ECP-2008-GEO-318007

Plan4all

INSPIRE Requirements Analysis

Deliverable number	*D2.3*
Dissemination level	*Public*
Delivery date	*16th November 2009*
Status	*Final*
Author(s)	*EUROGI, AMFM*

*e**Content**plus*

---

[1] OJ L 79, 24.3.2005, p. 1.

Table of Content

1. Introduction

The project **Plan4all** is focused on the harmonisation of spatial planning data based on the existing best practices in EU regions and municipalities and the results of current research projects. The project involves detailed description and summarising of the current situation and standards, proposal, testing and implementation of spatial planning metadata profile, common data model and harmonisation procedures. The important part of the Plan4all project is networking standards of spatial planning data, based on previously collected and analysed experiences, and then defining common procedures and methodologies for spatial data sharing and utilisation of new pan-European standards for spatial planning data within the EU.

The expected results from Plan4all are European forums for SDI (Spatial Data Infrastructure) in spatial planning, a database and analysis in terms of organisation, sharing, and harmonisation and SDI recommendations for spatial planning.

Spatial planning is a holistic activity that is not directly addressed by INSPIRE Annexes, nevertheless it is one of the most spatial data driven activity. In the last few years, due to the massive use of digital data for producing "plans" in different scales, public authorities, mainly at national and sub-national (local) level, demonstrated interest and put in place efforts to harmonise data used in spatial planning in order to compare different policies and planning maps. The way how to perform this harmonisation and interoperability varies from country to country and from region to region of the same country spanning from using a common legend and a unique base cartography to using common data models, neutral exchange formats. It is wise to note that most of initiatives of mentioned harmonisation of spatial planning data took place in the framework of *e*-government applications.

The Plan4all will focus also on implementing the INSPIRE Directive into spatial planning processes, mainly based on building spatial planning data models and metadata profiles.

1.1 Scope

The aim of the Work Package 2 "State of the art analysis" is to analyse the current status in spatial planning, used technologies, INSPIRE requirements and also identify the requirements that will affect the specialization and implementation of spatial planning SDI.

The present deliverable D2.3 "Analysis of INSPIRE requirements" provides an implementation-neutral and INSPIRE oriented set of recommendations for the modelling concepts for geographic data and metadata which will be further developed in WP3 and WP4.

Moreover, in order to consider all the present aspects, constraints and possible evolutions of the spatial planning in Europe, the outcomes of the present document are to be considered complementary to those coming from other deliverables of WP2, especially deliverable D2.4 "Analysis of user requirements on planning systems": Other useful inputs can be derived from the results of the survey done in task 2.2 "Identification of innovation challenges and a framework structure for analysing relevant technology developments and trends".

1.2 History of the document

The deliverable was originally titled "INSPIRE requirements analysis and capacity building". Since the issue of the capacity building is addressed by task 2.1 of WP2, for the sake of clarity it has been proposed to amend the title of the deliverable to "INSPIRE Requirements

Analysis". This has been discussed and agreed with WP2 leader and WP2 task leaders, the project coordinator and the project officer.

Nevertheless, since the capacity building has to occur throughout the project at different levels for different topics, the document contains a short annotated reading of INSPIRE in order to provide capacity building on this specific topic.

The type of analysis to be conducted by the all partners involved in the task 2.3 of WP2 was already announced during the project kick-off meeting in Prague. This activity is aiming to produce as much as concrete results out of the analysis of documents already produced by INSPIRE and other related projects and to be used for further considerations and decisional activities.

Regarding the number and the type of documents it has to be noted that they have been chosen according to two criteria: some of them have been proposed by the task leader and some others have been proposed by the partners involved. The list has been considered consistent in terms of dedicated resources and in terms of fully representing the reference documents on which to build the analysis and to draft the conclusions to be transmitted to other work packages and to the project as a whole.

The analysis of the previous documents originated some conclusions and overall comments that have been opportunely treated in order to reach some intermediate results. These actions have been specifically performed and carried out before, during and after the WP 2 meeting in Schwechat, Austria in September 14-15 2009.

Subsequently, mainly key partners of the task and the leader have reconsidered some parts of the document in order to achieve a real draft version to share with all partners and to treat through an internal validation seminar held almost one month before the dead line of the deliverable. The seminar has been organised by the task leader and managed accordingly to the project coordinator.

1.3 Seminar with external experts

The Seminar was held in Rome in October 5th and 6th 2009 with the participation of six external experts[1]. All of them commented on the deliverable and on work package 2 as a whole and two of them presented the specific case of SDI and related spatial planning issues for Finland and Netherlands. It has to be pointed out that all the experts have been chosen according to their specific skills of knowing the thematic issues of the spatial planning and with a strong knowledge of INSPIRE.

The comments addressed by the experts dealt with general recommendations in order to make a better deliverable and in order to consider some methodological aspects in the recommendations to be addressed by the report for further development within the project.

The main general and methodological issues which have been addressed and pointed out during the discussion may be summarised in the following items:

- In spatial planning, it is absolutely fundamental to take into consideration the flow of data, information and cartography from the local (regional, province, township,..) level to upper level (national, etc.) and vice versa;

---

[1] The experts are: Zorica Nedovic-Budic (Univ. College Dublin), Stan Geertman (Univ. Utrecht), Michele Campagna (Univ. Cagliari), Paul Janssen (Geonovum), Pawel Decewicz (CGP), Gábor Remetey-Fülöpp (HUNAGI), Matti Holopainen (ALFRA).

- The previous point has so much relevance that may represent a bottleneck for applying INSPIRE principles and praxis;

- The scale (in terms of pure cartographic parameter) is strongly affecting data exchange and interoperability;

- The scale (in terms of an overview consideration of land and territory characteristics) is a fundamental aspect which involves the planning process based on national regulations. It also strongly affects the interchange of data and GI;

- Metadata play a key role as facilitators of data interchange among institutions;

- Metadata may also help to address the scale issues of data;

- Together with geo-information and cartographic data for spatial planning purposes the textual information are absolutely relevant. It may be easily considered that GI = Cartographic data + Text in the dominion of spatial planning;

- Textual component should be considered in wide sense and finalised to different users which span from planners to citizens and developers;

- Textual information has to be georeferenced;

- Some local authorities (even supported by some national policies) use the map as an interface with the final user;

- INSPIRE is seen in some situations as facilitator for opening the process of using data by entities other than the data producer or owner. This process is making more possible the development of collaboration between the private and the public sectors;

- The spatial planning is indeed very much connected with the planning process which has its own performance according with the national situations where it performs;

- The planning purpose has been absolutely recognised as out of scope of the Plan4all project nevertheless to have in the background it has been recognised useful for achieving sustainable results;

- The very difficult problem is that each Member State uses its own process in planning as it is related with administrative, legal, economical and societal aspects of each country;

- A particular interesting idea originated within the meeting suggested to use Plan4all findings, when available, for supporting the work performed by public administrations and users in every day life for achieving INSPIRE in his totality;

- It has been strongly suggested that the project takes into account other EU directives such as the Public Sector Directive and other more technical directives such as on the environmental issues, the noise pollution and others;

- The cross border aspects have been outlined as particularly relevant and that on which the project may demonstrate how useful is to use INSPIRE approach for spatial planning;

- It has been also emphasised that the project may have a substantial value in demonstrating at national level how to insure the flow of data between different levels and clusters of the administrations;

- Plan4all should also be able to give a clear outlook of data liability as they are utilised for spatial planning in public administrations;

- Connected with some previous listed points dealing with textual information linked to GI, Plan4all has been considered as a potential tool for insuring transparency in the planning chain;

- All the seven themes which Plan4all is focussing on have been recognised absolutely attuned and fully descriptive of the spatial planning;

- Specifically the theme "Land Use" (Annex 3 of INSPIRE) and "Land Cover" (Annex 2 of INSPIRE) have been considered absolutely relevant but, at the same time, highly complex. This does not make trivial to treat these themes in terms of activities foreseen within the project (metadata and data modelling);

- A clear link between the cadastre and spatial planning has been addressed;

The peer experts have addressed some other issues and recommendations. They are mainly referred to how to maximize the results of the analysis conducted in Annex 1 and 2 of this deliverable (D 2.3) in order to make them more clear and more effective for further usage within the project itself. Comments and recommendations have been bundled into the final version of the deliverable.

1.4 Content

This document is organised as follows. Chapter 1 provides the rationale of the deliverable through an introduction, a scope and a document history. Chapter 2 deals with the methodology used to create the deliverable, along with short synthesis of the analysis activity. Chapter 3 provides short annotated readings of INSPIRE. Chapters 4 and 5 deal respectively with recommendations for metadata profiles and recommendations for data models coming from INSPIRE. Chapter 6 provides some hints and recommendations coming from the analysis of other relevant documents (INSPIRE related projects and/or spatial planning projects and initiatives). Chapter 7 provides some thoughts about terminology. This deliverable has also two annexes providing respectively the list of analysed documents and the analysis sheets. The annexes are provided as separated documents.

