of data from different sources and simultaneously keep the detail of both the graphical and textual information as high as possible.
By the term vertical harmonisation we understand the data interoperability processes operating through several levels of hierarchic structure or, in some cases, generating new levels with generalized data coming from the detailed data on the lower level.
In establishing interoperability rules, we therefore do not see the setting of the unified data format, the unified data model and the unified geoinformation technology for all producers of geospatial data. Local specifics should berespected, whereas the feature of information continuity across territorial units should ensure:

- Standardized legend of the monitored phenomena separately for the local

and regional level, and the legend of plan phenomena of all municipalities for the needs of Plan4all portal;
• Application processes and technical solutions for the transformation of data models in both horizontal and vertical directions.

9.3. How to make spatial planning data interoperable

As already mentioned, spatial planning data currently exist in very diverse forms and data structures throughout the European countries. The Plan4all project was a European project focussed on the interoperability and harmonisation of spatial planning data and metadata while observing basic INSPIRE principles. One of the main tasks of the Plan4all project was to achieve such a process of data interoperability that would allow the utilization of source data from individual countries in a form common to the all. There were three main stages specified within the Plan4all project for achieving interoperability of spatial planning data (see Figure 9.1):

1. Definition of appropriate conceptual models
2. Process of spatial planning data harmonisation
3. Publishing of harmonized data

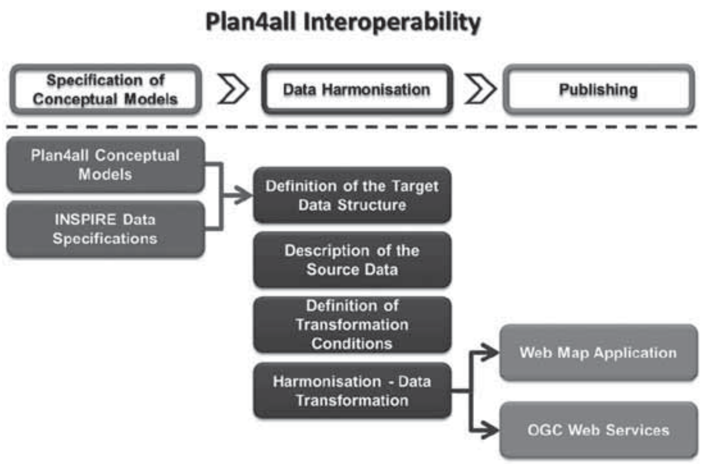


Figure 9.1: Plan4all interoperability scheme

The INSPIRE data specifications and the Plan4all conceptual models for relevant themes were corner stones of the whole harmonisation process (see Chapter 6). On the basis of these models, a final structure of harmonized data was formed as the first step of the data harmonisation process.
The second step represented a precise description of source data intended for har-

monisation. It allows for better understanding of data for the determination of transformation conditions. This description includes a layout of the data structure, characterization of individual object types and an overview or a list of codes. Sometimes spatial data are not in a GIS structure and must therefore be modified and transformed into an appropriate format.

The set up of transformation conditions is a key point of the harmonisation process. The conditions are formed by relations between source and target data that should be defined at the object, feature and attribute levels. For the representation of the relations, a transformation table or scheme are usually used. When the transformation conditions have been defined, the final step of the whole harmonisation process can be run. The whole transformation can be performed by means of transformation tools or directly with the help of SQL queries. Harmonized data, which are saved in the target structure, may be published in several ways. In the individual regions included in the Plan4all project, publishing of harmonized spatial planning data was tested through the regions' web map applications and also by providing data via OGC web services, WMS or WFS. In this phase of the project, the harmonized data are presented as map layers in a web client or in the form of web services.

9.3.1. Plan4all regions

The Plan4all project covered 15 European countries. The existing content for spatial planning exists in all of these countries and the project demonstrated possibilities for how this content could be standardised. The level of spatial data content is not equal in all countries; in some, the content is well developed but in others, there is still only content in development. From the 24 partners involved in the project, 17 data providers gave their spatial data for testing purposes, representing content from a range of countries and regions.

In the course of the project lifetime, the Plan4all team was invited to participate in the testing of the INSPIRE Annex II and III data specifications. Spatial planning is multidisciplinary and reflects many INSPIRE themes from various fields. Because it was not possible to cover all of them, the team chose main 3 themes for testing INSPIRE data specifications:

- Land Cover
- Land Use
- Natural Risk Zones

The involvement of partners in the testing of the INSPIRE themes is indicated in Figure 9.2

	CZ	LV	DE	LV	IT	MT	GR	ES	ES	IE	NO	IT	BG	RO	IT	CZ	FR
	Olomouc	TDF	LGV Hamburg	ZPR	PROVROMA	FTZ	GEORAMA	NASURSA	Gijon	MAC	AVINET	DIPSU	EPF	ADR Nord Vest	Lazio	HF	MEDDTL
LandCover					■	■		■	■			■		■	■		
LandUse	■	■	■	■	■	■	■		■	■	■	■	■	■		■	■
Natural Risk Zones	■											■		■			

Figure 9.2: Plan4all Data providers and covered INSPIRE schemes

Regarding spatial planning, LandUse is one from the most important INSPIRE themes. Most project partners are directly involved in urban or landscape planning, or they deal with planning data. Therefore they paid particular attention to the Land Use theme.

9.4. Pilot on land use

The pilot described below is only one example of Plan4all testing spectrum, but it should give a good idea to readers about Plan4all interoperability and data harmonisation processes. The pilot was elaborated for Land Use data from Sumperk and Olomouc cities in the Czech Republic and it served as an example to other project partners for understanding principles, methods and expected outputs of data harmonisation.

9.4.1. Data harmonisation

In the case of both Sumperk and Olomouc, the main input into the harmonisation process was local planning data that the municipalities had published on the web. The data was in SHP and raster formats, originated from DGN (graphic data) and DOC (textual data) file formats. Although the data were the same formats, the data structures (data models) as well as cartographical presentations of data were completely different and represented a perfect input for a data harmonisation example. Prior to defining the transformation model for data harmonisation, it was necessary to carry out a detailed description of the structure of the source data, including the definition of individual attributes and of the range of values. The target data structure (structure of harmonized data) was defined on the basis of the Plan4all Conceptual Model for Land Use. As mentioned above, within the Plan4all project, Plan4all conceptual models were tested as well as INSPIRE data specifications. However, the testing of INSPIRE data specifications was not finished at the time that this book is being prepared, so only the first test is described here. It was decided to use a Po-

stgreSQL/PostGIS database for Sumperk and Olomouc pilots.
The making of the transformation conditions proceeded in two sub-steps:

1. Firstly, the relations between source and target attributes were defined.
2. In the next step, relations between code lists of individual source and target data attributes were specified.

An example of the definition of relations between attributes in the transformation model for spatial planning data of the town of Sumperk is shown in Figure 9.3 (a part of transformation scheme):

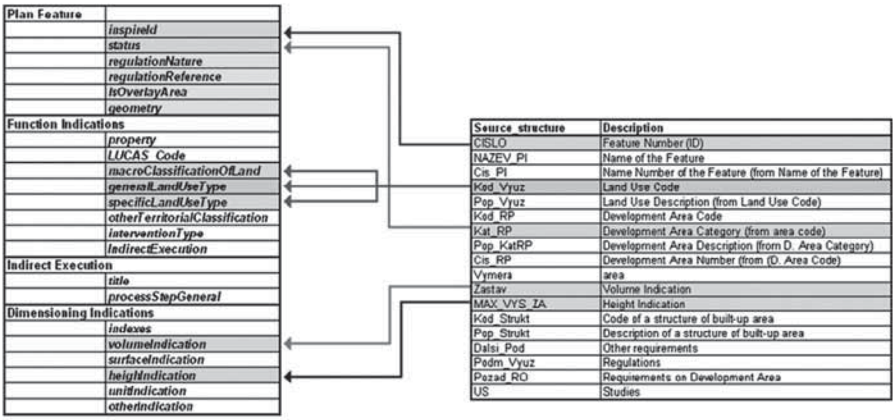


Figure 9.3: Examples of the definition of relations between attributes in the transformation model

The source data item (Kod_vyuz), refers to a source item, which is used for filling in the most important attribute of the GeneralLandUseType harmonized database. At the same time, in case a different transformation key is being used, this Kod_vyuz item is used for filling in other target attributes (MacroClassificationOfLand and SpecificLandUseType). Items referring to optional attributes were filled in on the basis of source data. Items in the target database refer to attributes that have mostly a metadata character – the value is the same for all the database records, but does not exist in source data. These items were all filled in at the same time.
The second sub-step of the definition of transformation conditions was to define relations between code lists of source and target data. The relations between individual items can be simple, but they are sometimes very complicated. Figure 9.4 outlines complications with the definition of relevant relations between the source and the target code lists.

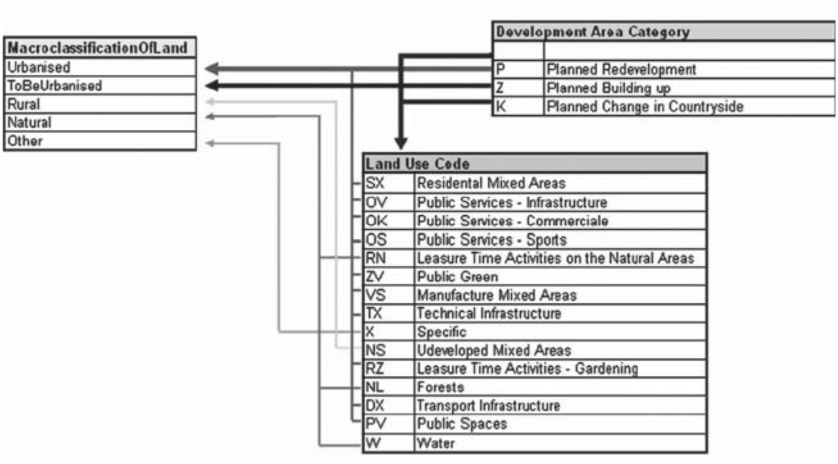


Figure 9.4 : An example of complex relations between items of source and target data

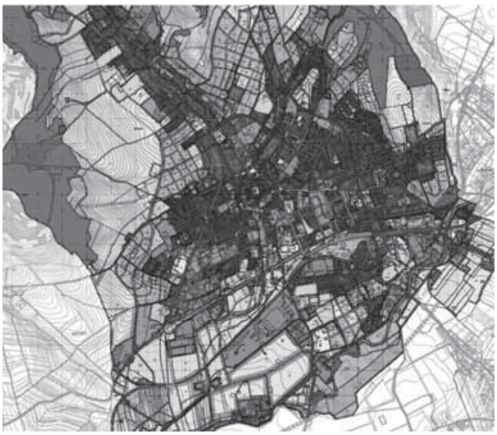
The attribute of the harmonized database is filled in with a value which is dependent on the values of attributes of the source database, either solely on the "Development Area Category" attribute in case it contains the value of P or Z, or also on the "Land Use" attribute if the value of "Development Area Category" is K or is not filled in. When the all transformation conditions were defined, the source data could finally be harmonized. It was possible to provide the transformation process using ArcGIS Model Builder, spatial data integrator Talend Studio, Humboldt harmonisation tools or PostGIS. Each project partner chose his own solution for data harmonisation; in the cases of Sumperk and Olomouc, the harmonisation process itself was carried out on the basis of SQL queries.

9.4.2. Data publishing

Harmonized data was published in a web map application and in the form of WMS and WFS web services. Help forest and Olomouc municipality, who are partners responsible for Sumperk and Olomouc pilots, use a system called GeoHosting. GeoHosting offers services that support the creation of a spatial data sharing system with the possibility of publishing data for any user that has access to the internet. The system is based on open formats and is open for interaction with other SDI platforms. The system is developed on the OpenSource platforms (MapServer, GeoServer) and allows data and metadata publishing, usage of existing data sets for data processing, integration of spatial data from different sources, data input to user-defined structures and more. Some components of the GeoHosting system were integrated into the general Plan4all portal.

