PLAN4ALL – SPATIAL PLANNING DATA HARMONISATION ACCORDING TO THE INSPIRE DIRECTIVE

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Abstract

Spatial planning acts between all levels of government so planners face important challenges in the development of territorial frameworks and concepts every day. Spatial planning systems, the legal situation and spatial planning data management are completely different and fragmented throughout Europe. Nevertheless, planning is a holistic activity. All tasks and processes must be solved comprehensively 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 (GIT).

The Plan4all project focuses on the interoperability and harmonisation of spatial planning data. Plan4all is a European project and co-financed by the eContentplus programme of the European Commission. The aims are to define common procedures, methods and standards for spatial planning data management and sharing, to support holistic planning, to support the development of a European network of public and private actors from different levels as well as Spatial Data Infrastructure (SDI). Plan4all is based on existing best practices in European regions and municipalities and the results of current research projects. Plan4all focuses also on implementing the INSPIRE principles into the planning processes. Metadata profiles, data models and networking architecture are developed for seven selected themes from Annex II and III of the INSPIRE Directive. The directive provides common mechanisms for data sharing. The Plan4all standards enable to publish and share spatial planning data from pilot regions on the Plan4all geoportal (http://www.plan4all.eu). The expected results include European forums for SDI in spatial planning, database of best practices and analysis of best practices in terms of organisation, sharing, harmonisation as well as SDI recommendations for spatial planning. The whole sector should profit from the availability of understandable and more transparent planning information across Europe.

Keywords: Spatial planning, Harmonisation, INSPIRE, SDI, Metadata

1 THE NEED FOR HOLISTIC SPATIAL PLANNING

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). Spatial planning strongly influences our society on all levels as it addresses the environment where people live and work, the location of social and economic activities and the way in which processed resources are exploited. Spatial planning includes all levels of land use planning that are urban planning, regional planning, environmental planning, national spatial plans, and European/international cross-border planning.

Today's spatial planning practise is facing major challenges such as decentralisation – following regionalisation on the one hand and globalisation on the other hand, cross-border and transnational planning, vertical and horizontal integration, bottom-up approaches and involvement of multiple actors on different levels with different interests and intentions in the planning process. Often these ideas and concepts are difficult to apply because the legal situation in Europe is fragmented and planning laws are disjointed.

Even experts from one country might have problems to understand the planning regulations of the neighbouring country. Especially for investors and decision makers it is almost impossible to compare planning regulations across Europe. Traditionally, standardisation in spatial planning activities has been rather poor. 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 are characterising for the European situation in spatial planning (Plan4all D.2.1 and Plan4all D.2.2). The idea is not to have isolated information islands, where spatial planning ends at the "coastline", and where planning relevant data is produced and maintained to own standards or even no defined standards at all. Administrative borders should not be knowledge borders. The idea is to support the exchange of compatible spatial planning data and to support the access to the data. Access can be given starting from simply viewing the spatial data, up to even having the right to download it. 'Information islands' need to turn into 'information systems' and 'information infrastructures' that allow different kinds of user access to spatial data from various sources.

2 PLAN4ALL – THE CONTRIBUTION TO HOLISTIC SPATIAL PLANNING

2.1 Goals of Plan4all

Plan4all is a European project running from May 2009 until October 2011 and co-financed by the eContentplus programme of the European Commission. Plan4all focuses on interoperability and harmonisation of spatial planning data in Europe to support holistic spatial planning activities. Data harmonisation means that all member states use a common set of coordinate reference systems, data models, classification schemes, portrayal rules, etc. Interoperability is understood as providing access to spatial datasets through network services, independent from whether the existing dataset is actually changed (harmonised) or just transformed by a service for publication (Plan4all D.2.3 2009). The aim of Plan4all is to support the development of a European spatial data infrastructure (ESDI) and a European network of public and private actors from different levels, i. e. local, regional and national public bodies, stakeholders, ICT industry, organisations dealing with planning issues and regional development, universities and international organisations (see figure 1). The main objectives are to define the rules for European spatial planning data interoperability, to find consensus about harmonisation of spatial planning data, and to contribute to the establishment of an SDI. Plan4all is based on existing European best practises, the results of current research projects, the INSPIRE directive and the requirements of the users. INSPIRE is a European initiative regulating the development of a European spatial data infrastructure[1]. The directive 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 by common implementing rules to guarantee usability in the community and transboundary context.

[1] The acronym INSPIRE refers to the Directive 2007/2/EC of the European parliament and the Council of 14 March 2007 with the aim to establish an Infrastructure for Spatial Information in the European Community. The directive entered into force on 15 May 2007 and will be fully implemented in 2019.