2. Methodology

A collaborative methodology for sharing views and results among the partners has been used, along with an external consultation activity through the seminar on October 5th and 6th jointly organised in Rome by the task leader EUROGI and all the task leaders involved in WP2.

One aspect has to be taken into consideration: INSPIRE is at the moment an evolving process, especially as far as technical implementing rules are concerned.

This implies that the results of the present deliverable should be considered as a still picture of the state of the art and that this specific project has to be considered for the specific support that it gives to challenge and clarify some of the data themes of INSPIRE Annexes.

The entire process of producing the deliverable, according to the decisions of the consortium, has been performed through the internal web site - WIKI. This gave great opportunities to manage the feedbacks and to foster the interactions among the partners.

2.1 List of analysed documentation

The list of the analysed documents is contained in the Annex 1. Three types of documents have been analysed and further considered for the outcomes of this deliverable:
- documents originated by INSPIRE:
  - Approved;
  - Not yet approved;
  - In progress;
- documents originated by INSPIRE related projects, mainly under the aegis of the *e*ContentPlus programme;
- documents originated by other projects and or initiatives related to spatial planning.

2.2 Preliminary analysis sheets

According to what has been presented during the kick-off meeting, twenty three documents (see Annex 1) have been analysed through the application of a common format composed of some descriptive items and of a SWOT table for the evaluation of the document itself and for the extraction of the most useful to be inserted in the final recommendations.

The outcomes of this activity are enclosed in the Annex 2. They represent a valuable result containing the findings of the analysis performed by various partners having different peculiarities and interests.

2.3 Synthesis of the analysis

According to what already said before the documentation analysis produced the following outcomes according to the typology of the documents themselves:

- INSPIRE technical implementing rules:

  - technically consistent for IT;

  - thematically oriented for the data considered in the annexes;

  - some other documents (INSPIRE Feature Concept Dictionary and INSPIRE Glossary) aim to create a common (semantic) platform of understanding;

- clear and mandatory for Member States;

- neither a TWG (thematic working group) and/or a DT (drafting team) is already established on one of the seven themes considered by the present project.

- INSPIRE related projects:

  - focussing on specific thematic aspects;

  - generally oriented to only treat the mandate data type (addresses, geo-names, etc.)

  - testing and/or implementing INSPIRE implementing rules;

  - representing good examples of focussed themes;

  - addressing some components of spatial planning (e.g. addresses, geo-names, etc.) neither of the seven themes considered by the PLAN4ALL project.

- Other documents:

  - giving a comprehensive view of the spatial planning activity ;

  - highlighting the multidisciplinary aspect of planning;

  - showing that the planning is deeply connected with the national and sub national situation and public administration efficiency.

The analysis has produced the following outcomes to be considered as recommendations for the project:

- interoperability of urban data bases is far to be achieved without a consistent effort at all levels (EU, national and even sub-national);

- at national and local levels the vocabulary of terms to be used within the planning activities is often self defined by each user. This generally produces relevant problems in terms of semantic interoperability;

- planning is an holistic activity which is addressed by INSPIRE in a complex way through his technical documents;

- the seven themes treated by the project may be considered together with other themes of INSPIRE annexes a sufficient covering of the entire dominion of the spatial planning but not exhaustive;

- spatial planning is one of the most spatial data oriented activity of public authorities. It demands base data and thematic data;

- the interoperability may be achieved on the base data and on thematic data;

- the services delivered to the citizens by the spatial planning are completely based on GI;

- spatial planning needs source data from different dominions and is delivering information to different final users;

- the time dimension is absolutely relevant in planning, representing often one of the most heavy limit;

- it is wise to consider to produce a metadata profile and a data model for each of seven data themes considered by the project, trying to keep them simple enough to be agreed and usable by the wider audience of stakeholders in the spatial planning domain.

3.   INSPIRE annotated reading for Plan4all

3.1   Foreword

In spite of the fact that the deliverable has evolved since the first version of the description of work and the capacity building aspect is addressed by other tasks and WPs, it has been considered valuable to have a brief commented presentation of INSPIRE.

The following may be used for the benefit of a better understanding of the present document and for giving valuable references for the reading and active utilisation of other deliverables of the project.

3.2   INSPIRE

With the acronym of "INSPIRE" we refer to the 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. The Directive entered into force on the 15th May 2007 and will be fully implemented by 2019.

The INSPIRE initiative started by the consideration that spatial information is fundamental to support Community policies, environmental policy in particular, and to fulfil environmental protection requirements. It is necessary to establish coordination in order to combine high quality information and knowledge from different sectors on different levels (administrative, cultural, etc.) and undertake policy-making in an integrated way. This is important to help in understanding the complexity and interactions between human activities and environmental pressures and impacts.

Since planning is a holistic activity of Public Administrations it matches the Communities policies, which are the core of the INSPIRE initiative.
Environmental policies are the priorities in INSPIRE point of view, but they coincide with many issues of Plan4all objectives.
Plan4all is a challenging test bed for INSPIRE.

The current situation of spatial information in Europe presents problems of fragmentation of datasets and sources, gaps in availability, lack of harmonisation between datasets in different scales and duplication of information collection, loss of time and resources in searching for needed data.

To address these issues INSPIRE establishes measures regarding the availability, quality, organisation, accessibility and sharing of spatial information at central level of Member States even if the involvement of various levels of public authority, across different sectors is taking place. Moreover INSPIRE is promoting an Infrastructure for Spatial Information in Europe and facilitating public access to spatial information across Europe, enabling much improved Community policy-making and implementation of Community environmental policies in the Member States.

The issues addressed by INSPIRE are common in the field of spatial information. The innovative aspects of INSPIRE include the cooperation of different actors with the involvement of both public and private sector. Relevant and challenging coordination among Public Administrations in different levels is in order to guarantee shared solution to improve and solve current problems.
The spatial planning continuously sees the involvement of different stakeholders (public, private, citizens, associations, etc.).

INSPIRE addresses mainly policy and activities that may have a direct or indirect impact on environment; there are also implications and overlaps with other activities, policies and initiatives which have complementary objectives (such as the Sixth Environment Action Programme adopted by European Parliament in 2002, the Directive 2003/4/EC of the European Parliament and of the Council on public access to environmental information, the Directive 2003/98/EC on reuse of public sector information, the Commission Decision 2000/479/EC on implementation of a European pollutant emission register, the Regulation No 2152/2003 of the European Parliament concerning monitoring of forests and environmental interactions, Community funded programmes and projects -like Galileo, GMES, etc., to mention just a few). The INSPIRE Directive intends to complement such initiatives by providing a framework that will enable them to become interoperable, and will also be built upon their experience not to duplicate the work that has been done.

Moreover it is open for use by and future extensions to other sectors such as agriculture, transport and energy.

The Directive applies to spatial data and services held by or on behalf of public authorities and used in the performance of their public tasks. Data must be in electronic format and must relate to one or more of the themes listed in Annexes I, II, III of the Directive. Subject to certain condition, it may apply to data held by third parties other than public authorities, if requested, or to natural or legal persons performing public administrative functions under national law.

The Directive does not require collection of new spatial data; it foresees that data should be collected only once and then stored, made available and maintained at the most appropriate level; the infrastructure should ensure that it is possible to combine data from different sources in consistent way and share them between users and applications. Data should be available (under condition), easy to be discovered and to be evaluated. The Directive does not affect the existence or ownership of public authorities' intellectual property rights.

Spatial planning generally utilises data already produced and is not in charge of producing new reference data.
Thematic data is the core of planning, therefore it seems important to concentrate on metadata of thematic cartography produced in the planning activities.
As far as new data collection is needed it seems obvious and wise that the data shall be designed and acquired according to INSPIRE requirements and guidelines. This process is expected to give to data modelling a more relevant role.

The main objective of INSPIRE is to establish a European Spatial Data Infrastructure (SDI), defined in the Directive as the "... *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 ...*"

INSPIRE does not establish new infrastructures, but it is based on infrastructures created by Member States that are made compatible by common Implementing Rules (IRs) and measures established at Community level, to guarantee compatibility and usability in the Community and in transboundary context.

Existing Spatial Data Infrastructures are valuable means to support spatial planning processes, especially in transboundary contexts, to enhance exchange of strategic data, to improve the use of impact assessment and evaluation of plans and provisions in spatial planning, with transparency and shared methodology.

Main provisions of the Directive concern metadata, interoperability, network services, data sharing and coordination measures.

Member States shall create Metadata for all the data and services related to spatial data themes contained in the Annexes, and they shall be compliant to Implementing Rules.

Interoperability measures mean the possibility 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; measures include aspects to be addressed in the Implementing Rules in order to ensure consistency between items of information, make it comparable, enable unique identification, and so constitute a common framework for data sets and services.