For the Sumperk pilot, the harmonized data were published into layers of Plan Feature Status, General Land Use, Height Indications and Volume Indications using GeoHosting. For the Olomouc pilot, the layers used were Plan Feature Status, General Land Use, Specific Land Use and Indirect Executions. Figure 9.5 presents a comparison of the differences in source data from Sumperk and from Olomouc and also a comparison of their harmonized outputs. Thanks to data harmonisation, data that was originally different has an identical visual presentation style and may be easily compared and analysed.

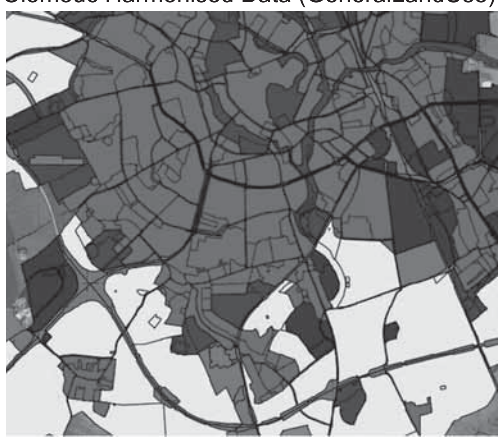
Sumperk source data



Olomouc source data

Sumperk Harmonised Data (GeneralLandUse)

Olomouc Harmonised Data (GeneralLandUse)



Sumperk Harmonised Data (FeatureStatus) Olomouc Harmonised Data (FeatureStatus)

Figure 9.5: A comparison of harmonized data from selected regions

Once published, data can be discovered easily through a metadata catalogue and can be displayed or added into various thematic or general maps. Figure 9.6 presents a Land Use thematic map composed strictly from web services WMS. There are currently WMS's of Sumperk Land Use, Olomouc Land Use and the referential WMS Topography layer. The services are grouped in a Geohosting project and stored on the Plan4all general portal. In Geohosting, it is possible to add any WMS or WFS layers or internal data (e.g. SHP). The whole project can be easily published in a web map application or in a new web service, which means that all included web services are grouped into one new service. All the functionality is available on the Plan4all portal (Figure 9.6).

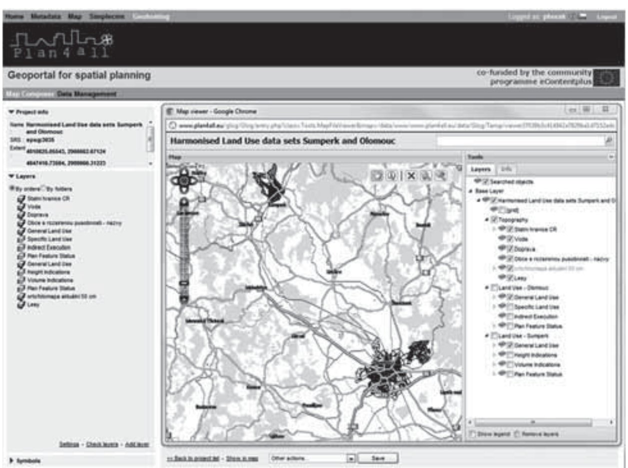


Figure 9.6: Integration of different web services on the Plan4all portal

9.4. Plan4all data harmonisation experience and reflection

The Plan4all project tried to implement INSPIRE principles in spatial planning practice, or at least, to demonstrate a potential method for implementation. Spatial information services allow users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an interoperable and interactive way for a variety of uses. Nevertheless, a range of such services is still limited and sometimes is totally missing. Improvement of this situation undoubtedly requires better data harmonisation and interoperability between spatial planning systems.

The present experiences with the spatial data harmonisation process within Plan4all testing may be summarized into several recommendations:

- To better understand source-target relations, a precise definition of the source data should be created and described. There does not exist any fixed standard for planning data in many countries and the definition should help to harmonise different data in the same way.
- Exact specification of code lists and enumerations with an explanation of terms is highly valued. The same values may imply different meanings to people from different countries and consequently, harmonised datasets may be technically correct, but are not correct in reality. This is not a problem of the data model, but a consequence of differences in spatial planning in European countries.
- Multiplicity of harmonised attributes is a problem. It is better to avoid this situation and to appropriately modify the data sources
- It is necessary to keep models, schemes and tables as simple as possible.
- The precise specification of metadata fields and their omission from the data helps to make the data structure clear.
- Defining the symbols and colours for harmonised data is necessary for correct presentation and publishing.

Chapter 10

Spatial planning and the INSPIRE Directive: the point of view of the Plan4all stakeholders

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EUROGI

10.1 Introduction

The Plan4all project aims to target real needs of professionals (both planners and ITC experts) dealing with the spatial planning. Accordingly, the activities carried out by the partners of the Plan4all Consortium have systematically been exposed to the wider community of the prospective users in various ways, including newsletters, articles in relevant journals, active attendance of scientific symposia and dedicated seminars in the context of the annual INSPIRE Conferences. Convening and managing a string of workshops has been instrumental in raising awareness about the issues targeted by the project and in collecting useful feedback about the Consortium approaches and results.

Such workshops, listed in Table 1, were convened at the country level, even though they often included the active participation of representatives from multiple countries. For example, Nordic countries were present at the workshop in Iceland and South-Eastern European countries attended the workshop in Slovenia. As a member of the Plan4all Consortium, EUROGI (the European umbrella organisation for geographic information) has been entrusted with the whole management of the workshops. The local members of EUROGI, who themselves are associations of geographical information professionals, have provided the necessary links with targeted communities of stakeholders in workshop locations. Moreover, ties were systematically extended to other INSPIRE-related initiatives, in particular to other eContentplus projects and Thematic Working Groups (activated around the most relevant issues such as land use).

MEETING	EUROGI LOCAL MEMBER	LOCATION	DATE	REF.
PLAN4ALL national workshop – Italy	AMFM GIS	Rome	6th October 2010	http://www.amfm.it/attivita/conferenza2010/2.php
PLAN4ALL national workshop – Ireland	IRLOGI	Dublin	14th October 2010	http://www.irlogi.ie/GISIreland2010_Agenda.pdf
PLAN4ALL national workshop – Austria	AGEO	Vienna	23rd November 2010	http://www.ageo.at/aktuelles/raumplanung
PLAN4ALL national workshop – Iceland	LISA	Reykjavik	3rd February 2011	http://www.landupplysingar.is/index.php?option=com_jevents&task=icalrepeat.detail&evid=54&Itemid=0&year=2011&month=02&day=03&uid=7348624fd9d2e9e5df3e7af053f8a4e4&lang=is
PLAN4ALL national workshop – Netherlands	GEONOVUM	Utrecht	3rd February 2011	http://www.geonovum.nl/dossiers/planforall
PLAN4ALL national workshop – Hungary	HUNAGI	Budapest	3rd March 2011	http://unsdihu.blogspot.com/search?updated-min=2011-01-01T00%3A00%3A00%2B01%3A00&updated-max=2012-01-01T00%3A00%3A00%2B01%3A00&max-results=4
PLAN4ALL national workshop – Denmark	GEOFORUM	Middelfart	14th March 2011	http://www.geoforum.dk/Default.aspx?ID=8740&gmId=204
PLAN4ALL national workshop – Slovenia	CEKTRA	Ljubljana	19th April 2011	http://en.cektra.org/events/conferences/
PLAN4ALL national workshop – Czech Republic	CAGI	Prague	25th May 2011	http://www.cagi.cz/novinka.php?id=303
PLAN4ALL national workshop - France	AFIGEO	Paris	27th June 2011	http://www.afigeo.asso.fr/voir-toutes-les-news/403-atelier-national-plan-4-all-le-27-juin-a-la-defense.html

Table 10.1: The country workshops managed by EUROGI for the Plan4all Project

The cycle of workshops started in September 2010 in Italy and ended in June 2011 in France, paving the way to the final P4all conference in Brussels (October 2011). Within this time span, the workshops aim has evolved from dissemination and awareness-raising to reality checking of the results.
All the workshops have achieved the goal of starting high-level discussions about issues of geographical information interoperability and of its significance for urban and regional planners. In some cases, the workshops output was useful for launching or supporting legislative developments in the relevant field.
However, the main result has possibly been the dialogue between two different and quite separated cultures: the ICT experts and the planners. Despite the fact that for many years planners have been actively exploiting a large set of tools provided by ICT, such tools could deliver better results to the planners, as far as the planners have a better understanding of ICT (e.g. the conceptual approach of ICT to describe entities and relationships of territorial phenomena). On the other hand, the complexity of the planning process, which cannot be totally described as an algorithm, has to be more thoroughly understood by the ICT experts in order to avoid overly simplified descriptions of reality and therefore unsatisfactory automated tools. The lively discussions that have followed the presentations of the various workshops have provided good evidence both for the need and the desire of such dialogue.
Each workshop has produced reports and other documents that are usually available on the websites of the local EUROGI members. The workshops have also stimulated a number of dissemination activities meant to raise interest for the event in every community. In the following text, the main features of each workshop are described on the basis of such documentation.

10.2 Plan4all workshop in Italy (Rome,6th October 2010), in cooperation with AMFM GIS

The first workshop was held in a historic building in the very downtown of Rome, about eighteen months after the Plan4all project began. The 100+ attendees were officials of local authorities and of other bodies, officials from Environmental Agencies at a regional and national level, planners, professionals in the field of GI applications and experts from academia.
At the time, it appeared to be of relevance to provide the audience with a detailed description of the project and of its goals in relation to the INSPIRE Directive, which was received in the Italian legal system only six months before. Moreover, the work in progress about the metadata, the data models and the networking architecture was revealed and discussed. Afterwards, many representatives from public bodies entrusted with the spatial planning presented their views and referred to their own

experiences. In particular, the national institute of professional planners provided a speech about how the sharing of geographic information in spatial planning could impact upon the culture of urban planners and policy makers. The foreseen changes in professional practices and the related challenges for university education were outlined.
Consensus was reached about the advantages of the foreseen interoperability of territorial data when dealing with cross-border phenomena (e.g. management of the environment). The discussion became livelier when it touched upon issues of the spatial planning processes and procedures. In Italy, the regional governments have legal powers (in different ways) in the spatial planning of their own territories; the twenty different planning laws pass portions of such regulatory powers to lower administrative levels (provinces, municipalities etc.) in different ways; therefore, interoperability of relevant data must be achieved at the national level as well as the European level. In this context, interoperability of data also means the reshaping both of areas of interest and of current procedures in involved administrations.
Inside each regional territory, progress towards digital planning data and processes appear to face some cultural opposition, often motivated by planners' distrust of the ICT tools. However, the scenario is rapidly evolving in terms of legal frameworks and human resources. Accordingly, the involvement of the lower administrative levels would be beneficial to the validation and acceptance of the Plan4all results as well as the global INSPIRE approach. Finally, the attendees expressed a strong interest in remaining in touch with the developments of the project.