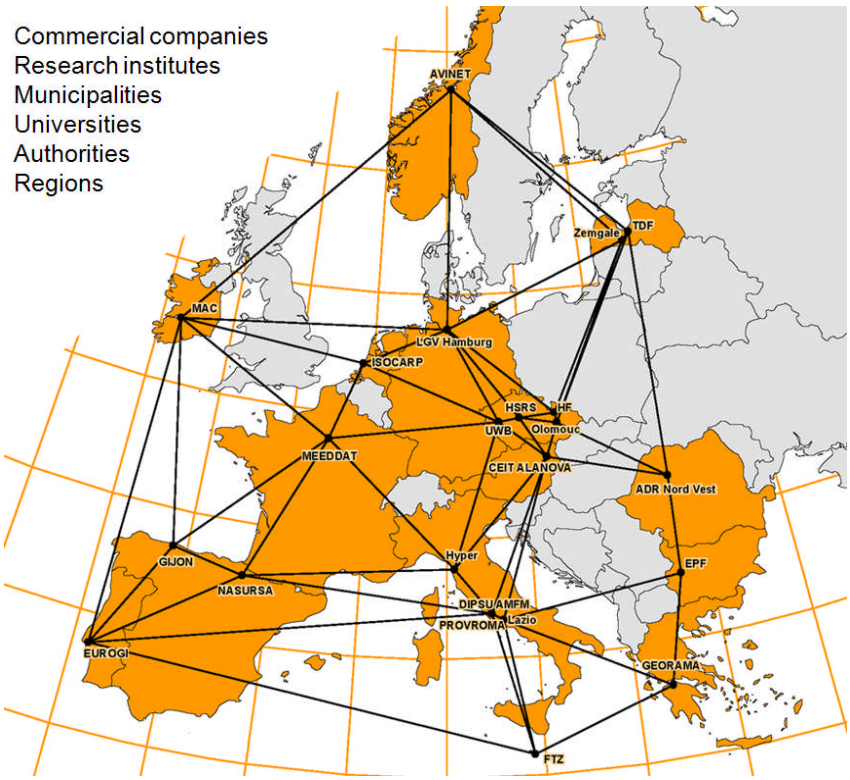

Fig. 1: Network of Plan4all partners

2.2 Geoinformation technologies in the spatial planning process

Geoinformation technologies (GIT) in the planning process focus on managing and conveying information to improve the decision-making process. One of the most basic tools for public and private organisations in spatial planning is Geographic Information Systems (GIS) as a decision support tool for both technical experts and decision-makers. GIS allows users to conduct complex geospatial analyses combining data from various sources such as socio-economic statistics, satellite imagery and monitoring data. GIS-based decision support applications are available for fields ranging from transportation, resource management, energy infrastructure, land use planning and disaster management to real estate, business development and marketing. GIS also plays an important role in informing and involving citizens in the planning process. In the past, GIS applications were generally installed locally on a laptop or PC or as an application running on an organisation's network. As the amount of spatial data available and usage of GIS has 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 which rely on Web Services technology and standardised data formats to allow users to access data distributed across various organisations. Such infrastructures are actively supported in Europe through the INSPIRE Directive (Schrenk/Farkas/Brun 2010). In this context Plan4all focuses on the definition of common procedures and methods for spatial planning data interoperability. Into more detail, Plan4all creates metadata profiles and object-oriented data models for data sharing via the Plan4all geoportal.

2.2.1 Plan4all metadata profile

The most common instruments in the European planning systems are the land use local plan for regulating local land use and the regional plan focused on regional development and structure. Nevertheless, planning legislation varies between countries and sometimes even within countries there are significant differences in the terminology associated with planning acts. Especially at the regional level, plans are on different scales and administrative levels (Schrenk/Farkas/Brun 2010). Plan4all metadata profile (Plan4all D.3.2.2 2010) aims at making spatial plans comprehensible and comparable. 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, maps in paper as well as in digital form, individual components may be optionally described by independent metadata records with links to the corresponding spatial plan. In addition to spatial plan metadata Plan4all metadata profile consists of dataset metadata and service metadata.

The Plan4all metadata profile fulfills the requirements of national metadata regulations, national spatial planning legislation, user requirements for spatial planning metadata and the INSPIRE directive. National and user requirements on metadata were collected using questionnaires. The goal was to compare national metadata regulations and to define common sets of items, which 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). Plan4all spatial plan metadata and dataset metadata are an extension of the base elements defined by INSPIRE. Additional items – coming from ISO 19115 – have been required by the users as well as national legislation. The service metadata profile was adopted from INSPIRE service metadata profile without extra elements over the INSPIRE profile.