Network services include discovery services, view services, download services, transformation services, services allowing spatial data services to be invoked; for the purposes of services technical specification with minimum performance criteria shall be implemented based on Implementing Rules; those services should be easy to use, available to the public and accessible via the Internet or other means of communication.

Member States shall adopt measures for data and services sharing in its public authorities, and eliminate practical obstacles and restrictions, in order to improve access to data. Each Member State shall adopt measures and arrangements on sharing that may include licensing, charge, limitations, with compliance on implementing rules.

The devolution applied by each Member State to the sub-national planning originates different situations in each country (authority for regional or local planning versus national planning.
Measures provided by INSPIRE intend to overcome the differences that may limit the coherence of Spatial Data Infrastructures.

Coordination and complementary measures should be designated by Member States, with appropriate structures and mechanisms, in order to coordinate different levels, stakeholders and contributions; each Member State shall designate a contact point to be responsible for contacts with the Commission in relation to the Directive. The role of the contact points is to provide results about the transposition of INSPIRE in National legislation and will also be responsible for providing regular information about the implementation of INSPIRE in their country and report on behalf of the Member State to the Commission.

3.3   Implementation of the Directive

The INSPIRE Directive represents a common framework, addressed to the Member States, whose purpose is to align national legislation and achieve a joint result. All Member States have to transpose the Directive into national laws, and have freedom in the form and method to adopt and to realise the Community objective, based on internal legal order.

Thus, after the Directive came into force, many documents, surveys, preparatory works, specifications, guidelines and arrangements have been settled and are going to be settled to constitute the base for the future implementation of the national initiatives.

The European Commission has the implementing power to lay down the measures necessary for the implementation of the Directive. In particular, the Commission is empowered to adopt Implementing Rules laying down technical arrangements for the interoperability and harmonisation of spatial data sets and services, rules governing the conditions concerning access to data sets and services, as well as rules concerning the technical specifications and obligations of network services.

Since such measures are of general scope and are designed to supplement the Directive by the addition of new non-essential elements, they are adopted with regulatory procedure with scrutiny.

The Implementing Rules are being developed taking into account the broader international context in the field of spatial data infrastructures and e-government, as well as the many initiatives, operational experiences, international agreements and protocols, relevant user requirements, existing initiatives and international standards, as well as feasibility and cost-benefits studies already in place across the many thematic and geographical communities having a stake in the development of INSPIRE.

INSPIRE represents a solid and robust background on which to build 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. The planning process has to be considered a separate issue out of direct scope of INSPIRE.

Implementing Rules focus on the five specific areas:

- **Metadata**: the Directive requirements on metadata are the most urgent, as is asked to Member States to ensure that metadata for datasets corresponding to the themes listed in Annex I and II are created no later than two years after the date of adoption of the Metadata Regulation (03/12/2010), and no later than five years in case of dataset corresponding to the themes listed in annex III (03/12/2013). The Commission Regulation on Metadata was adopted on 03/12/2008, and entered into force on 24/12/2008. A guidance document based on ISO 19115 and ISO 19119 has been issued by the Commission, and metadata editor has been made available through the INSPIRE Geoportal;

- **Data Specifications**: Data specifications refer to design of harmonised rules for interoperability of spatial dataset and services. The process for developing data specifications involves a number of stakeholders, with many interactions and consultations, and follows a two-step approach:

  - 1) Development of conceptual framework and specification methodology. This work resulted in a Generic Conceptual Model (GCM) and a Methodology for Specification Development;

  - 2) Development of data specifications for each data theme listed in the Annexes of the Directive. This work is going to be carried out based on the conceptual framework and specification methodology.

    So far on 14/12/2009 it is expected the submission for opinion of the INSPIRE committee of Implementing Rules for the interoperability of spatial data sets and services for Annex I spatial data themes. By 14/12/2012 it is expected the submission for opinion of the INSPIRE committee of Implementing Rules for the interoperability of spatial data sets and services for Annex II and III spatial data themes. A series of relevant documents has been issued by the Data Specifications Drafting Team;

- **Network Services**: network services include: discovery services, view services, download services, transformation services and services allowing spatial data services to be invoked. These are required for sharing spatial data between the various levels of public authorities in the Community; they should make possible to discover, transform, view and download spatial data and to invoke spatial data and e-commerce services. Network services may have a stimulating role helping in the development of added-value services of third parties by improving access to spatial data that extend over administrative or national borders. A series of relevant documents has been issued by the Network Services Drafting Team;

- **Data and Service Sharing**: Data and service sharing consist of all those measures that enable the spatial data infrastructure to work in profitable way. The operations to lay down Implementing Rules have started in 2008, and a Draft Implementing Rule on INSPIRE Data and Service sharing has recently been commented by SDICs and LMOs and then has passed the consultation with the Regulatory Committee and became a draft Commission Legislation. A Draft Regulation regarding the access to spatial data sets and service under harmonised conditions has been issued by the Data and Service Sharing Drafting Team: the adoption of the regulation is expected by December 2009;

- **Monitoring and Reporting**: Implementation of the Directive and future evolution requires continuous monitoring of the implementation of the Directive itself and regular reporting. Thus, the activities of the Drafting Team have started with the entering into force of INSPIRE Directive, and will follow its implementation. The implementation of provisions for monitoring and reporting is expected by May 2010.

Implementing rules address 34 spatial data themes needed for environmental applications. Spatial data themes are divided into the three annexes:

- **Annex I:** Coordinate reference systems, Geographical grid systems, Geographical names, Administrative units, Addresses, Cadastral parcels, Transport networks, Hydrography, Protected sites;

- **Annex II Themes**: Elevation, Land cover, Orthoimagery, Geology;

- **Annex III Themes**: Statistical units, Buildings, Soil, Land use, Human health and safety, Utility and Government services, Environmental monitoring facilities, Production and industrial facilities, Agricultural and aquaculture facilities, Population distribution – demography, Area management/restriction/regulation zones and reporting units, Natural risk zones, Atmospheric conditions, Meteorological geographical features, Oceanographic geographical features, Sea regions, Bio-geographical regions, Habitats and biotopes, Species distribution, Energy resources, Mineral resources.

Almost all the themes listed in the INSPIRE Annexes, for their general character, are valuable for spatial planning. Anyway, as stated in the Description of Work, Plan4all will focus on seven of them.

The Implementing Rules are adopted as Commission Decisions or Regulations:
- A decision is the instrument by which the Community institutions give a ruling on a particular matter; is an individual measure, by which institutions can force or forbid a particular action and the persons to whom it is addressed (a Member State or a citizen of the Union) must be specified individually. Decisions are adopted by the Council, by the Council in conjunction with the European Parliament or by the Commission;

- A Regulation is a general measure that is binding in all its parts; unlike directives, which are addressed to the Member States, and decisions, which are for specified recipients, regulations are addressed to everyone. A regulation, after its adoption by the Council in conjunction with the European Parliament or by the Commission alone, is directly applicable, which means that it creates law which takes immediate effect in all the Member States in the same way as a national instrument, without any further action on the part of the national authorities.

At the beginning of the process of adoption of Implementing Rules, Draft Implementing Rules are subject to stakeholder and/or public consultation, before the Commission submits

the proposals for Implementing Rules to the Regulatory Committee envisaged by the Directive.

The adoption of Implementing Rules follows the so called "Comitology procedure", that provides for the Commission to be assisted by a Regulatory Committee in the process of adopting such rules.

The Committee (the "INSPIRE Committee") is composed of representatives of the Member States and chaired by a representative of the Commission; they enable the Commission to establish dialogue with national administrations before adopting implementing measures. The Commission ensures that measures reflect as far as possible the situation in each of the countries concerned. Implementing Rules are binding in their entirety.

3.4   The INSPIRE transposition and implementation phase

The INSPIRE transposition and implementation phase started in 2007 and will last until 2019.

By the adoption of the Directive, all the stakeholders involved in the process of INSPIRE implementation are working to lay down common Implementing Rules for each area of interest. Next steps include the adoption of Implementing Rules, the transposition of the Directive into national legislation of Member States and the application of measures of Implementing Rules for the Spatial Data Infrastructures components.

Plan4all will contribute to the definition of data models and metadata profiles for some of the spatial data themes listed in the INSPIRE Annexes from the spatial planning point of view.
Furthermore, Plan4All may be recognised as the thematic network in charge of defining the draft definition for an important part of annex III theme 4 (future land use). Some of the consortium members representing the planner community and representing the GI community are central to that role.

4. Definitions and scope of the seven INSPIRE data themes focused by Plan4all

The following section provides a brief description of the seven INSPIRE data themes relevant to Plan4all. The information are derived from INSPIRE "D2.3 Definition of Annex Themes and Scope v3.0": refer to that document for a more comprehensive description of the themes. INSPIRE D2.3 provides a list of bibliographic references: these are not listed here, but could be taken into account in WP3 and WP4 as valuable reference material.