10.3 Plan4all workshop in Ireland (Dublin,14th October 2010), in cooperation with IRLOGI

The workshop took place as a component of the annual IRLOGI GIS Ireland 2010 conference, which is the main GI/GIS/SDI conference in Ireland.
Apart from raising awareness of the Plan4all project and its progress to date, the workshop aimed to explore the appropriateness of an approach to dealing with the incorporation of zoning (the legend of the planning documents in Ireland) into the INSPIRE system. The attendees were mainly professional planners with local authorities as well as GIS persons from various local authorities and other organisations.
The starting point of the discussion was a survey (carried out in 2009) of the Irish planning legislation and standards. This survey uncovered a general lack of knowledge and understanding of INSPIRE related issues. Moreover, the same survey noted that GIS is usually exploited in the Irish planning system as a tool to support many administrative functions. However, when dealing with spatial planning deci-

sion-making, and specifically when such decisions interact with political processes, a discontinuity in the use of GIS arises. This can be credited to practical and technical barriers as well as to the fact that the data sets that are needed by spatial planning are often not captured and maintained to acceptable standards.
On the other hand, a best practice example relating to discovery and viewing of spatial data can be found in the Irish Spatial Data Exchange (ISDE), which is a collaborative initiative involving the Marine Institute; the Department of Communications, Energy and Natural Resources; the Environment Protection Agency; the Department of Environment, Heritage and Local Government; Geological Survey Ireland; and the Coastal and Marine Resources Centre at University College Cork. ISDE, as a Discovery Service for spatial data resources that are available from various organisations, allows the search of metadata catalogues operated by each of the partner organisations. The metadata are compliant with the INSPIRE Metadata Implementing Rules using ISO standards and the catalogue service is implemented according to CSW 2.0.2 and is therefore independent of any technologies.
Two other important initiatives are being carried out in Ireland:

- iPlan - a system used to process and monitor planning applications through the different stages of the planning process, used by about 70 of the 88 Planning Authority sites in Ireland;
- ePlan - the spatial planning application tracking system provided by the Irish LGMA (Local Government Management Agency) and used by most Local Planning Authorities in Ireland to administer and provide public web access to the local spatial planning process.

Currently, citizens are able to interrogate the planning files for a number of planning authorities simultaneously in order to get a graphical depiction of the progress of the applications from receipt to determination. However, a lack of standardisation of the land use types makes it difficult to have a coherent overview between plans at different levels; this has negative implications within the INSPIRE framework.
Therefore, the picture of the Irish condition appears to be quite complex. This situation confirms the usefulness of dissemination activities such as those carried out by Plan4all, aimed at establishing and maintaining links among the various stakeholders and in particular between planners and IT solutions providers.
In order to both overcome the current barriers and enhance the positive effects of the existing best practices, it was suggested to:

- give a statutory basis to certain spatial planning based datasets produced by public planning bodies in respect of obligations for capture and standards of production;
- draw from INSPIRE to guide a program for strengthening the statutory re-

quirements for capture of digital data relating to spatial planning;
• make a common data reference set for zoning, land use, and infrastructure objectives; and
• capture and maintain data associated with applications for development permits, granting of permits, commencement of construction activity and its completion.

A response to the variety of the land use types is the creation of the so-called Generic Zone Types (GZTs). About 8 broad zoning categories into which the hundreds of specific different zones contained in the 400+ plans would be compacted. Through the Plan4all project, the GZT approach should be considered as a useful template within the INSPIRE framework.

10.4 Plan4all workshop in Austria (Vienna, 23rd November 2010), in cooperation with AGEO

The workshop was hosted in the City Hall of Vienna. The attendees were from the community of data providers, users and data processing organisations, private sector and public administration. The point of view was mainly that of professionals entrusted with planning activities. Of interest were:
• harmonisation of spatial data and of spatial data infrastructures;
• models of cooperation; and
• legal aspects and accessibility of the spatial information.

The issue of fragmented planning systems was raised. Such fragmentation appears to create or be caused by separated and potentially conflicting user requirements, strict rules on intellectual properties and technical incompatibility of the solutions.
In parallel, the regional diversities impact upon the standardisation processes, the quality of datasets and services and the availability of data and metadata.
Experiences and suggestions were presented in reference to the above. As a way to overcome such problems, the attendees acknowledged the relevance of the INSPIRE approach and of its related initiatives including the Plan4all project. However, the promotion of the INSPIRE approach should rely upon applicable solutions. It was suggested:
• to take into account the differentiated levels (local vs. regional, mainly) of the planning processes;
• to rely upon consolidated data and metadata standards;
• to fully cooperate to the European SDI;
• to exploit the above to deal with the challenges of cross-border planning.

Due to the specific point of view of the meeting, a large debate was devoted to clarify the planning processes as a cycle and not as a cascade. In each occurrence of such a cycle that involves different scales and stakeholders every time, the SDI should be able to provide the planner with information as needed.

10.5 Plan4all workshop in Iceland (Reykjavík, 3rd February 2011), in cooperation with LISA

The Plan4all workshop in Reykjavík was prepared and carried out by LISA in cooperation with the main stakeholders including the National Planning Agency, the National Land Survey and the Association of Local Authorities in Iceland. This cooperation ensured that good communication and information was sent out to a large group of people that will need to consider and act upon developments in this field. The workshop was complemented by a meeting with LISA´s workgroup in Metadata issues and focused on:

- the Plan4all project;
- the implementation process of INSPIRE in Iceland;
- the report on digital planning in Iceland.

The workshop produced for the first time a suggestion on how to carry out digital planning in Iceland. This was of great interest to the public and was much discussed at the workshop. A need for a change in the legal framework was outlined. Moreover, the establishment of a nation-wide GI database (including the available data) was acknowledged as necessary for digital planning; such a database is deemed to be instrumental for the public administration at the same level of the population register. Such developments call for more GI education in the planning sector.

The workshop in itself can been seen as one of the first steps taken in that direction as well as the start of further cooperation among those that work with planning processes and with planning data in Iceland.

A modular approach appeared to be suitable to implement the INSPIRE Directive in the local context. This means that simple rules and data structures (easily manageable by the municipalities) are required first, and then a more complex and comprehensive approach later. This is confirmed also by comparison with the relevant experiences in Norway and in Denmark.

10.6 Plan4all workshop in The Netherlands (Utrecht, 3^{rd} February 2011), in cooperation with GEONOVUM

The workshop, hosted in the Provinciegebouw of Utrecht, was mainly centred on the issues related to the formation of a data model and data specifications for (Planned) Land Use, useable in INSPIRE.
The discussion built upon the draft of the concept data specification and model made available for comments by the INSPIRE Thematic Work Group (TWG) for Planned Land Use in October 2010, the final release of which was due in the weeks after the workshop. It has to be noted that the results of this INSPIRE TWG have been based on the advice and proposals of Plan4all via representatives of Plan4all partners who were also working inside the TWG at the same time.
The aim was to exploit the experience of the Netherlands, where both data making and publishing of commonly accessible digital Planned Land Use information are already a legally enforced practice based on Dutch standards, in order to provide feedback to the INSPIRE TWG. It was also of interest to discovering what INSPIRE could mean for the daily activities of the planners. Therefore, the participants were asked to evaluate such documentation as a preparation for the workshop and to examine the following statements and questions:

1. What will be the use-case of the INSPIRE Land use data provided? Spatial planning data in the Netherlands are available and accessible and provide information for spatial planning and realisation in operational terms and legal context (what can be realised, where etc.). INSPIRE Land use data are a projection of these official data sets. How is that perceived as a data provider? And as a data receiver (cross border)?
2. The toughest thing to decide when making a model is the "level of detail" in the specification. Too much detail means that the model will be unworkable for the member states. Too little detail will result in useless data. What do you think about the level of detail? This question has a data-provider perspective (can I convert my data to the model?) and a user-perspective (If I get data in this model from my neighbour member states would that be useful for me?).
3. INSPIRE Land use is about current and future land use. Both subjects work with different terminology. We have decided to make separate models for current and future landuse where the current land use model will be harmonised with land cover. For the future land use, the terminology is from spatial planning. Does the planning world think that current land use and future land use can be harmonised in one model?
4. The only thing that is shared between current and future land use is the nomenclature (how is a residential area defined, etc.).The member states

can use their own nomenclature but must provide a legend to the common nomenclature defined by INSPIRE. For the common nomenclature we started with the LUCAS (Land Use/Cover Area frame statistical Survey) nomenclature. Can your nomenclature be mapped to LUCAS?

On this basis, the discussion firstly addressed the usability of the INSPIRE data on land use. Inside the Netherlands, the exchange of digital Land Use information for spatial planning is practiced by law. Therefore, greater impact and benefits will emerge in reference to the administration of the border regions and integration of cross-border information. It has also been noted that, in the long run, spatial planning practices will benefit from harmonisation at the European level.

A centrally organised publication facility was indicated as necessary for the publication of INSPIRE data. With such architecture, the data owners and providers will not be directly concerned about proper implementation, however they should be properly informed about incoming INSPIRE rules in order to adequately tune their activities.

A short exercise confirmed the feasibility of mapping the Dutch model of land use into the INSPIRE data specifications, due to the similarity of the INSPIRE data model with the Dutch Spatial Planning standards. However, such mapping would cause the loss of quite a lot of information because the Dutch data model is more detailed than the INSPIRE model. More problems were envisaged for the metadata, for example where the concept of dataset might be different and change from individual spatial plan to spatial plan type; and for some technical issues, for example the coordinate reference systems where the Dutch Spatial Planning standard prescribes the Dutch coordinate system while INSPIRE prescribes ETRS 87.

Even if the above problems are mitigated by the planned central connecting node in the INSPIRE infrastructure (e.g. providing coordinated transformation services), it appears to be necessary to clearly define and maintain the mapping rules between the national practices and INSPIRE. Ideally, this should be the responsibility of the entity providing the national standards.

As far as the legal rights (of ownership, publication, etc.) for digital land use data are concerned, no specific problems are foreseen. In the Dutch legal system, a spatial plan is governmental data and any party can have access to these data and use it or process it for its own needs. Mapping and publishing according to an INSPIRE data specification can be one of these needs. At most, suitable proclaimers and disclaimers should be added to the data sets.

Finally, the participants stressed the need for continuing the effort of disseminating information to the relevant stakeholders. Workshops (like those convened the Plan4all project) and newsletters in various formats would be appropriate.

10.7 Plan4all workshop in Hungary (Budapest, 3rd March 2011), in cooperation with HUNAGI

The workshop, held in the central Hotel Gellért, was attended by 210 registered participants who are members of an informal network in the field of digital spatial planning. The neighbouring countries of Austria, the Czech Republic and Slovakia provided active support.

Special attention was paid to the event by the Hungarian government. Representatives from five Ministries and three Deputy State Secretariats attended the Plan4all workshop. The Plan4all workshop was classified as an official event of the Hungarian Presidency of the European Union, upon request of the Ministry of Foreign Affairs based on the support of the Ministry of Interior. Consequently, HUNAGI was authorised to use the logo of the Hungarian Presidency during the event.

The workshop dealt with the role of digital spatial planning in sustainable use of the territory and the harmonisation of spatial planning data based on the existing best practices in EU. It aimed to:

- bring together the prime stakeholders and major players;
- promote Plan4all and INSPIRE on a national, regional and municipal level in Hungary; and
- allow the exchange of views and experiences among the participating stakeholders.

Presentations dealt not only with technical and technological aspects, but also with legal aspects. For example, the theme of public sector information (PSI) access and re-use were discussed in depth and in association with the issue of business models for public-private data sharing. Another non-technological issue addressed was the introduction of local drivers and supports for planning policy or decision-making processes.

Two topics that were highly relevant to the workshop themes were delivered on a Deputy State Secretary level, namely:

- the role and use of GI/GIS and territorial information system in spatial planning; and
- the paradigm change and the new guiding principles in the public administration including time and speed, cost effectiveness, time for clean-up, distinction and subsidiarity.

The accessibility of plans was also an issue covered and the web-based service of the National Regional Development Plan was introduced.

As an overall outcome, the participants agreed on the need for special attention to be paid to the regulation and legislative framework for digital spatial data necessary for spatial planning. Moreover, the relevance and benefits of international cooperation and networking were underlined. Finally, the workshop gave the governmental decision-makers a unique opportunity to learn more about Plan4all, INSPIRE, PSI and their connections and also to share their views with the community of professional spatial planners.

From the spatial planner's perspective, the participants agreed upon the following recommendations:

1. geospatial Information plays a key role in making sustainability possible. It is necessary not to lose the opportunity provided by GI and SDI to spatial planning;
2. a strong voice from the planning community is needed in INSPIRE-related public consultations and testing. LMOs and SDICs could also assist by learning, understanding and considering user needs;
3. further dissemination of, and access to, references to common procedures and methodologies for spatial data sharing and utilisation of new pan-European standards for spatial planning data within the EU would be helpful; and
4. exchange of experiences and best practices of Environmental Impact Assessments and Strategic Environmental Assessments (applicable also in cross-border settings) would enhance cost effectiveness in spatial planning.

HUNAGI promoted the access and use of the "International Manual of Planning Practice" elaborated by ISOCARP (the International Society of City and Regional Planners, also a Plan4all partner) for all the Hungarian spatial planning entities, including local and higher level governments. This information source describes and compares the planning systems of more than 100 countries worldwide, including all European countries, the same number of countries where Spatial Data Infrastructures are under development or being implemented.

10.8 Plan4all workshop in Slovenia (Ljubljana, 19th April 2011), in cooperation with CEKTRA

The event was held in the premises of the Ministry for Public Administration of the Republic of Slovenia in Ljubljana. The attendees were from nine countries: Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Macedonia, Austria, Italy, France, and the Czech Republic. The EC Joint Research Centre also sent a representative. The presentations targeted issues of interest for the whole area of South-Eastern Europe (SEE), and not only for the hosting country. In such a context, countries

that are not yet members of the European Union showed interest in the INSPIRE-related developments.
Since seven out of ten SEE countries are not taking part in the Plan4all project, the workshop brought added value of the analysis of the SEE area to the project. The dissemination of the project results is of great importance to that area from the perspective of spatial planning and also of the whole concept of INSPIRE directive.
The main objectives of the workshop were:

- country analysis in the area especially with regards to non-project countries;
- collecting contributions and suggestions from the area;
- exchanging best practices;
- promoting the project and its results ;
- fostering the cooperation in the area among spatial planning institutions;
- attracting stakeholders and other forums involved in spatial planning in the area; and
- identifying gaps in the spatial planning approach in the area, with potential impact on future projects.

In the following open discussion, remarks and suggestions by presenters, moderators and audience were put together in the following points. These points have been presented to the attendees and were accepted by them:

- some good practices in the region can be acknowledged:
    - utility cadastre in Slovenia;
    - harmonisation with the European norms and standards in the planning and spatial arrangement in Macedonia; and
    - vision of spatial planning in Serbia;
- this workshop was instrumental in bringing the INSPIRE message to the SEE level and specifically in the field of spatial planning;
- SEE countries are following the same road as the EU in terms of procedures and standards;
- SEE countries intend to apply the INSPIRE principles;
- involvement of all stakeholders in the process of INSPIRE (not only spatial planning processes) appears necessary;
- establishing systematic links between ICT and spatial development indicators (ESPON) should be an advantage;
- spatial development monitoring and evaluation in post planning phase (permanent planning procedure) through data infrastructure knowledge dissemination (added value to the data system) should be enforced;
- INSPIRE should be brought to levels beneath the national level i.e. the

local levels;

• the harmonisation and interoperability inside each state should be taken into account in order to cope with the evolution of responsibilities according to federal structures;

• knowledge, awareness raising and capacity building about SDI's in general would benefit the users;

• as an umbrella organisation, EUROGI should continue to bring together users, providers, governmental and nongovernmental stakeholders;

• cooperation in terms of know-how and experience exchange between the stakeholders within and among SEE and other EU countries is indispensable for the future of the area;

• data specifications and data compatibility should be continuously checked to ensure effectiveness for spatial planning;

• INSPIRE has to be a user driven initiative;

• spatial planners are both producers and users of the spatial information;

• some countries see the usefulness of the Plan4all deliverables and express the importance of their implementation and sustainability of the project after the foreseen end in October 2011;

• for the success of the INSPIRE process it is important to involve the stakeholders in future EU programs and calls.

10.9 Plan4all workshop in Czech Republic (Prague, 25th May 2011), in cooperation with CAGI

The Czech association for GI held its Plan4all workshop in Prague, in a beautiful location near the Charles Bridge. The major stakeholders were present, confirming the interest stimulated in the Czech Republic by the content of the Plan4all project, as well as the Czech project partners (including the coordinator of the Consortium). Due to the peculiar shape of the Czech territory, the issues related to the cross-border planning are of high interest for the local community of planners. The links with other related projects (as SDI-EDU) were examined.

A specific feature of this workshop was that the attendees had the opportunity to practically test on their laptops the issues addressed by the presentations, with reference to GI tools and to geoportals.

The lively discussion of the meeting in Prague was extended the following day in Mikulov, near the Czech-Austrian border, where CAGI was holding its annual GI congress with a large attendance of representatives from public administration. It was possible to share the ideas of the previous day in the context of this important congress.

10.10 Plan4all workshop in France (Paris, 27th June 2011), in cooperation with AFIGEO

This workshop gathered at the Grande Arche de La Défense (Puteaux) and included a representative panel of French key players in charge of the production and use of digitised spatial planning documents.
The workshop was also supported by the French ministry of Ecology, Sustainable Development, Transports and Housing (MEDDTL - Ministère de l'Écologie, du Développement durable, des Transports et du Logement), which is in charge of legislation for Spatial Planning and its application by the local authorities. It is also one of the partners of the Plan4all project.
The objectives of this workshop were to:

- present the results of the Plan4all project in connection to the INSPIRE directive;
- present the future specifications of the "Land Use" INSPIRE theme to foster and facilitate the proofreading phases and the tests of those specifications;
- contribute to the exchange of good practices and to raise the awareness of the French key players for the implementation of the INSPIRE directive for all the elements which are related to spatial planning;
- launch the debate on the implementation of a strategy aiming at harmonizing the digitised spatial planning documents, while grasping the opportunities offered by INSPIRE.

During 4 hours, this workshop was organised into three main presentations, followed by exchange sessions:

- Plan4all: objectives and main results, presented by MEDDTL;
- specifications of the theme "Land Use" of the INSPIRE directive; and
- proposals to test the specifications of the theme "Land Use" of the INSPIRE directive.

The INSPIRE specifications are commonly considered as complex documents and therefore stress was placed on the explanation of the context and the content of the "Land Use" theme. This included clarification of the approach, explanation of the retained models for the specifications, answers to the questions to generate feedback on the call for tests and comments from the European Commission.

10.11 Conclusions

The set of workshops convened by EUROGI with its national members confirmed the relevance of the aims of the Plan4all project and the interest and potential value of its results.
Each workshop has stressed the importance of establishing and maintaining links between the two professional communities of spatial planners and IT experts. Moreover, it appears to be necessary to explain and apply the INSPIRE principles in the reality of professional practices, as an continuous effort.
Such issues were taken into account by the Plan4all project itself. A dedicated blog was open inside the project wiki in order to collect suggestions and comments from the project partners. The posts provided useful insights into the local approaches to spatial planning, in line with the workshop results.

Chapter 11

Some lessons learnt cooperating in the Plan4all project

During the final phase of the project, while this book was being produced, a blog was activated on the project wiki in order to collect the points of view of the project partners. The comments posted hereafter are from the Consortium partners and from one affiliated partner, the National Contact Point for Plan4all in Poland. Affiliated partners were any entity that was interested in the activities of the Plan4all Project, including the exploitation of results.
The comments are presented here with minor editing. In a few cases the comments have been shortened in order to increase the readability. Anyone interested in finding out more information about the partners may refer to the section of book related to the partners' descriptions (Note of the editors).

FTZ - Fondazzjoni Temi Zammit (MT)
"The Plan4All activity elicited some very interesting outcomes, which indicated that it is sometimes difficult to bring together different datasets across different thematic social and physical fields. In order to conform to the Plan4all requirements, the conceptual models served as a veritable exercise in comprehensiveness due to their holistic and detailed approach. The main issues in the Maltese context concern the fact that the Conceptual Models reflect their name: they are concepts that require tweaking and need to consider different levels of conformity including local-national (NUTS 2,3,4,5 compared to NUTS 1) and national-supranational (NUTS 1 compared to EU). Each level has its own hurdles to overcome and the attempt by Plan4all is both bold and innovative as it attempts to bring together these different levels. The main recommended changes would be to include an information sheet on the difficulties experienced in order to align and aggregate the data across the local and regional areas and then up to the national and super-national levels. The different professions, software and methodologies used in the countries is too great to compile in one document, but drafting such a sheet would allow policy and decision makers to understand the hurdles that are still faced by spatial information. The CLC1990-2000-2006 runs proved that this can be done if one uses a harmonisation of the top-down (model) and bottom-up approach (users-data creation), and Plan4all is working well along this approach."

NASURSA - Navarra de Suelo Residencial (ES)

"In our opinion, the most important outcomes of the Plan4all project are: a spatial planning metadata profile; procedures for the transformation of local/regional/national spatial planning data into a European standardised format; and procedures for the publication of INSPIRE compliant WMS and CSW services that allow the sharing of spatial planning information at the European level. While these outcomes focus on technical issues regarding the sharing of spatial planning data by using Spatial Data Infrastructures, decisive actions must be taken on the following aspects in order to further exploit the project results:

- To deepen the semantic aspects of spatial planning information across different administrative levels (local, regional, national), within and between countries.
- To disseminate standardisation advantages within the spatial planner's community, especially at local and regional levels.
- To share technical knowledge of Plan4all standards with the technical staff involved in the development of Spatial Data Infrastructures across the EU."

Provincia di Roma (IT)

"The main advantage obtained through our participation in the Plan4all project has been a better knowledge of the specifications released from OGC and INSPIRE, and of the OGC-compliant open source software that is available. … The Province of Rome is committed to the use of standards for better interoperability and, when it is possible, to the use of open source software…. However a global immediate transition cannot be accomplished because of the need to ensure the continuity of service and because of the existence of a large legacy software installed base. It can therefore be expected that in the near future, the legacy software and the new standard compliant software must live and operate together. In this context we can make good use of the approach of the Plan4all project in terms of data and metadata translation between systems, and of the methodology that we and the other participants, developed during the project."

Hyperborea (IT)

"… Plan4all is perceived as a very strategic project for the company, and even better for its customer base. Active further exploitation of project results is being achieved through the assessment of the Plan4all solution with data coming from affiliated partners (i.e. Sardinia Region councillorship for environment protection), and by integrating the solution within a Tuscany region co-funded project, RUPOS. Hyperborea is gathering positive consensus from its customers and partners and is strongly promoting the possibility to "license" both its own portal and the Plan4all

central portal."
"Already, the report on Analysis of User Requirements on Planning Systems, which was one of the first project outputs, is a very important document for understanding that the large number of different data formats in the Czech Republic is a trivial problem compared to the situation across the whole Europe. The project gives great opportunity for the development of tools and data specifications that would make spatial planning data from different countries more readable and understandable. Experience with testing the Plan4all conceptual data models and INSPIRE technical specifications shows the possibility of their practical utilisation and, of course, of their limits. From a technical point of view, the Plan4all solution is based on the general Plan4all portal and on equivalent portals of project partners. The main emphasis is not placed on a hierarchical structure, but on the standardised data exchange. Implementation of OGC web services and the proposal of a Plan4all metadata profile have been crucial to such data communication ability. Thanks to this technology and project experience, future users in the spatial planning field can learn new ways of spatial planning data use."

ADR Nord Vest - Agentia de Dezvoltare Regionala Nord-Vest (RO)
"At the level of local and county public authorities from the North-West Development Region of Romania, Plan4all has significantly raised awareness on the importance of publishing harmonised, relevant digital spatial planning data. Transparency in urban- and territorial planning should be provided by urban planners in such a manner that other public authorities, up to the European level, can easily understand the content of these data and use them in decision making processes. … In view of exploiting the results of Plan4all project, the Agency offers continuous support for public authorities in the region in creating metadata, data and related services for sharing using the newly developed, regional spatial planning geoportal. Furthermore, it is necessary to improve cooperation with the institutions dealing with the implementation of INSPIRE rules at the national level, as the success of the project outcomes can be significantly increased with the help of a concerted effort to disseminate the advantages of data harmonisation within the communities of urban- and territorial planners."