4.1 Land Cover

- **Definition:** Physical and biological cover of earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies;

- **Description**: land cover is a physical or biological description of the earth surface. It is different from the land use, which is dedicated to the description of the use of the earth surface. Land cover information has to be homogeneous and comparable between different location in Europe;

- **Scope, use examples**:
  - policies from European Community and UN (e.g. International Convention on Climate Change, Water Framework Directive, Convention for Biological Diversity, etc.);
  - some use examples by policy framework:
    - Regional Planning/ESDP, ESPON, Structural Funds: assessing impacts of policy against regional development perspective;
    - Implementation of Common Agricultural Policy: rural development, agri-environmental measures;
    - Environmental policy/Water Framework Directive: integrated watershed analysis;
    - ...
  - some examples of European/International classification schemes: CORINE (Coordination of Information of the Environment), LCCS (Land Cover Classification System);

- **Important feature types**: (examples based on CORINE for illustrative purpose only):
  - Artificial surfaces (Urban fabric – Industrial, commercial and transport units – Mine, dump and constructions sites – Artificial, non-agricultural vegetated areas);
  - Agricultural areas (Arable land – Permanent crops – Pastures)
  - Wetlands (Inland wetlands – Maritime wetlands)
  - ...

- **Important attributes:** Area, perimeter, land cover type

- **Links and overlaps with other themes**: Orthoimagery, Land use. 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, Oceanographic geographical features.

4.2 Land Use

- **Definition:** Territory characterised according to its current and future planned functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational, etc..);

- **Description**: land regulation is the general spatial planning tool at regional and local levels. Land use may be ordinary mapping of existing functions as well as plans describing how land may be utilised at present and in the future;

- **Scope, use examples**: many of the management and planning activities at local level require detailed data. The level of accuracy varies: the need for accurate data is higher in urban or built-in areas and lower in rural and natural/semi-natural areas. Land use is important for impact assessment and monitoring of implementation of policies and legal instruments for sustainable management of the environment. Land use is important for policies such as the Water Framework Directive, the Integrated Coastal Zones Management and for activities such as the Environmental Impact Assessment and the Strategic Environmental Assessment;

    - example of classification schemes: ISIC[3] (International Standard Classification of All Economic Activities)

- **Important feature types**:

    - Boundary of plan/regulation;
    - Land use category area;
    - Land use regulation area;
    - Land use restriction area;
    - Elements within a plan (road boundaries, building boundaries, ...)

- **Important attributes:** land use category, land use regulation category, land use restriction category, present/existing or proposed/future, legal reference, date of entry into force, <u>link to text regulations for each area</u>;

- **Links and overlaps with other themes**: Cadastral Parcels, Hydrography, Transport Networks, Protected Sites, Land Cover, Buildings, Human Health and safety, Utility and governmental services, Production and industrial facilities, Agricultural and aquaculture facilities, Population distribution, Are management/restriction/regulation zones and reporting units, Natural risk zones, Habitats and biotopes, Energy resources, Mineral resources.

4.3 Utility and Government Services

- **Definition:** includes utility facilities such as sewage, waste management, energy supply and water supply, administrative and social governmental services such as public administrations, civil protection sites, schools and hospitals;

---

3 http://unstat.un.org/unsd/cr/registry/isic-4.asp

- **Description**: a very broad theme including different types of objects such as utility services/networks (pipelines for transport of gas, water, oil, sewage, transmission lines for electricity, phone, cableTV), waste treatment facilities and waste storage, environmental protection facilities (sewage/waste treatment sites, anti-noise constructions, facilities against natural hazards), administrative and social governmental services (policy stations, fire fighter stations, hospitals, health care centres, schools, public administration offices);

- **Scope, use examples**: land use planning and risk management (e.g. Seveso II directive). Information about environmental protection facilities is useful for evaluation of policies, indicators development and generally on reporting of environmental issues. Administrative and governmental facilities are used by citizens and in public administration activities and in planning.

- **Important feature types and attributes:** a series of feature types and attributes for each type of information (utilities, waste, administration and governmental facilities) are provided in INSPIRE D2.3 (refer to that document);

- **Links and overlaps with other themes**: Hydrography, Buildings, Land use, Environmental monitoring facilities, Production and industrial facilities, Energy resources.

4.4   Production and industrial facilities

- **Definition:** Industrial production sites, including installations covered by Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control[4] and water abstraction facilities, mining, storage sites;

- **Description**: Location of production industries, mines, waste/disposal sites and energy production facilities. Concerning industries these may be chemical, hydrocarbons, mines or any other industry. Usage of PRTR[5] categories is relevant as common nomenclature for such facilities. Kinds of production/industrial facilities are: industrial sites, nuclear installation locations, energy resource extraction and production sites, mines;

- **Scope, use examples**: needed in modelling and assessment of pressures on the environment, in land use planning, in risk and hazards management. Needed at all geographic levels, from Europe to local;

- **Important feature types and attributes:** a series of feature types and attributes for different types of facilities are provided in INSPIRE D2.3 (please refer to that document);

- **Links and overlaps with other themes**: the datasets addresses in this theme may overlap with other themes and borders between themes should be identified. Particular care towards: Land Use, Agricultural and aquaculture facilities (closely related),

---

4   OJ L 257, 10.10.1996, p.26 Directive as last amended by Regulation EC No 1882/2003

5   http://www.prtr.net/ and http://www.bipro.de/__prtr/documents/e-prtr_regulation.pdf

Utility and government services, Environmental monitoring facilities, Buildings, Addresses, Energy resources, Mineral resources.

4.5 Agricultural and aquaculture facilities

- **Definition:** farming and production facilities, including irrigation systems, greenhouses, and stables;

- **Description**: farming facilities are constructions used in agricultural production, defined to include cropping of annual crops or perennials and rearing/breeding of animals. Forestry in general is probably not included, but intensive forestry plantation on former fields may be included. Facilities may be classifies according to the NACE 1.1[6]: the ISIC system for classification of industrial sites may also be relevant. Aquaculture facilities include productions and treatment facilities for fish, mussels, seaweed, and the like. It does not include permanent or semi-permanent systems for the breeding of the organisms;

- **Scope, use examples**: Important for local land use planning, agricultural and water management, environmental impact assessment;

- **Important feature types and attributes:** these facilities may have an exact location of site (point area). Objects may be spatially expressed as points, but if the production area is substantial, area coverage may be relevant.

  - Attributes for agricultural facilities and for aquaculture facilities: classification systems, kind of facility, role of facility in production system, kind of production, kind of emission (different substances), quantity of emission (different substances);

- **Links and overlaps with other themes**: Buildings, Addresses, Hydrography (for irrigation systems), Land Cover, Land Use, Production and industrial facilities, Environmental monitoring facilities.

4.6 Area management/restriction/regulation zones and reporting units

- **Definition:** areas managed, regulated or used for reporting at International, European, national, regional and local levels. It includes dumping sites, restricted areas around drinking water resources, nitrate-vulnerable zones, regulated fairways at sea or large inland waters, areas for dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, relevant reporting units and coastal zone management areas;

- **Description**: a wide range of management areas from any sector, e.g. environmental, transport, health, education, energy, fisheries, agriculture, not already being covered by the INSPIRE theme "Administrative units";

6http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_CLS_DLD&StrNom=NACE_1_1&StrLanguageCode=EN& StrLayoutCode=HIERARCHIC

- **Scope, use examples**: reporting and statistical presentations. OSPAR reporting units at sea, Biogeographic regions;

- **Important feature types and attributes:**

  - Attributes for management regions: sector, sub-sector, management activity type, responsible organisation, year of verification;

- **Links and overlaps with other themes**: Administrative units, Transport networks, Hydrography, Geology, Statistical units, Land use, natural risk zones, Sea regions, Biogeographical units, Mineral resources, Energy resources.

4.7   Natural risk zones

- **Definition:** vulnerable areas characterise according to natural hazards (all atmospheric, hydrological, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to affect society), e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions;

- **Description**: "natural risk zones" are zones where natural hazards areas intersect highly populated areas of particular environmental/cultural/economic value. Risk is defined as:

  risk = hazard * probability of occurrence * vulnerability

  The internationally agreed terminology (UNISDR - International Strategy for Disaster Reduction)[7] on disasters should be adopted for this theme. Examples of natural hazards to deal with are: Areas prone to flooding by inland waters and lakes, Areas prone to flooding by spring tide/exceptional sea level rise, Earthquakes, Volcano eruptions, Mud slides – land slides – quick clay soils slides, Areas prone to mountain blocks slides and stone slides, Areas prone to snow slides – avalanches, Area susceptible to forest – bush – grassland fires, Area of installations prone to storms – wind damages, Coastal erosions, Radon areas;

- **Scope, use examples**: data and services about natural hazards and risk zones are of paramount importance for efficient risk management. The aim is to minimise risks by making the society more resistant to hazards, either by minimising threats or by regulation of land use and production activities susceptible to the hazards. Risk analysis is the basis for all work on planning and living with natural and technological hazards. Possible forms of usage are:
  - Reporting, indicators, trends, overall policy development;
  - Susceptibility analysis, mapping and prediction;
  - Physical and sector disaster-prevention planning;
  - Emergency operations/disaster response;

- **Important feature types and attributes:** see INSPIRE D2.3 for details;

---

7 http://www.unisdr.org/

- **Links and overlaps with other themes**: 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, Environmental protection facilities, Meteorological geographical features, Oceanographic geographical features.