MAC - The National Microelectronics Applications Centre (IRL)
"In Ireland, spatial planning best practice has been researched, widely discussed and an Irish Plan4all test platform was established using the Plan4all Metadata Profiles. This has allowed the Planning Authorities in the counties of Limerick, Kerry and South Tipperary to explore the complete INSPIRE-compliance process, especially in the context of the recent version 2.0 of the INSPIRE Data Specifications.

The platform is discoverable and viewable on both the Irish Spatial Data Exchange (ISDE) and Plan4all GeoPortal, confirming its National and pan-European INSPIRE compliance. The project experience and outcomes are now being shared with other Irish Planning Authorities across Ireland."

Gijón- Ayuntamiento de Gijón (ES)
"The key points of the Plan4all project have been:

- Better understanding of the INSPIRE directive with the internal departments that were involved.
- Working with standards: Publishing services compliant with INSPIRE and OGC. WMS and WCS.
- State of the art of software, especially OGC-complaint, open software.
- Sharing, not only technical knowledge, but also organisation and administrative knowledge, with partners from different countries, and with several points of view (local, regional, national).
- Improvement for our SDI including metadata, datasets and services OGC-compliant."

ZPR - Zemgale Planning Region (LV)
"The Zemgale Planning region, in the framework of the eContentplus project Plan4all, has provided innovative and state of the art practice for implementing the INSPIRE Directive in Latvia by: 1) Studying the existing best practices of EU regions and municipalities and the results of current research projects, as well as available legislation and experiences in Latvia; 2) Introducing the Zemgale Plan4all Geoportal with Networking Architecture for Sharing Data and Services, which allows for the discovery, visualisation and sharing of spatial data according to INSPIRE principles and OGC standards; 3) Contributing to the preparation of implementation rules for harmonisation in order to provide interoperability of spatial planning data sets and services; 4) Deploying spatial planning data and metadata on a regional level, publishing them local on the Plan4all Geoportal and transferring existing data and metadata into INSPIRE models; 5) Publishing local and regional data or transferring existing data and metadata into INSPIRE models (off line, on fly); and 6) Validating Metadata Profiles, Data Models and Networking Architecture on local and regional levels. The Project provided significant knowledge and practices exchange between the 24 partners from 15 countries in terms of professional and personal development."

Regione Lazio (IT)
"… This kind of experience highlighted the complexity of the concept of interope-

rability; the cooperation activity demonstrated that interoperability is not only a technical matter but rather an exercise in the harmonisation of spatial descriptions and planning approaches. This complexity was evident in the very beginning of the cooperation process. The common dialogue needs to harmonise two basic pillars: basic spatial lexicon and planning conceptual scheme. … In addition, the complexity of a dialogue on interoperability becomes higher if we consider the different types of knowledge and approaches that geographers, planners, experts of software, experts of SDI, public managers and institutional representatives have. All these profiles are present in the Plan4all project. At least four levels of qualitative interoperability emerge in the Plan4all project implementation … The positive actions of the Plan4all project are to demonstrate all these aspects, this should lead to reflection about INSPIRE Directive; its top-down approach should be always monitored by national, regional and local institutions, in order to establish a two-way dialogue, to better know the needs of single territories and to build together a really interoperable global language. … “

MEEDDAT - Ministry of Ecology, Energy, Sustainable Development and Town and Country Planning (FR)

“The MEDDTL strategy for involvement in Plan4all was to ensure compatibility between the French activities in the field of digital spatial plans and the INSPIRE future implementation rules regarding Land Use and the six other themes that Plan4all investigates. … It is worth mentioning that the spatial planner’s interest community requires widening beyond the Plan4all circle because the INSPIRE implementing rules, which will be adopted later in 2012 regarding the annex III themes and thus including spatial plans, must potentially be applied to any local governments by the end of 2014 for new spatial plans in digital form, and by the end of 2019 for existing datasets. As the number of local governments in Europe exceeds 100,000 entities, networking as well as the identification and promotion of best practices is quite challenging. On the other hand the Plan4all project enabled the testing of the compatibility of the French geoportal and geocatalog with a European geoportal, enabling the digital spatial plan datasets and services documented in the French system to be visible on the Plan4All portal. ...”

CEIT ALANOVA (AT)

“One of the most interesting aspects of the Plan4all project was to meet, handle and finally solve several difficulties which inevitably occur during harmonisation procedures. We already knew some of these problems as we have been running a cross-border spatial information and statistics database since 2003 (CentropeMAP, CentropeSTATISTICS). The location of the Centrope region, at the intersection of the countries of Austria, Czech Republic, Hungary and Slovakia, is unique in Europe. For a common development of the region, harmonised cross-border geographic datasets are crucial. The cross-border initiative follows the approach of processing spatial referenced data via OGC WMS. In a long-term development process, it aims to achieve a distributed spatial data management with full interoperability of systems and formats, based on INSPIRE standards and Plan4all results and considering all relevant regional stakeholders. The CentropeMAP and CentropeSTATISTICS data catalogue also have to include consistent metadata documentation, referring to the achievements of Plan4all as well as general agreements on data provision and use. Plan4all, as a best practice network, provides significant exchange of capacity, knowledge and experience between multiple stakeholders on Spatial Data Infrastructures in relation to the Spatial Planning Panorama across Europe."

AVINET - Asplan Viak Internet (NO)
"Having been closely involved with the evolution of spatial planning processes in Norway since the introduction of the public internet, AVINET has found it professionally rewarding and interesting to take part in Plan4all. Expanding the geographical and cultural scope of integrating spatial planning data from local and cross-border scenarios to pan-European data sharing introduced a wide range of new issue. These included the impact of different legal systems, the importance of harmonised Spatial Data Infrastructure data as input to spatial planning processes and the gap between the CAD based "drawing approach" and the GIS based "data approach". At the same time, Plan4all identified similarities that replicated themselves across Europe. As a company, we have learned valuable lessons from Plan4all; knowledge that will be utilised to enhance our products and services within the domains of natural resource management and spatial planning, and to contribute to the successful roll-out and implementation of INSPIRE compliant SDIs for spatial planning throughout Norway and beyond."

ISOCARP -International Society of City and Regional Planners
"It is clear today that the information age is influencing our behaviour, everyday life and planning practices. In the Plan4all project, one of the conclusions is that the impact of ICT/SDI on spatial planning is still underdeveloped; a lot of planners do not have the necessary information and the background to use and benefit from the actual evolution of services. The processes currently in use are only the beginning of the spatial planning era and methods. In these processes, new types of conflicts between cities, municipalities and regions will however appear."

Olomouc - Statutarni město Olomouc (CZ)
"Within the framework of the Plan4all project, the City of Olomouc is especially interested in publishing local land-use documentation. From our point of view, the main advantage, based on our participation on Plan4all project, is knowledge of the INSPIRE principles. Also, awareness of planning practices in other European countries/regions based on state of the art analysis is very helpful for us. The Municipal Authority (Council) procures land-use plans also for neighbouring municipalities within the framework of the Olomouc Municipality with Extended Authority. … . As part of the Plan4all project we try to standardise the outputs and test the application, allowing the public to make use of remote access to the data published for the entire Olomouc Municipality with Extended Authority. … We use experiences from the implementing stages of project in national discussions on INSPIRE data specifications and national standards (especially Land Use theme)."

National Contact Point for Plan4all in Poland (PL)
"… In Poland, 6 out of 16 regions are together implementing projects of approximately 130 million Euro in value (2010-2012). This is not the complete image of what is going on in Poland at the present time. Some of these regions (including the Mazovia-Warsaw region), have signed agreements on the computerisation of local spatial development plans and regional development plans. This is 45 million euro project, involving 292 municipalities. Prior to the start of UML modelling, they were given Plan4all documentation. Some other regions do not implement their spatial planning component at all, still concentrating on INSPIRE Annex I data and information (which in general is the Kingdom of Surveyors) in Poland. There is also a "grey zone" whereby authority for Regional IT and Information Society issues is taken by IT managers, for whom spatial planning is only one of many issues. So availability of the spatial planning information, according to the Plan4all metadata profile or general INSPIRE obligations, will differ over time for different regions.
…"

AMFM GIS ITALIA

The association was formerly established in the 1990s as the Italian chapter of Automated Mapping and Facilities Management International and was subsequently renamed Automated Mapping Facilities Management Geographic Information Systems Italia. It is a non-grant funded, non-profit making association of institutions, companies and users (professionals and students) who have specific interests in geospatial information and applications. AMFM is based in Rome. According to the tendencies of the 90s, AMFM GIS Italia was established to create awareness about geo-spatial information; to facilitate the exchange of knowledge and experience of Geographic Information Systems and Spatial Information between public and private sectors within Italy; and to promote the development of applications for the territorial applications and the management of services and infrastructure, supporting coordination among different levels of government (central, local and sub-local).

At the European level, AMFM GIS Italia joined as a founder member to EUROGI (European Umbrella Organisation for Geographic Information). Their president was also president of EUROGI for two mandates. In Italy, AMFM GIS Italia founded, together with some other organisations, the Italian Federation ASITA (Italian Scientific Associations for Geographic and Environmental Information), covering also in this case the presidency for several terms.

AMFM GIS Italia members are industrial members, user members and individual members. Some honorary members are indicated by Italian Governmental Institutions related to GI and to cartography. It is worth noting that user members are strongly characterised by energy and facilities companies as they are among the most relevant users of GI.

Each year, the association holds one national conference and some workshops and seminars on specific themes. AMFM GIS Italia has been involved as an NGO, since the foundation, in all Italian initiatives related to geospatial information. The Association promotes the dissemination of methodologies and processes of standardisation, communication and sharing of geo spatial information to enhance interoperability. The Italian Forum of Open Geospatial Consortium has been established under the aegis of AMFM GIS Italia, which has been the initiator and promoter of the INSPIRE initiative in Italy.

AVINET

Avinet is a consultancy company specialised in Internet based map and database solutions. Avinet is active within in R&D projects and also offers a range of map-based applications for the public sector, tourism and e-learning. The company provides consultancy services such as specification, development, running and maintenance of Internet based map and database solutions, participation in national and international research and development projects and delivers academic lectures within GIS.

CEIT

CEIT Alanova gemeinnützige GmbH
CEIT ALANOVA is an applied research institute that acts complementarily with existing organisations and in close cooperation with scientific and research institutions, enterprises and public administrations to ensure the flow of knowledge between research and practical applications.

VISION AND MISSION

CEIT Alanova seeks innovation through research and development, the main tools of information and knowledge society for business, government, and especially citizens. Therefore CEIT Alanova defines itself as a research and development institution with a Central European orientation, as a service to the people and companies in this region.

THE TEAM

The team consists of planners, geographers and computer scientists. All of them have worked in international teams, have published in international journals and magazines and are committed to the vision of CEIT ALANOVA to advance the City of Schwechat as the "mobility hub" and to become a "knowledge hub" in the near future.

FIELD OF ACTION

Specifically its competences cover the following domains:

- Cities and Urban development - Holistic / Interdisciplinary / Trans-disciplinary approaches
- Urban Planning and Regional Development
- Urban Technologies, Transport Technologies, Environmental Technologies
- Information and Knowledge Society
- Sustainability and Resource Management

• Geographic Information Technologies, GIS

DIPSU

The Department of Urban Studies of Rome III University was born in 2003 out of the former Department of Planning and Architectural Studies. People directly involved in the department are three full professors, eight associated professors and six researchers. They are doing research on urban contemporary development and design, spatial organisation and policies. In particular, research activities involve new ways of governing European cities in a context of social and economic globalisation. International exchange with universities and institutions active in the fields of urban studies became an important activity for the department on all levels (teachers, researchers, students). Teachers and researchers participate in international organisations and associations of planning, urban and sustainable development. Teaching activities are especially in the fields of master and PhD courses.

EPF

The Euro Perspectives Foundation was founded in 2008 in Sofia as a new institutional structure able to address public interest in an enlarged Europe. It aims to bring endogenous capacities to cross-fertilise through territorial cooperation with regional stakeholders in the EU and outside for added value regional polices and EU Integration.