5. Recommendations for Metadata

The main goal of the Plan4all is the implementation of the INSPIRE Directive into spatial planning processes. On the metadata level the project will focus on metadata profiles for the following spatial data themes: (i) Land Cover; (ii) Land Use; (iii) Utility and Government services; (iv) Production and industrial facilities; (v) Agricultural and aquaculture facilities; (vi) Area management/restriction/regulation zones and reporting units; (vii) Natural risk zones.

The work of the INSPIRE Drafting Team on Metadata is mostly relevant for this task: reference documents for this chapter are the INSPIRE "Metadata Regulation" and the INSPIRE "Technical Guidelines based on EN ISO 19115 and EN ISO 19119 (Revised edition)". The content of the metadata profiles will be mainly that foreseen in chapter 8 – "Dataset level metadata" on the INSPIRE template for data specifications.

As far as metadata are concerned, Plan4all will work on two levels (figure 1):

- on one hand INSPIRE requirements claim for the definition of metadata elements on dataset level, for each spatial data theme (points (i) to (vii) above), in addition to the mandatory metadata elements set of the INSPIRE Metadata Regulation;

- on the other hand a main objective of the project is the definition of an overall spatial planning metadata profile derived from the metadata profiles on dataset level.
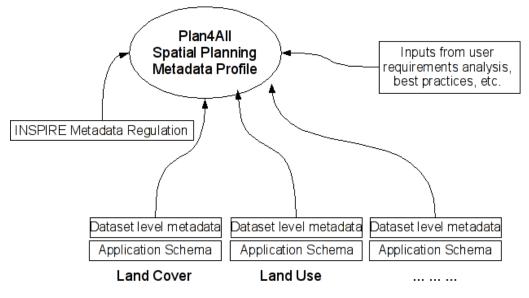

Figure 1: Plan4all and Metadata

The INSPIRE "Metadata Regulation" is mandatory for all spatial data themes of the INSPIRE Directive Annexes. The INSPIRE document "Technical Guidelines based on EN ISO 19115 and EN ISO 19119 (Revised edition)" provides technical guidelines for the implementation of the INSPIRE Metadata Regulation on the base of ISO 19115 (ISO 19115 and ISO 19115/Cor1:2006) and ISO 19119 (ISO 19119 and ISO 19119:2005/Amd1:2008). The document compares the core requirements of ISO 19115 against those of INSPIRE: the conclusion is that the conformance to ISO 19115 does not guarantee the conformance to INSPIRE.

On the other hand, it has to be said that the conformance to INSPIRE Metadata Implementing Rules does not guarantee the conformance to ISO 19115 (e.g. INSPIRE does not contains the ISO 19115 Core elements).

The technical guidelines provide a list of specific constraints on ISO 19115 required by INSPIRE (these constraints are not listed here, but need to be taken into account by WP3) and guidelines on how to use ISO 19139 (an ISO standard providing XML implementation of metadata) to implement ISO 19115, with a specific mention to multilingual aspects.

Unfortunately INSPIRE materials about metadata do not address some specific issues for the use of ISO 19139: ISO 19115 conditional obligations, for example, cannot be expressed using the XML Schema grammar. Annex A – Table A.1 of ISO 19139 provides a list of "Conformance Rules not enforceable with XML Schema".

The use of the ISO Standard Schematron[8] is suggested to enforce ISO 19115 obligations (Schematron is used, for example, in the Australian and New Zealand Metadata Profile[9]). The use of Schematron enables to address other kinds of restrictions required when working at metadata profiles (e.g. a more stringent metadata obligation)

---

8 http://www.schematron.com

9 http://asdd.ga.gov.au/profileinfo/

6. Recommendations for Data Models

The main goal of the Plan4all is the implementation of the INSPIRE Directive into spatial planning processes. On the data model level the project will focus on building data models for the following spatial data themes: (i) Land Cover; (ii) Land Use; (iii) Utility and Government services; (iv) Production and industrial facilities; (v) Agricultural and aquaculture facilities; (vi) Area management/restriction/regulation zones and reporting units; (vii) Natural risk zones.

The work of the INSPIRE Drafting Team on Data Specifications is mostly relevant for this task: reference documents for this chapter are the INSPIRE documents "D2.5 Generic Conceptual Model" and "D2.6 Methodology for the development of data specifications".

It is worth noting that the Plan4all will not issue complete data specifications for the cited spatial data themes: instead, it will focus on application schemas (mainly chapter 5 – Data Content and Structure of the INSPIRE template for data specifications)[10] from the spatial planning point of view.

6.1 The Generic Conceptual Model (INSPIRE)

The Generic Conceptual Model (GCM) is, from a modelling perspective, the common foundation for all theme-specific (Annexes I, II and III of the INSPIRE Directive) data specifications: every INSPIRE application schema shall import the definitions of the GCM as specified in the INSPIRE documents D2.6 "Methodology for the development of data specifications" and D2.7 "Guidelines for the encoding of spatial data".

The GCM is not a ready-to-use data model for INSPIRE, but a set of requirements and recommendations for theme data specifications and a set of base type for theme data models (application schemas according to the INSPIRE terminology).

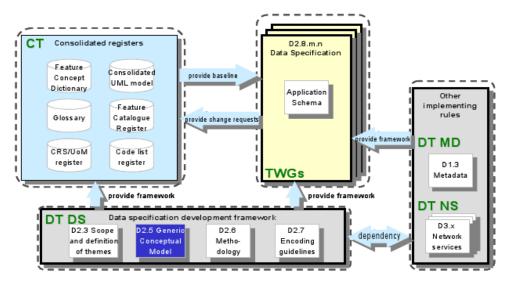The GCM is part of the INSPIRE data specification development framework, as shown in the figure 2.

Figure 2: GCM in the data specification development framework (from INSPIRE D2.5)

This means that the GCM is related, besides INSPIRE documents D2.3 "Definition of Annex Themes and Scope", D2.6 "Methodology for the development of data specifications" and D2.7 "Guidelines for the encoding of spatial data", to other documents and registers:

- the terms used in the GCM are drawn from the INSPIRE Glossary[11];

- application schemas shall be based on the GCM and maintained in the so-called "Consolidated INSPIRE UML model", that also includes external schemas such as those from ISO 19100 series;

- the "INSPIRE Feature Concept Dictionary Register"[12] is used to manage the names, definitions and descriptions of spatial object types used in applications schemas;

- other registers include coordinate reference system register, a feature catalogue register and a code list register;

- the implementing rules on metadata and associated guidelines;

- the implementing rules on network services and associated guidelines.

INSPIRE data specifications are the result of a data interoperability process based on existing data and, where available, user requirements and use cases.

It is worth stressing that there is a difference between harmonisation and interoperability. Data harmonisation within INSPIRE and the future ESDI (European Spatial Data Infrastructure) means that all Member States use a common set of coordinate reference systems, data models, classification schemes, portrayal rules, etc.; harmonisation on the specification level comprises also semantic aspects. Interoperability within INSPIRE is understood as providing access to spatial data sets through network services, independent of whether the existing data set is actually changed (harmonised) or just transformed by a service for publication in INSPIRE, depending on the approach taken by each Member State (INSPIRE D2.5 Generic Conceptual Model).

The GCM provides the INSPIRE interoperability framework, that consists of the following interoperability components:

(A) INSPIRE Principles	(B) Terminology	(C) Reference model
(D) Rules for application Schemas and feature catalogues	(E) Spatial and temporal aspects	(F) Multi-lingual text and cultural adaptibility
(G) Coordinate referencing and units model	(H) Object referencing modelling	(I) Identifier Management
(J) Data transformation	(K) Portrayal model	(L) Registers and registries
(M) Metadata	(N) Maintenance	(O) Quality
(P) Data Transfer	(Q) Consistency between data	(R) Multiple representations
(S) Data capturing	(T) Conformance	

Figure 3: Interoperability components (from INSPIRE D2.5)

These components cover different aspects that need to be taken into account in order to enable interoperability. They apply to all types of spatial data, including those with vector

---

11 https://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY

12 https://inspire-registry.jrc.ec.europa.eu/registers/FCD

representation and topological properties as well as coverages: however, the components will in general be different for different spatial representation types, and contribute in a different way to the spatial data interoperability.