EUROGI

A NETWORK OF GI/SDI NETWORKS

The European Umbrella Organisation for Geographic Information (EUROGI) was established in 1994 on the basis of a recommendation from the European Commission (EC). It is an independent not-for-profit organisation, which represents the whole of the Geographic Information (GI) and Spatial Data Infrastructure (SDI) communities, focusing principally on usage issues, and in so doing strongly articulates a user's perspective. The membership comprises mainly of National Geographical Information Associations, which themselves have in total about 6000 organisational members across Europe. EUROGI is an inclusive organisation open to participation by all European GI/SDI stakeholders, being built as a network of GI-SDI networks.

VISION

Geographic Information in all its aspects should become a fully integrated component of the European knowledge-based society.

MISSION

In order to ensure good governance, economic and social development, environmental protection and sustainability and informed public participation, EUROGI's mission is to maximise the availability and effective use of GI throughout Europe. This will require EUROGI to stimulate, encourage and support the development and effective use of GI and relevant technologies, and to act as the voice for the European GI community.

FTZ

The Fondazzjoni Temi Zammit (FTZ) is a Maltese not-for-profit foundation located at the University of Malta in Msida. Set up in 2004, it teams up several municipalities and key stakeholders together with the University of Malta to act as a collaborative network for the implementation of local and international projects of benefit to the Maltese community. FTZ is establishing itself as the island's premier multi-stakeholder partnership for regional development.

FTZ helps to provide the critical mass often required for participation in such projects, through networking, clustering and capacity-building actions. Its collaborative nature facilitates the achievement of the foundation's broader mission to create greater social cohesion and contribute to the moulding of tomorrow's knowledge-based society – "an inclusive society without frontiers to knowledge".

FTZ's five main thrusts of action build on the experience the foundation has gained so far in the following areas:

- ICT-assisted Education
- Research and Innovation
- Culture and the Arts
- Environment
- Social and European issues

The Fondazzjoni Temi Zammit was also mandated to set up national centres/agencies for e-learning, research mobility and energy management.

AKC

Avicenna Knowledge Centre, focusing on eLearning, is a founding member of the Virtual University for Small States of the Commonwealth (VUSSC) and the Avicenna Virtual Campus (AVC).
RMC
The Malta Research Mobility Centre, which forms part of the European Services network, EURAXESS, supporting researchers and hosting the national portal for research mobility (www.eracareers.org.mt).
MIEMA
The Malta Intelligent Energy Management Agency (MIEMA) was established in June 2007.

GEORAMA

GEORAMA
NON GOVERNMENTAL - NON PROFIT - ORGANIZATION
ΜΗ ΚΥΒΕΡΝΗΤΙΚΟΣ - ΜΗ ΚΕΡΔΟΣΚΟΠΙΚΟΣ ΟΡΓΑΝΙΣΜΟΣ

GEORAMA was founded in 2006 and the headquarters are situated in Patras.
GEORAMA is intending to play the role of a development pole in the coastal area of Western Greece and to actively participate in bottom-up European Integration, rooted in civilian mobilisation and institution building as a result of interaction between local/regional stakeholders and EU/international/global networks of excellence.
The founding members of GEORAMA initiated and implemented a number of interregional co-operation projects funded by the EU Territorial Co-operation programs (INTERREG IIIC). They realised that there was a need for a new institutional set up to continue the thematic work of these networks after the expiration of their financing by the EU. GEORAMA is fed by the concepts, results and ambitions of the interregional co-operation networks and is devoted to continue the work of these and other initiatives.
PRIORITIES
The priorities of GEORAMA follow the EU Territorial Co-operation policies:
• Promote innovation and economic development to improve the competitiveness and employment of EU & Global space.
• To control the impact of human activity on the environment, enhance territorial resources and prevent risks.
• To Improve mobility and sustainable territorial accessibility.
• Promote sustainable urban development.
• Empower civil society strategy.
• Environment as common heritage is the first division of activity aiming at sustainable growth with clear focus on environmental protection.
The second activity that characterises GEORAMA is the upgrading of human

resources, knowledge integration, thinking globally and acting locally, increasing employment opportunities for segments of the population that are excluded or not facilitated to take an active approach towards responsible positions in public and private sector and attracting talent..

GIJON

Gijón and the sea go hand in hand. The city is in the central part of the coast of Asturias and is protected by two capes: "Torres" and "San Lorenzo". The Bay of Biscay has shaped the industrial, commercial and urban development, the weather and even the essence of Gijón. The sea is always present. The smell and the murmur of the sea spread through the streets of the city and reach the inner lands of the municipality.
Nine beaches, not only at the core of the city but in also hidden cliffs, together with a marina, several times awarded blue flag due to the high quality of its facilities, and a constantly growing industrial port make up the eighteen-kilometre long shoreline of Gijón. One can enjoy a walk along an unbroken path for the length of the seashore.
Gijón is 181.6 square kilometres. Most of it belongs to rural areas. The topography of Gijón is smooth; only slight slopes can be found on the plateau. Plenty of water streams and small watercourses flow amid plantations of eucalyptuses and woods of oaks, yew trees and chestnut trees (native tree species of Asturias).
Over 90 % of the population of Gijón live in the built-up area of the city that spreads along the coast. The peninsula of "Santa Catalina" (Saint Catherine) and the old quarter of "Cimadevilla" are the core of the modern city and mark the limits or the historically different urban areas.
The industrial area is to the west of the city. It is presided over by the port of Gijón and by the docks, industrial estates and working-class areas ("La Calzada" and "El Natahoyo"). From the beach of "San Lorenzo" (Saint Lawrence) to the "Providencia" to the east, the residential areas have spread, interrupted only by suburban development areas like the districts of "La Arena" and semi-urban areas like "Somio".
To the south, limited by the marina, the circle of "San Miguel"(Saint Michael's) and the gardens of "Begoña", is the historic city centre where the main cultural, administrative and commercial areas are. Southernmost are "El Llano", "Pumarín" and "El Coto". The intense industrialisation process that started around the middle of the 19th century determined the current aspect of these districts.

HF

Help forest s.r.o. was founded in 1994 as a private limited company, fully oriented to the development of software and geographical information systems (GIS) with specialisations in geodata publishing and sharing through web services.
The company is located in Šumperk, a town in the Olomouc Region of the Czech Republic, called "The Gate to Jeseníky mountains."
The Help forest team consists of professionals in GIS, geography, databases, remote sensing, computer systems and programming. Help forest aims to provide the best available GIS technology and services to customers and users in the Czech Republic. The company specialises in GIS data analysis, interactive maps and plans, mainly in spatial planning, tourism, forestry, agriculture and public administration.
Apart from static and interactive maps, the typical use of GIS systems includes modelling of flood risks, routing analyses, smart network analyses, global portal solutions, remote sensing, data collection and much more.
The company maintains an extensive spatial data library and can produce high quality electronic and traditional mapping products for clients.
Experts from the Help forest have participated in European research projects for several years together with other members of the Czech Centre for Science and Society (CCSS) and WIRELESSINFO association. The company members obtained extensive experience from the completing of these projects: NATURNET-REDIME project (www.naturnet.org), MILQ-QC- TOOL (www.milq.org), AMI4FOR (www.ami4for.org) and Collaboration and Rural (C@R) (www.c-rural.eu). The Help forest was also the main coordinator of the national project Earthlook CZ (www.earthlook.cz).

HSRS

HSRS is an SME that has worked for more than 16 years in the Czech and European market and offers a wide variety of services dealing with the creation of geoinformation systems. HSRS is one of two Czech members of Open Geospatial Consortium (OGC). HSRS also has a representative in the INSPIRE drafting team. HSRS is a member of two Czech Research networks, CCSS and WirelessInfo.
HSRS has large experience with SDI for agriculture, environment, risk protection

and urban planning. It is responsible for the flood protection system of the Liberec region; the management of systems, and in some cases also for Web hosting, for 20 municipalities; and the Czech environmental metadata and catalogue system. It has cooperated on the definition of the Czech national INSPIRE profile and also on the profile for urban planning. HSRS is now responsible for the urban planning scenario in the Humboldt project. As an organisation working on Czech CLC (2000, 2006), it also has large expertise in this area. HSRS developed its own product Metadata catalogue, Micka; view client, Hslayers; and WPS library, PyWPS. HSRS is currently a subcontractor of IBM Czech Republic for developing the Czech National INSPIRE portal. Currently HSRS, together with the Latvian company Exigen, won a tender for the Latvian Spatial Planning Portal.
Realised projects: Map server for the Forest Management Institute Brandys nad Labem; I&CLC2000 – Update of database Corine Land Cover for the Ministry of the Environment of the Czech Republic; Project of European Commission IST-2000-28177 Premathmod (as a project partner); Project of European Commission IST-2000-28177 WirelessInfo (as a project partner); Project of European Commission Davinci mobile services for veterinarians; Project of European Commission Humboldt (GMES and INSPIRE); Project of European Commission Plan4all; Project of European Commission Habitats Realisation of map server for Liberec region; Realisation of map server for Vysocina region; Map server for Znojmo, Kutna Hora, Telc, Koprivnice, Kolin, Trest; Map server for micro-region Hrotovicko, municipalities Kosetice, Senozaty, Moravske Budejovice and others; SPRAVADAT - Management of geographic information and knowledge; System of transmission document data for actualisation of information system of public administration of surveying and cadastre (GEOPLAN); Flood protection system of Liberec Region; Integrated transport system for Liberec; Middle Bohemia Geoportal; Metadata system for European Geological Services- One Geology; Portal for European Spatial Planners Plan4all; contribution to the portal of BlackSee countries Envirogrids.

HYPERBOREA

Hyperborea is a company that has operated since 1995 in the ICT sector, applying computer technologies to the environment and cultural heritage fields. It was formed by a group of dynamic people, able to adapt their competencies to continuously evolving domains. The interdisciplinary know-how, which has improved over the years, defines the company's offering and it is able to satisfy any kinds of needs coming from very different marketplaces. Hyperborea has built a business model oriented to quality, becoming the partner of public and private organisations.

The company manages an integrated offering for different production contexts, from the cultural heritage field to the environmental field through the Information & Communication Technology sector.
OFFERING
Hyperborea has a flexible company structure in order to manage a diversified offering and a team with different skills and competences. The “Environment Business unit” works for the application of ICT technologies to environmental sector matters; the “Cultural Heritage Business unit” is engaged in the realisation of software and services for archives, museums and libraries; and finally the “System Integration Business unit” plans technological solutions in the domain of enterprise content management, knowledge management and business process reengineering, mobile solutions.
Hyperborea's added value is the ability to mix different competences in an integrated offering.
R&D
Hyperborea has a structured R&D department. Hyperborea's R&D department, engaged in EU and international projects activities, aims to follow the development of international competitive contexts and current innovation tendencies and to enrich its competencies and its know how through activities managed with a high standard of professionalism: participation in international activities and EU projects; management, consolidation and expansion of the partnership network in EU context; management of EU projects, in areas with high level of innovation and technology.

ISOCARP

ISOCARP is a global association of experienced, professional planners, and was founded in 1965 with a vision of bringing together recognised and highly qualified planners as well as other stakeholders involved in the development and maintenance of the built environment in an international network. ISOCARP has members from over 70 countries and is a non-governmental organisation, recognised by the United Nations and the Council of Europe and with a consultative status with UNESCO.

LAZIO REGION

Lazio Region is a local autonomous authority with its own statute, power and functions in accordance with the principles established by the Constitution.
The most important functions of Regione Lazio involve the health sector, social welfare, training, vocational education, town planning, public housing, economic development, tourism and cultural activities, agriculture, forestry, mining, regional public transport, public works, environment, and implementation of EU regulations and policies.