The GCM builds on the ISO 19101 "Geographic information - Reference model" as reference model for data specifications and on the *General Feature Model* (GFM) of ISO 19109 "Geographic information – Rules for applications schemas" as the meta-model for developing conceptual models. The GFM is used as conceptual formalism (see next figure):
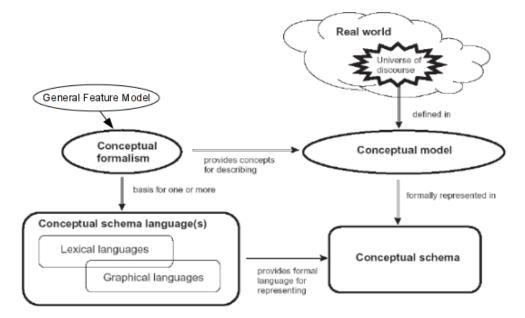

Figure 4: From reality to conceptual schema (adapted from ISO 19101)

The figure provides an illustration of the role of conceptual modelling for geographic information:

- a *universe of discourse* is a selected part of the "real world" that one is wishing to describe. This is done through the identification of spatial objects retained to be relevant for the mentioned selected part of the world, as well as their attributes and relationships. The result of the process is a so-called *conceptual model*;

- the *conceptual schema* is a rigorous description of a conceptual model, done through a *conceptual schema language* (i.e. UML);

- an *application schema* is a conceptual schema that defines how a universe of discourse shall be described as data and operations;

- a *conceptual formalism* (i.e. the *General Feature Model*) provides the rules, constraints, functions, processes and other elements that make up a conceptual schema language.

ISO 19101 provides two representations of spatial object type and their properties: an application schema and a feature catalogue. An application schema, expressed in a formal conceptual schema language, specifies the structure of a spatial data set (types of spatial objects, attributes, association roles, operations). A feature catalogue provides the same information of an application schema but in a textual form for human reading.

Both application schemas and feature catalogues are used in INSPIRE for different purposes:

- application schemas specify the structure of spatial data sets, in terms of types of spatial objects, their properties (attributes, relationships, operations) and constraints;

- a feature catalogue (in INSPIRE feature catalogues are automatically derived from the corresponding application schemas) is mainly a different (human readable and textual) representation of the information content of an application schema.

In INSPIRE application schemas and feature catalogues are complemented by the *Feature Concept Dictionary (*FCD). The FCD provides means to manage names, definitions and descriptions of spatial object types used in INSPIRE application schemas and features catalogues: this is a main instrument in support of cross-theme harmonisation of concepts in INSPIRE. Next figure shows the relationships among these elements:
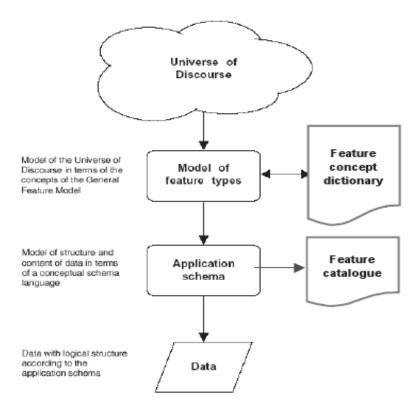

Figure 5: From reality to conceptual schema adapted from ISO 19109 for INSPIRE (from D2.5)

The INSPIRE GCM lists 74 requirements and 29 recommendations. All requirements and recommendations relevant for Plan4all should be considered in work package 4 of the project; here a subset of relevant and more general requirements is listed:

- *requirement 1*: every INSPIRE application schema shall import the definitions of the Generic Conceptual Model. This transitively means that also other external models (e.g. those of the ISO 19100 series of standards) will be imported;

- *requirement 2*: no concept shall be modelled as part of an INSPIRE application schema if it is competing with a concept already established as part of the Generic Conceptual Model;

- *requirement 3*: general terms and definitions in all INSPIRE data specifications shall be drawn from the INSPIRE Glossary. Terms that are important in the context of a theme, but which are not part of the INSPIRE Feature Concept Dictionary (see 9.3 of the GCM) shall be defined in the INSPIRE Glossary;

- *requirement 4*: the reference model specified in ISO 19101 shall be used as the reference model of the INSPIRE data specifications;

- *requirement 6*: every INSPIRE data specification shall be documented using the template given on http://www.ec-gis.org/inspire/ds/[13];

- *requirement 7*: linguistic text related to concepts proposed for adoption in the INSPIRE Feature Concept Dictionary shall be translated at least to all official languages of the European Union;

- *requirement 9*: every INSPIRE application schema shall conform to the General Feature Model as specified in ISO 19109 7.3-7.7;

- *requirement 10*: every INSPIRE data specification shall include one or more INSPIRE application schemas modelled according to ISO 19109 Clause 8, with particular attention to 8.2;

- *requirement 11*: every spatial object type specified in an INSPIRE application schema shall be drawn from feature type concepts in the INSPIRE Feature Concept Dictionary Register with status "valid" or proposed as a new register item when no adequate spatial object type already exists;

- *requirement 12*: if no related concept exists in the INSPIRE Feature Concept Dictionary Register, that can be reused or amended, a concept from another international feature concept dictionary or feature catalogue shall be reused and proposed for adoption in the INSPIRE Feature Concept Dictionary Register, if possible;

- *requirement 13*: spatial object types shall be modelled according to ISO 19109 7.1-7.2, 8.1, 8.5-8.9 and according to the additional rules in Clauses 9-12, 18, and 22 of the GCM;

- *requirement 14*: the profile of the conceptual schema defined in the ISO 19100 series that is used in the application schema shall conform with ISO 19109 8.4;

- *requirement 16*: basic types as specified in ISO/TS 19103 6.5 shall be used in an INSPIRE application schema, whenever applicable;

- *requirement 19*: every INSPIRE application schema shall be specified in UML, version 2.1;

- *requirement 20*: every spatial object type and its properties shall be shown in class diagrams in the UML package describing the application schema (or packages contained by that package);

- *requirement 21*: The use of UML shall conform to ISO 19109 8.3 and ISO/TS 19103 with the exception that UML 2.1 instead of ISO/IEC 19501 shall be used;

- *requirement 23*: to model constraints on the spatial object types and their properties, in particular to express data/data set consistency rules, OCL shall be used as described in ISO/TS 19103. In addition, all constraints shall be described in the application schema in English, too;

- *requirement 24*: in the case where a spatial object may change in a way where it is still considered to be the same spatial object and user requirements for the provision of life-cycle information for a spatial object are identified, the life-cycle information shall be part of the model of the spatial object type as specified in this sub-clause;

---

13 The link is broken. It is possible to use as a template the structure of any of the data specifications documents available at
http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2

- *requirement 27*: every INSPIRE application schema that distinguishes multiple versions of a spatial object shall require that different versions of the same spatial object shall not have different external object identifiers (see Clause 14 of GCM);

- *requirement 32*: the spatial object types of an INSPIRE application schema shall be represented in a corresponding feature catalogue;

- *requirement 33*: every feature catalogue shall contain the information specified in the corresponding application schema in accordance with ISO 19110 8;

- *requirement 36*: any specification of a coverage function in an INSPIRE application schema shall be in accordance with ISO 19123 and 9.2.3 (of the GCM);

- *requirement 39*: for all geographical names and exonyms the support for multilingual text in the INSPIRE application schemas shall be considered;

- *requirement 45*: code lists specified in or referenced from an INSPIRE application schema shall be multi-lingual and use a language-independent code for every entry in the code list;

- *requirement 46*: in every INSPIRE application schema, English shall be used for package, class, attribute and association role names;

- *requirement 53*: units of measurements shall be described using the model contained in ISO 19136 D.3.13;

- *requirement 56*: every spatial object type of Annexes I and II of the INSPIRE Directive shall receive a property of type "Identifier" (see 9.8.2), with cardinality "0..1" or "1", unless it is known that no requirement exists to identify or reference spatial objects of that type;

- *requirement 60*: where applicable, additional theme-specific metadata requirements and/or recommendations shall be specified in INSPIRE data specifications in conformance with ISO 19131 and the Implementing Rule on Metadata;

- *requirement 69*: multiple representations of the same real-world phenomenon shall be modelled explicitly in the application schemas.