LGV

The Landesbetrieb Geoinformation und Vermessung (LGV Hamburg) - Agency for Geo-Information and Surveying -has the task of collecting, storing and developing data relating to location on the surface of the earth. It is responsible for the production and publication of official maps and for keeping the official land register of the Free and Hanseatic City of Hamburg. The geo data and services are a prerequisite for all cadastre, planning and building purposes.
LGV Hamburg, an agency under the supervision of the Ministry of Urban Development and Environment, provides these services. With about four hundred employees working in four divisions (administration, geo information, surveying and geo data services), LGV Hamburg has annual expenses of 26M Euro and is financed by 11M Euro income and 15M Euro in state subsidies. The subsidies finance a substantial portion of LGV Hamburg tasks representing part of Hamburg's infrastructure (not income-oriented), such as provision of a Spatial Data Infrastructure (SDI) and the Metropolitan Region (SDI-MRH), and maintenance of cadastral data. LGV Hamburg has the leadership in the field of Spatial Data Infrastructure (SDI) including INSPIRE in Hamburg.
LGV Hamburg is the coordination centre for all these SDI activities including consulting, data collection and digitisation, operation and maintenance of the geo portal. Under the direction of LGV Hamburg, a special working group works on the topic of 'protected sites' and 'land use'. The goal is to define, store and present the geo data 'protected sites' (topic of INSPIRE, annex I) or 'land use' ('XPlanung', topic of INSPIRE, annex III) in a standardised and uniform way.

MAC

The National Microelectronics Applications Centre (MAC) (www.mac.ie), was established in 1981,by the Irish Government, to provide consultancy and complete innovative electronic, software and e-business/e-government technological solutions.
MAC has a 30-year track record of delivering to tight schedules with industry, SMEs and public agencies to assess and assist entrepreneurial and innovative technical solutions that have enabled the growth of several multi-million Euro companies. We have completed numerous evaluations, studies and outsourced R&D projects for European companies, where we act as the innovator and designer of their future services and product set.
As an SME, the focus of MAC's commercial work is on the further development and extension of its distributed monitoring and control systems, that includes:

- Central Web Server and Wireless Sensor Networks
- INSPIRE-compliant data and metadata for open interoperability.
- Applications for public smart-grid fault monitoring in the power utility sector, water quality management in the environment sector, and distributed smart irrigation in the agricultural sector.

To ensure that its technology is always state-of-the-art, and that the MAC Team are continuously improving their excellence in its application and management, MAC partners with some of the World's best organisations in a number of European and National development projects. MAC is particularly strong in managing distributed development teams in those organisations for on-time and on-budget delivery of such technical developments. MAC builds on its strong project management skills, experience of productising technology applications and distributed systems development expertise.
In addition to Plan4all, MAC's EU projects include:
HABITATS
(Social Validation of INSPIRE Annex III Data Structures in EU Habitats) (www.inspiredhabitats.eu), is a CIP PSP ICT project that is focused on the adoption of INSPIRE standards through a Social Networking Web 2.0 participatory process with real citizens and business.
I2Web
(Inclusive Future-Internet Web Services), an FP7 ICT STREP that is making interactive and Social Networking accessible for disabled and elderly people, based on User-Centered and Inclusive Design (www.i2web.eu).

EuroPetition
(www.europetition.eu), is an eParticipation Preparatory Action project coordinated by MAC with 19 Local Authorities across Europe, using Web 2.0 online services to coordinate local, cross-border and pan-European European Parliament and European Citizen Initiative (ECI) petitions from citizens across the EU.

MEEDDAT

Ministry of Ecology, Sustainable Development, Transport and Housing: A ministry now for the future.
The Ministry plays a major proposing and innovation role in European and international bodies.
Actions are based on performance targets and methods:

• Meeting the challenge of climate change by supporting the development of a „decarbonised“ economy, efficient energy and reducing all greenhouse gas emissions.

• Invent a responsible growth for a sustainable future based on new modes of production, consumption and travel, and that respects the environment while seeking social progress and development rights.

• Facilitate new modes of production and consumption based on sobriety in the use of raw materials, fossil fuels and natural resources as a whole.

- Build more, build better and participate in the development of sustainable towns.

• Conserve biodiversity and environmental quality, an issue as important as climate change.

• Master the natural hazards and reduce risks to health technology and safeguard the health and lives of our citizens and the quality of the natural environment through a rational and appropriate use of the precautionary principle.

• Turning our territories into sites implementing sustainable development initiatives by mobilising all actors.

• Strengthen the competitiveness of territories within the framework of a cohesive and balanced development of all components: improved attractiveness, improving their services, better access to services.

• Involve all socio-economic stakeholders and all citizens in pursuit of the first 8 goals and put the country in motion, making it more participatory, adapting modes of governance and public decision and widespread consultation with stakeholders.

The Planning, Housing and Nature General Directorate (DGALN) is in charge of the policies in the field of resources, habitats and territories. Preserving biodiversity, effectively managing resources (water, space, etc.), protecting natural areas, developing housing, a framework of quality of life, all this requires policies to control urban development while meeting needs of the population, especially in terms of housing and equipment.

NASURSA

Navarra de Suelo Residencial, S.A.- NASURSA is a company specialised in spatial planning and urbanism, promoting the sustainable development of the region of Navarre. In 1999, NASURSA was established as a public society of the Department of Housing and Spatial Planning of the Government of Navarre. The company consists of four sections:

LAND DEVELOPMENT

Management and development of land (mainly residential areas), and initiation of urbanisation activities, in collaboration with different entities like Government, municipalities and real estate developers.

SPATIAL PLANNING

Development of spatial planning instruments defined in the Spatial Planning Act of Navarre 35/2002. All instruments are guided by the Territorial Strategy of Navarre (ETN) and the five existing sub-regional spatial plans.

NETWORK OF LOCAL OFFICES FOR TECHNICAL ASSITANCE

By means of three offices located in small and medium size towns across Navarre, assistance is provided to municipalities and citizens in the field of spatial planning, urbanism and housing rehabilitation

TERRITORIAL OBSERVATORY OF NAVARRE

Its main activities are the elaboration of evaluation and prospective studies on different scales, the coordination of territorial development projects and the management of an information centre.

Investigation projects:

- Plan4all. Harmonising spatial planning data in Europe.
- Ulysses. Planning instruments for cross-border areas.
- Report on the validity of the Territorial Strategy of Navarre-ETN.
- INTERREG III C: RePlan - Re-assessing Planning Instruments, Cu.T - Cultural & Tourism Nets and Grisi for Soho.

Participation in networks related to spatial planning and urbanism:

- ESPON, European Spatial Planning Observation Network.

- AEBR, Association of European Border Regions.
- OSE, Spanish Observatory for Sustainability.
- CTP, Working Commission of the Pyrenees.
- SITNA, Territorial Information System of Navarre.

More details at: http://www.nasursa.es

NW ARD

The North-West Development Region was established in 1998 through the voluntary association of the 6 counties in the north-western part of Romania, also known as Northern Transylvania. The region has a strategic geographical position, being situated at the Hungarian and Ukrainian border.

The North-West Regional Development Agency (RDA) was created by the decision of the North-West Regional Development Board (RDB) as a non-profit public utility body, having the status of a legal entity and representing the executive body of the Board. RDB, the deliberative organism that coordinates the entire regional development process in the North-West Development Region, is made up of the presidents of the County Councils of the 6 counties and representatives of the municipalities, towns and communes.

The responsibilities of the North-West RDA are mainly focused on the objectives of regional development policy in Romania: the diminution of the existent regional disparities, the correlation of the government sectoral policies in the region, as well as the stimulation of interregional, internal and international, cross-border cooperation, including cooperation within the Euro regions.

One of the main attributions of the Agency includes the management and development of regional partnerships, with the support of, and under the coordination from, the North-West RDB. It provides information on the European Union policies and practices at a regional level, and also the principles on which the regional development policies are based. The North-West RDA takes part in the implementation of international projects of regional and local interest.

The agency has a vast experience in planning, being responsible for elaborating and monitoring regional planning documentation, and having elaborated the Regional Development Strategy as well as the Regional Innovation Strategy for the North-West Development Region of Romania. In addition, it is now the Intermediate Body for the implementation of the Regional Operational Programme 2007 - 2013. At the same time, the agency is taking part in a series of European projects: Plan4all – European Network of Best Practices for Interoperability of Spatial Planning; NEE-

BOR - Networking for Enterprises in the Eastern European Border Regions; BISNet Transylvania Project – Business Innovation Support Network for SMEs, member of the Enterprise Europe Network; ASVILOC - building up an innovation transnational system; ENSPIRE EU – Entrepreneurial Inspiration for the European Union, etc.
http://www.nord-vest.ro

OLOMOUC

OLOMOUC

The City of Olomouc (100.362 inhabitants) is one of the most important Czech cities.
First written document mentioning Olomouc dates from 1055. It is the best-preserved historical city of Moravia, having the second largest urban reservation area, next to Prague. The city centre boasts a unique piece of monumental baroque sculpture and architecture – the Holy Trinity Column. In 2000, the Column appeared on the UNESCO World Cultural Heritage List, being the tenth Czech monument to be honoured this way.
Thanks to its history, the ancient university, sophisticated culture and arts, as well as its geographic position in the very centre of Moravia, it has always attracted tourists, businessmen and entrepreneurs. From the economic point of view, the City of Olomouc is an industrial city with developing services. Its growth potential is vast due to its advantageous position, a long tradition of manufacturing and skilled workforce.
In January 2001, the City of Olomouc became the centre of the Olomouc Region and also the seat of the Regional Authority of the Olomouc Region. Due to Olomouc's position in the heart of Moravia and its role as an administrative and shopping centre, the public sector is well developed here. The local industry consists of food processing and engineering. The municipality tries to attract strategic services to Olomouc, since this sector is still underdeveloped here.
Foreign investors capitalise on well-prepared industrial zones. Currently they are completely built-up and used, mostly by investors from abroad. The City attracts big companies but also does its best to support small and medium-sized local enterprises and Scientific and Technical Park of Palacký University.
The Municipal Office as a local planning authority procures land use plan for Olomouc and land use plans for neighbouring municipalities. The City also coordinates the public and private programmes of changes in the area, construction and other activities influencing the development of the area, and putting the protection of public interests arising from special regulations in concrete terms.

The City of Olomouc monitors the demand of entrepreneurs and potential investors and captures the strategic document

- City and Olomoucko Micro-Region Strategic Development Plan approved by the Olomouc City Assembly.

  And maintains and updates

- The price map of building plots of Olomouc updated and approved on an annual basis

For more information visit http://www.olomouc.eu

PROVROMA

The Province of Rome extends over an area of 5,352 km2 and is the most populated province in Italy with its 4,053,779 inhabitants (2007). Its territory includes 121 municipalities, among which is the municipality of Rome, which counts more than 2,700,000 inhabitants. The Province of Rome is a second tier local authority in the Italian decentralised government (NUTS III). It is an intermediate authority between municipalities and regions legitimated by the Royal Decree No 5929, dated 15th October 1870. The province oversees and administers strategic functions in different fields such as protection and enhancement of natural resources (water and energy resources, parks and natural reserves), waste management, control of water discharge, noise and gas emissions, road maintenance and transports, promotion of cultural heritage and vocational training courses.

With regards to urban and territorial planning, the Province of Rome is responsible for elaborating the General Provincial Territorial Plan that defines strategies and objectives for territorial planning and management by promoting a sustainable, balanced and polycentric development of the provincial territory. The Department in charge of the policies concerning territorial planning has developed an SDI for managing spatial data, by signing a first agreement with the Land Agency (Territorial Agency Protocol – May 2008), to access data related to municipalities, and a second one with the Ministry of Environment and Protection of Land and Sea (MATTM) giving its adhesion to the initiative called " Cartographic Co-operating System - National Cartographic Portal ", as an organisation providing its cartographic data and metadata according to the CNIPA directives on Public System of Connectivity and Cooperation. The SDI developed by the Province of Rome provides services such as metadata catalogue search services, mapping, editing as well as download services.
http://www.provincia.roma.it

TDF

The society "Technology Development Forum" was founded in 2004. The founders of the society are public legal and private persons who have joined together to promote economic development based on knowledge. TDF founders are: the Latvian Academy of Science, Ventspils University, LAS Institute of Physical Energetic, Jelgava City Council, the University of Latvia Institute of Mathematics and Computer Science (IMCS) and several individuals including scientists and innovation development specialists. The mission of TDF is to facilitate the development of high-tech innovation according to the national and EU programming documents, and to promote the implementation of innovations and development of high value-added production. The society has participated in Phare 2002, Phare 2003, Interreg IIIC, ESF EQUAL, ESF, Norway and EEA grants and Econtent programmes' projects and gained good project management experience.

UWB

The University of West Bohemia (UWB) was established by the Act of the Czech National Council No. 314/1991 Coll. in 1991 through the merger of the Institute of Technology and the Faculty of Education. At present the University has 8 faculties with more than 60 departments and three institutes of higher education. Nearly 19,000 students can choose from a wide range of Bachelor, Master and PhD study programmes. The section of Geomatics, part of the University of West Bohemia, was involved in the execution of the Plan4all project as a lead partner.

Study

The International Organization for Normalization (ISO) defines geomatics as a “scientific and technical interdisciplinary branch focused on collecting, distributing, storing, analyzing, processing and presenting of geographical data or geographical information”. The section of Geomatics is focused on geodesy, GIS, cadastre and civil law, cartography and spatial planning and provides a wide range of study programmes.

Research

The research activities and the coordination of the Plan4all project were supported by experience from various projects including Humboldt, which contributes to the implementation of a European Spatial Data Infrastructure (ESDI); GPS station, a network of permanent GPS stations within the Czech Republic; precise models of

geoid and quazigeoid in central Europe; georeferencing and cartographic analyses of historical mapping of Bohemia, Moravia and Silesia; land data models; progressive collection of geospatial data and its processing; and other projects.
For more information please visit http://www.zcu.cz/en/ and http://gis.zcu.cz/.

ZPR

Zemgale region is located in the central part of Latvia, south from Riga, it has long (270 km) borderland with the Republic of Lithuania. Region area covers 10,733 km2, which is 16.6% of the total territory of Latvian Republic. Zemgale Planning region is under the supervision of LR Environmental Protection and Regional Development Ministry and according to the Regional Development Law has a status of derived public person. The functions of Zemgale Planning region includes:

- Development planning on regional level, working at regional economic profiles, elaboration of regional development plans and Spatial development plan;
- Coordination of regional and national interests at the working groups of national development Plan, Steering Committees of EU Structural funds and other financing instruments, at the National Development Committee headed by the Prime Minister, at the working groups of different branch sectors at different ministries, including the Ministry of Economics and the Ministry of Welfare responsible for implementation of the Lisbon strategy.
- Coordination of regional and local interests by preparing conclusion on local development plans and Spatial plans of self-governments to be in accordance to regional and national planning documents, monitoring and supervision of local planning processes;
- Organization of public transport in the region, opening and closing new routes, distribution of state funding among transport providers.
- Development and implementation of regional scale projects, coordination of public institutions, social partners to implement the priority actions in accordance to the Regional development plan.
- Management of EU structural funds
- Represent region and the interests of its 22 local self-governments on national and international level.

Region ensures innovative and start of art technologies for management of geographic information data in order to promote implementation of INSPIRE directive in Latvia. www.zemgale.lv

About Authors

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Stein Runar Bergheim is senior advisor in AVINET, a Norwegian technology company, and has 15 years of experience as an expert in GIS, database and spatial web applications from assignments in Europe, the Middle East and Norway within areas such as: establishment of regional, national and trans-national spatial data infrastructures (SDIs), spatial and societal planning; natural resource management; digitization and presentation of cultural heritage; and e-learning.
He has been a lecturer at the Sogn og Fjordane University College and a guest lecturer at the University of Tromsø. He was co-founder of Asplan Viak Internet in 2001 and managing director from 2002 – 2008.

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His expertise is in research project management and the evaluation of EC projects

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His research activities include digital terrain modelling and ortophoto imagery.

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His key expertise is in GIS development, mobile GIS solutions, GIS implementation in forestry, agriculture and eGovernance. He has also extensive experience of EC projects: NATURNET-REDIME www.naturnet.org, Collaboration at Rural (C@R) www.c-rural.eu, AMI4FOR www.ami4for.org, MILQ-QC-TOOL www.milq.org, Plan4all www.plan4all.eu and national project Earthlook CZ www.earthlook.cz.

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Corrado Iannucci

Corrado Iannucci coordinates the EUROGI activities in Plan4all. He holds a post-graduate degree in Computer and Control Systems Engineering from the University of Rome “La Sapienza”, where he currently teaches Foundations of Information Technology to the students of the degree program in Urban Planning and Territorial Information Systems.

Both as a professional consultant and a director of various companies, he has always worked in the field of the exploitation of ICT to support public agencies entrusted with urban management and environmental protection, both in Europe and Africa.

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His research activities include GIS, spatial databases, spatial analysis and data modelling.

Karel Jedlička

Karel Jedlička has a MSc. (2000) Geomatics - specialization in GIS – from the University of West Bohemia, Pilsen. After an Internship at University of Redlands and ESRI (2003), he is currently a Ph.D. student at Technical University of Ostrava.

His research activities include: Global Positioning Systems (GPS), GIS, spatial analysis and modelling, spatial databases, geomorphology. He has collaborated to some national (e.g. paGIS, AM/FM for ČEZ) and cross border (GmIS, Geometric harmonisation of ZABAGED and ATKIS) projects.

Jan Ježek

Jan Ježek has a MSc. (2004) from the Czech Technical University, Prague and is currently a PhD student at Faculty of Civil Engineering, Department of Mapping and Cartography, Czech Technical University, Prague.

His research activities include Open source GIS and Java programming language. He has experience with European projects (e.g. Humboldt).

Štěpán Kafka

Štěpán Kafka is a Doctor of Natural Sciences; he has obtained his degree from the Charles University, Prague. He is employed at VŠB – Technical University Ostrava, Faculty of Mining and Geology, Institute of Economics and Control Systems.

He is a member of the Czech Association for Geoinformation (CAGI), an expert of an INSPIRE drafting team, and is a representative of a company in OGC. Štěpán.

Lea Maňáková

Lea Maňáková works for Statutarní město Olomouc, in the Conception and Development Division, Department of Urban Planning and Architecture, (www.olomouc.eu) studied. She studied Mathematics and Geography in the faculty of Natural Sciences at the Palacky University, Olomouc.

Bino Marchesini

Bino Marchesini is currently the Legal and administrative officer of EUROGI. He initially trained as a lawyer at the University of Leiden. After a number of years in private sector, he contributed, with others, to the initial establishment of the Dutch national GI association (RAVI) where he wrote several reports for the government. He was Secretary to the Executive Board of the Dutch Kadaster, and as a director responsible for the policies on political developments, communication and legal affairs. From 2002 until end 2005 he was Secretary General of EUROGI and again -ad interim- from 2010 until March 2011.

Bruce McCormack

Bruce McCormack is a qualified town and regional planner who works as a planner for the Irish government department responsible for national spatial planning. He has been closely involved in INSPIRE having represented Ireland on the Expert Group and has helped to shape Irish representations on the Directive during its drafting process, being currently directly involved in its implementation.
From 2004 to 2011 he has been President and Vice President of IRLOGI, the Irish Organisation for Geographical Information. In 2007 he became Vice President of the European Umbrella Organisation for Geographic Information (EUROGI) and in 2011 he became the President of EUROGI.

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He is the facilitator of the INSPIRE thematic working group on land use and the vice president of EUROGI. He was previously the secretary general of the French council for geographic information and is well known in Europe as a senior GI expert.

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Mauro Salvemini is the president of AMFM GIS Italia, a member of the Global Advisory Council of OGC and an expert of the EC. Since 1975 he has researched and taught at the University of L'Aquila and at Sapienza University of Rome as well as several universities in the US, Spain and Egypt. He is the former president of AGILE (Association of GI Laboratories in Europe) and of EUROGI, where he currently fulfils the role of treasurer.
He is a pioneer and evangelist of GI and SDI theory, design and practice as professional consultant and is author of more than 70 publications.

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Manfred Schrenk is Head of CEIT (Central European Institute of Technology) and CEIT ALANOVA. He is vice president and treasurer of ISoCaRP (International Society of City and Regional Planners, www.isocarp.org), board member of OeGR (Austrian Spatial Planning Society, www.oegr.at), deputy president of AGEO (Austrian Umbrella Organisation for Geo-Information, www.ageo.at) and director of CORP (Competence Centre for Urban and Regional Planning, www.corp.at).
His specialisations include Planning and ICT, Impacts of ICT on Spatial Development and Geographical Information Systems in Spatial Planning.

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Franco Vico is Vice President of AMFM GIS Italia and portfolio leader of EUROGI/eSDI-Net initiative. Over the past four years he has been working hard in two European projects for AMFM GIS Italia: Plan4all (2009-2011) and eSDI-Netplus, on assessing sub-national SDIs (2007-2010).
Since 1990, he has taught courses on GIS and Analyses for Spatial Planning in Torino Polytechnic. He was the Coordinator of the Torino Polytechnic three-year degree course on GIS, from 1996 to 2006.

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Martin Vlk holds a position as scientific programmer and developer at Help forest s.r.o. He studied at the Brno University of Technology, Faculty of Mechanical En-

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He has studied in the Technical University of Vienna and the Michigan State University.
He has had an extensive work experience in the fields of software and webmapping development, strategic and transport planning, urban development, environmental impact assessment and logistics consultancy.

List of Acronyms

CAD	Computer Aided Design
CEN	European Committee for Standardization
CentropeMAP	Cross-border initiative between Austria, Czech Republic, Slovakia and Hungary
CLC	CORINE Land Cover
CORINE	Coordination of Information on the Environment
CS-W	OGC Web Catalog Service
DRM	Digital Rights Management
ELU	Existing Land Use
EPSG	European Petroleum Survey Group
ETRS	European Terrestrial Reference System
EU	European Union
EUROGI	European Umbrella Organisation for Geographic Information
GEOSS	Global Earth Observation System of Systems
GI	Geographic Information
GIS	Geographic Information System
GMES	Global Monitoring for Environment and Security
GML	Geographic Markup Language
HILUCS	Hierarchical INSPIRE Land Use Classification System
HTML	Hyper Text Mark-up Language
INSPIRE	Infrastructure for Spatial Information in Europe
IRs	INSPIRE Implementing Rules
ISO	International Organization for Standardization
ITC	Information and Communication Technology
JRC	Joint Research Centre
LCCS	Land Cover Classification System
LMO	Legally Mandated Organisation
LU	Land Use theme
NGO	Non-governmental organization
NUTS	Nomenclature of Units for Territorial Statistics
NZ	Natural Risk Zones theme
OGC	Open Geospatial Consortium
PDF	Portable Document Format
PLU	Planned Land Use
PSI	Public Sector Information
PSS	Planning Support System

SCOT	Strategic spatial planning document (in French)
SDI	Spatial Data Infrastructure
SDIC	Spatial Data Interest Community
SDI-EDU	Project funded by the EU Lifelong Learning Programme
SEE	South-Eastern Europe
SEIS	Shared Environmental Information System
SOA	Service Oriented Architecture
SRS	Spatial Reference System
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TJS	Table Joining Service
TWG	Thematic Working Group
UML	Unified Modeling Language
UNISDR	United Nation International Strategy for Disaster Reduction
WFS	OGC Web Feature Service
WMS	OGC Web Map Service
WPS	OGC Web Processing Service
XMI	XML Metadata Interchange
XML	eXtensible Markup Language

The Plan4all Project contributes to the standardisation in the field of spatial data from spatial planning point of view. Its activities and results will become a reference material for INSPIRE initiative; especially for data specification. Plan4all is focused on the following 7 spatial data themes as outlined in Annex II and III of the INSPIRE Directive :

- Land cover
- Land use
- Utility and governmental services
- Production and industrial facilities
- Agricultural and aquaculture facilities
- Area management/restriction/regulation zones and reporting units
- Natural risk zones

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