6.2 Methodology for the development of data specifications (INSPIRE)

The INSPIRE document D2.6 - "Methodology for the development of data specifications" describes the process of developing data specifications. The process is shown in the figure 6 and briefly summarised below.
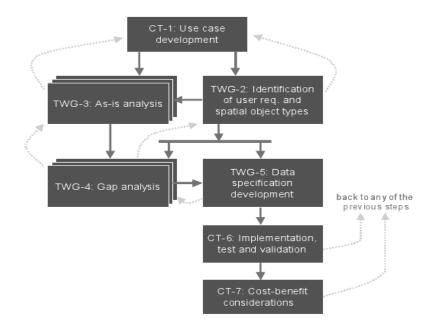

Figure 6: INSPIRE data specification development process (from D2.6)

1. Use case development (CT – Consolidation Team – and TWG-1 – Thematic Working Group): step results are: (i) use case descriptions done according to use case template given in Annex E of D2.6; (ii) Change proposal for the INSPIRE Glossary;

2. Identification of user requirements and spatial object types (TWG-2): step results are: (i) Change proposals for the INSPIRE Feature Concept Dictionary; (ii) "first cut" on the INSPIRE data specifications; (iii) list of requirements on data content, level of detail, relationships between spatial objects, data consistency, unique identifiers, metadata for evaluation, data quality. Resources for this task are: use case descriptions (CT-TWG-1), interoperability check-list (annex F of D2.6), and D2.3 "Description and scope of themes, the Feature Concept Dictionary;

3. As-is analysis (TWG-3): step result is the description of the current situation with respect to the data interoperability components. Resources are the use case descriptions (CT-TWG-1), requirements (TWG-2), check-list (annex F). The analysis is based on reference material submitted (by SDICs and/or LMOs) for data themes and existing interoperability and standardisation initiatives;

4. Gap analysis (TWG-4): the gap analysis compares the results of the as-is analysis against the first-cut data specification, and verifies if the source material of the as-is analysis enables to fulfil the data specifications. Step results are the description of data interoperability issues derived from user requirements and the as-is analysis, choice of harmonisation approach, analysis of reference material. Resources for this task are: use case descriptions (CT-TWG-1), requirements (TWG-2), check-list (annex F), and as-is analysis (TWG-3);

5. Data specification development (TWG-5): step results are: (i) candidate data specification; (ii) change proposals for the consolidated INSPIRE UML Model; (iii) change proposals for the INSPIRE Feature Concept Dictionary; (iv) change proposals

for the INSPIRE Glossary. Resources for this task are: requirements (TWG-2), as-is analysis (TWG-3), gap analysis (TWG-4), harmonisation approach (TWG-4), data specification template, first-cut data specification (TWG-2), consolidated INSPIRE UML Model, INSPIRE Feature Concept Dictionary, INSPIRE Glossary;

6. Implementation, test and validation (CT-6): draft data specifications created by TWGs are evaluated by the CT, the Drafting Team on Data Specifications, EIONET, SDICs, LMOs, and other relevant groups;

7. Cost-benefit considerations (CT-TWG-7): these considerations are done according to the document "INSPIRE data specifications Cost Benefit Considerations".

In developing application schemas the Plan4all **shall** take into account this process, at least from point 1 to 5: as far as point 1 above is concerned useful inputs can come from findings of the deliverable D2.4. "User Analysis Report".

D2.6 provides also a series of recommendations that shall be considered where relevant and applicable for the purposes of the project

7.   INSPIRE Networking Services

Commission regulation on INSPIRE Network Services (EC No 976/2009) was published on 19 October 2009[14] and will entry into force 20 days after its publication. In order to ensure that public authorities and the third parties are given the technical possibility to link their spatial data sets and services to the Network Services, the regulation defines the appropriate requirements for those services.

INSPIRE Network Services Architecture is based on the description provided in the INSPIRE document "D3.5 INSPIRE Network Services Architecture"[15]. At the core of the architecture are the INSPIRE Service Types: Discovery, View, Download, Transform and Invoke (these are described in more detail below).

INSPIRE Services have to be accessed via the rights management layer and may be accessed by applications and geoportals via the INSPIRE services bus.
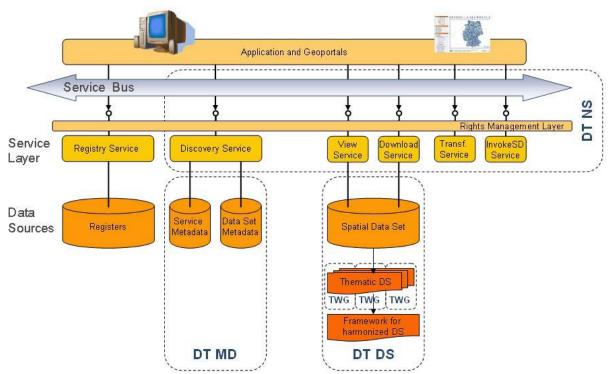

Figure 6: INSPIRE Services Architecture (from INSPIRE D3.5)

The text below provides a short description of basic Network Services:

- **Discovery Services**. The INSPIRE Directive asks Member States in article 11 (1) (a) to establish and operate a network of services for the discovery of spatial data sets and services "*for which metadata have been created*". "*Discovery services making it possible to search for spatial data sets and services on the basis of the content of the corresponding metadata and to display the content of the metadata*." Within the geographic information community various names have been assigned to instruments for discovering spatial data and services through the metadata properties; examples are Catalogue Services, Spatial Data Directory, Clearinghouse, Geographic Catalogue and Geodata Discovery Service. In INSPIRE these services are referred to as Discovery

---

14 COMMISSION REGULATION (EC) No 976/2009 of 19 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services

15 http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/network/D3_5_INSPIRE_NS_Architecture_v3-0.pdf

Services. The goal of discovery services is to support discovery of data, evaluation and use of spatial data and services through their metadata properties. Metadata is the information and documentation, which makes these resources understandable and sharable for users over time. Indexed and searchable metadata provide a controlled vocabulary against which discovery can be performed. INSPIRE Discovery Services shall provide the functionality for users both to manage and search catalogues for the purpose of discovery and evaluation within the context of the INSPIRE Directive. The network of services should also include the technical possibility to enable public authorities to make their spatial datasets and services available. The INSPIRE Directive specifies that Member States shall ensure that public authorities are given the technical possibility to link their spatial datasets and services to the network. This 'linking' service is also offered in the context of a discovery service as a capability of the discovery service[16]. No later than 9 May 2011, Member States shall provide the Discovery Services with initial operating capability. Not later than 9 November 2011, Member States shall provide the Discovery and in conformity with the Commission Regulation EC No 976/2009;

- **View Services**. The INSPIRE directive asks Member States in article 11(1) (b) to establish and operate "view services making it possible, as a minimum, to display, navigate, zoom in/out, pan or overlay viewable spatial data sets and to display legend information and any relevant content of metadata". Where public authorities levy charges for view services, the Member States shall ensure that e-commerce services (including rights management services) are available. The process of laying down implementing rules for the directive highlights the following aspects of a view service:

  - Nature of the Metadata
  - Common coordinate reference system
  - Temporal data dimension
  - View geometry selection
  - Multiple datasets view output format
  - Styling
  - Rights Management
  - Legend availability and handling
  - Correspondence between layers and INSPIRE themes
  - Multilingualism
  - Relationship with client applications

No later than 9 May 2011, Member States shall provide the View Services with initial operating capability. No later than 9 November 2011, Member States shall provide the View and in conformity with the Commission Regulation EC No 976/2009.

- **Download Services**. The INSPIRE Directive asks Member States in article 11(1) (c) to establish and operate a network of "download services, enabling copies of spatial data sets, or parts of such sets, to be downloaded and, where practicable, accessed directly". In addition, where public authorities levy charges for the download services, Member States shall ensure that e-commerce services (including rights management services) are available (arcticle 14(4)). A download service supports:

  - download of a complete dataset or datasets, or
  - a part of a dataset or datasets, and
  - where, practicable, provides direct access to complete datasets or parts of datasets.

---

[16] See for example http://portal.plan4all.eu/catalogue/?SID=&lang=eng

- Gazetteer like services are also covered by a type of download service.

In the context of INSPIRE and the scope of the Implementing Rules, datasets are restricted to the categories defined by the Annexes I-III (see Article 4), and for which metadata exist and are updated according to Article 5, and that spatial datasets are interoperable and harmonised according to Article 7-10. It is worth to note that the conceptual or application schema of the local or national spatial data set may and will often differ from the INSPIRE harmonised specification of the spatial object types in the data specification. In this case a download service may transform between the application schema of the spatial dataset and the harmonised schema on-the-fly, if possible, or a transformation service may be invoked. Alternatively, a member state may provide a download service based on derived datasets converted in advance of receiving the query. Search criteria need to support a variety of criteria, including spatial and temporal extents, metadata elements, and feature properties.

- **Transformation Services**. The INSPIRE Directive requires, in Article 11(1)(d), Member States to "establish and operate a network of transformation services, enabling spatial data sets to be transformed with a view to achieving interoperability". Transformation Service is a special case among the recognised INSPIRE service types, as its function is to help other services in achieving compliance with the relevant INSPIRE specifications. In many cases the functionality envisaged for a Transformation Service is recommendable to be embedded inside another service type. This can be justified both for performance and service robustness reasons and might be realised, for instance, in the form of a transforming View service or a transforming Download service. When regarded as an individual service instance, the Transformation Service is currently interpreted as a real-time Coordinate Transformation Service, chained with a Download Service for input data. This kind of Transformation Service is seen as a spatial data processing service, capable of transforming the input dataset from a Coordinate Reference System (CRT) into another.

- **Invoke Spatial Data Services**. The INSPIRE Directive asks Member States in article 11(1) (e) to establish and operate a network of "*services allowing spatial data services to be invoked*". In addition, where public authorities levy charges for invoke spatial data services, Member States shall ensure that e-commerce services (including rights management services) are available. The "Invoke Spatial Data Service" service allows defining both the data inputs and data outputs expected by the spatial service and define a workflow or service chain combining multiple services. It also allows the definition of a web service interface managing and accessing (executing) workflows or service chains. The "Invoke Spatial Data Services" service supports invoking individual (spatial) services as well as combinations of individual (spatial) services both synchronous and asynchronous, in service chains through a (web) service orchestration engine a.k.a. "workflow engine". The service chains are expressed in a standard (e. g. XML-based) notation that can be consumed by commercial as well as open-source orchestration engines from multiple sources. For spatial data services available on the Internet, the "Invoke Spatial Data Service" service will enable a user or client application to run them without requiring the availability of a GIS. This requires that a client application can discover the service, bind to it and invoke it. The orchestration/combination of Spatial Data Service with other services will require to precisely define the interactions between the services. Therefore, the interaction between the (spatial) services to be invoked is defined as a workflow or composite service in a standard notation (e. g. XML-based).

8. Other recommendations

This section provides a number of general comments, suggestions, recommendations that, although not directly related to the specific seven themes focused by Plan4all, are considered important and should be taken into consideration for future work of the project:

- The INSPIRE guidelines on the definition of a geographical grid system is not of major impact to Plan4All – but may have a few interesting usage areas once harmonized planning data are available across Europe alongside other spatial information. Planning data generalized into a geographical grid might be used to answer a great deal of statistical and analytical queries which are of major interest both on national and international (regional) level;

- While not directly concerned with harmonization of data models, the application of a unified CRS (Coordinate Reference System) on an abstract level introduces similar issues in the context of Plan4all. Planning data are commonly legally adopted according to a hard-copy with a given map projection. Subsequent re-productions of the planning data either at different scales and/or different coordinate systems alter the size and shape of planning areas and make the data invalid. The application of a joint CRS for presentation of planning data will therefore be something that has to happen at run-time and has to allow for the existence of local coordinate systems among content providers in order to secure the legality and usability of their local data holdings;

- Code lists, and related cross-language mappings, used in application schemas and metadata profiles should be managed at European level in order to ensure their coordinated management;

- In the reasonably assumption that many of the themes to be addressed by the project will deal with polygonal features it is wise to play a particular attention and explicitly express topological relationships. Some of such relationships, taken from D2.8.I.4 INSPIRE Data Specification on Administrative units – Draft Guidelines, are provided here as an example:
    - Administrative units at the same level of hierarchy must not overlap;
    - Gaps between administrative units are in principle not allowed. Boundaries of neighbouring administrative units have the same set of coordinates, within the specified resolution;
    - The border line that limits the administrative units shall correspond to the geometries representing the boundaries of this administrative unit;
    - The area boundaries must not have dangles, boundaries always divide different administrative units;
    - The geometry of an administrative unit shall be equivalent to the aggregation of geometries representing administrative areas which belong to this unit;
    - The border ring for aggregated administrative areas is equivalent to the boundaries of administrative units to which these areas belong.

- The project needs to remain focused on the agreed goals in function of the INSPIRE expectations. All the aspects related to the planning documents / regulation, processes and accessibility of planning-related services can be addressed within the existing scope of the project by incorporating the right terminology, concepts and relationships in the deliverables.
- It is recommended to strengthen the connection with the EU project HUMBOLDT.

This project is working on topics very relevant for Plan4all: definition of application schemas, definition of metadata profiles, definition of transformation rules for application schemas and metadata profiles, definition of transformation services. The process is based on scenarios: there is a specific sccenario on urban planning, but also the other scenarios can provide relevant input material;

- It is recommended to strengthen the connection with the EU project GIS4EU, mainly for the same reasons listed for HUMBOLDT;
- It is recommended to take into particular consideration the results of the EU project Orchestra, as an example of network services architecture.

9. Terminology

The process of developing data specifications (see INSPIRE document D2.6 - "Methodology for the development of data specifications", but also requirements 3 and 7 of INSPIRE D2.5) foresees in some step the possibility of modifications and/or additions to the INSPIRE Feature Concept Dictionary and to the Glossary.

This issue is crucial for the Plan4all in developing data models and metadata profile for the selected themes listed in the Description of Work, since:

1. on one hand spatial planning terminology is not shared or harmonised on either a European or a national level;

2. on the other hand the INSPIRE Feature Concept Dictionary and Glossary do not contain all relevant terms and concept needed for spatial planning.

A simple demonstration of the point 1, for example, is the result of the survey done in task 2.2 of the Plan4all: there are cases where partners from the same country have given different answers to the same questions. This is a clear demonstration of the drawbacks that can be encountered when terms and concepts are not clearly defined and shared.

In relation to the point 2, it has been carried out for this deliverable a simple comparative analysis of some terms coming from the survey questionnaire used in task 2.2 against the INSPIRE Dictionary and Glossary. The table 1 shows the result of this comparative analysis.

TERMS OF SURVEY	ITEM	ITEM CLASS	NAME	Definition source/ Reference citation	ITEM	ITEM CLASS	NAME	Definition source/ Reference citation
			INSPIRE FEATURE CONCEPT DICTIONARY				INSPIRE GLOSSARY	
Spatial planning								
resolution					62	general terms	resolution (scale)	
spatial data					64	general terms	spatial data	INSPIRE Directive
metadata					49	general terms	metadata	Directive 2007/2/EC
dataset					18	general terms	dataset collection data ISO 19115	ISO 19115:2005
aquaculture facilitites	22	theme	agricoltural and aquaculturalfacilities	Directive 2007/2/EC				
elevation	10	theme	elevation	Directive 2007/2/EC				
geology	13	theme	geology	EUROGEOSURVEY				
natural risk area	25	theme	natural risk zone	Directive 2007/2/EC				
area	167	spatial object type	area	INSPIRE generic concepual model				
biogeographic region	30	theme	biogeographical region	Directive 2007/2/EC				
geographical names				Directive 2007/2/EC	32	general terms	geographic identifier (label or code)	
trasportation (network)	187	spatial object type	trasport link (trasport network)	TWG TN				
vector data								
interoperability					42	general terms	interoperability	Directive 2007/2/EC
harmonising spatial data					10	general terms	data harmonisation	
planning data								
crossborder planning								
boundary		spatial object type						
base maps								
earth cover								
cadastre		spatial object type	cadastral parcel					
parcels		theme	cadastral parcels					
land use	17	theme		Directive 2007/2/EC				
stucture								
utilities								

Table 1: Comparative analysis: Survey Questionnaire vs INSPIRE Dictionary and Glossary

Bibliographic references

Arie Duindam *et all* State of Play of the Operational and Legally Bound Spatial Planning SDI in The Netherlands. GSDI 11 Conference[17]

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)[18]

Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata[19]

INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119 (Revised edition)[20]

Plan4all – W.P.2 – State of art Analysis – Survey

INSPIRE Registry – Glossary[21]

INSPIRE Registry – Feature Concept Dictionary[22]

INSPIRE Generic Conceptual Model (D2.5)[23]

INSPIRE Methodology for the development of data specifications: baseline version (D2.6)[24]

INSPIRE Guidelines for the encoding of spatial data (D 2.7)[25]

INSPIRE Definition of Annex Themes and Scope (D 2.3 Version 3)[26]

INSPIRE Draft Structure and Content Draft Structure and Content of the Implementing Rules on Interoperability of Spatial Data Sets and Services[27]

INSPIRE Network Services Architecture (D 3.5 version 3)[28]

INSPIRE Website – http://inspire.jrc.it

---

[17] www.gsdi.org/gsdi11/papers/pdf/129.pdf

[18] http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2007:108:SOM:EN:HTML

[19] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008R1205:EN:NOT

[20] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/metadata/MD_IR_and_ISO_20090218.pdf

[21] http://inspire-registry.jrc.ec.europa.eu/registers/GLOSSARY/items

[22] http://inspire-registry.jrc.ec.europa.eu/registers/FCD/items

[23] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.5_v3.1.pdf

[24] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.6_v3.0.pdf

[25] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/inspire_dataspec_D2.7_v2.0.pdf

[26] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf

[27] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/Draft_IR_Structure_and_Content.pdf

[28] http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/network/D3_5_INSPIRE_NS_Architecture_v3-0.pdf