Extensions for *spatial plan metadata with multiplicity of '1' are*[2]*:*

- File identifier, because every metadata file requires a unique reference (ISO no. 2)
- Metadata standard name. Phrase "**ISO19115/19119 - Plan4all profile**" shall be used (ISO no. 10)
- Metadata standard version. Phrase "**2003/Cor.1:2006, Plan4all:2010**" shall be used (ISO no. 11)
- Data quality scope; is the level to which data quality information applies (ISO no. 79)

*Multiplicity of 1..**[3]*:*

- Presentation form; it is required to distinguish hardcopy spatial plans from digital ones. Possible values are: mapDigital – for digital spatial plan; mapHardcopy – for digital plan with maps in paper form; imageDigital – scanned paper maps (ISO no. 368)

*Multiplicity of 0..**[4]*:*

- Application schema; it is required because it provides information about the conceptual schema of the spatial plan data. It might be used at this level for whole spatial plan structure description or at dataset level for individual corresponding datasets description. (ISO no. 21)
- Reference system information; because different reference systems are in use, information on reference system is required. Example: Codespace: urn:ogc:def:crs:EPSG:: Code: 4326 (ISO no. 13)
- Status; is required because it represents the status of the resource described by metadata. Possible values are in the ISO 19115 code list 'MD_ProgressCode'. It is needed to distinguish if the spatial plan is in design phase (underDevelopment) or if it has already been adopted. Plans after expiration date should be denoted as "obsolete". (ISO no. 28)
- Legal relevance; not every spatial plan is legally binding. The phrase "**NO LEGAL RELEVANCE**" should be used if the spatial plan has no legal relevance. (ISO no. 68)

Multiplicity of 0..1[5]*:*

- Maintenance and update frequency; users require information on updates frequency. Example: annually. (ISO no. 143)
- Purpose; is required by the users because it summarizes the intentions with which the resource(s) was developed (ISO no. 26)

[2] Multiplicity of 1 indicates that each element always needs to be expected in the metadata record and can occur only once.
[3] Multiplicity of 1..* indicates that there shall be at least one instance of this element in a result set.
[4] Mulitplicity of 0..* indicates that the presence of the metadata element in a result set is conditional but the metadata element may occur once or more.
[5] Multiplicity of 0..1 indicates that the presence of the metadata element in a result set is conditional but can occur only once.

Additional items for *dataset metadata* are: file identifier, metadata standard name, metadata standard version, application schema, data quality scope, reference system info and maintenance and update frequency as defined above. In addition the following items were added:

Multiplicity 1..:*

- Spatial representation type, e.g. vector.
- Distribution format; because data is available in different formats, the distribution format is required by the users. In addition it should include information about the format version. Example: shapefile, version 1.0 (ISO no. 271)

Multiplicity 0..:*

- Geometry type; is required because it represents the geometrical type of a spatial dataset which spatial representation type is 'vector', and it may assume three possible values: point, polyline or polygon (ISO no. 37,178)
- Image; an image/graphic that illustrates the resource; a legend should be included. (ISO no. 31)
- Character set; character coding used for the dataset. (ISO no. 40)
- Transfer options; number of volumes, data carriers etc. for off-line distribution. Example: Medium: cdRom, volumes: 6 (ISO no. 273)
- Source; because it describes the sources that were used during the production process of the dataset. (ISO no. 85)
- Process step; is useful because it describes the process of data acquisition. Example: e.g. digitalization of analogue orthophotos. (ISO no. 84)

Multiplicity 0..1:

- Parent identifier; file identifier of the metadata to which a metadata is a child. It is used for the identification of spatial plan which the dataset is part of. (ISO no. 5)

Compound elements taken from ISO are metadata about the responsible party for the plan (contact information such as person responsible, address, phone number, email, etc.; ISO 375, 376, 379, 381-386, 390), the process step (e.g. before approval, approval of plan, expiration of plan; 87-90) and the source (e.g. level of the source data, spatial reference system used by the source data, etc.; ISO 93-96). Plan4all metadata records may be multilingual. From the perspective of European spatial planning activities it is recommended to provide metadata at least bilingual – in national language (as metadata language) and English.

The Plan4all metadata profile is an extension of mandatory INSPIRE metadata elements with ISO elements that are required by national metadata profiles and the requirements of the users based on a user requirements assessment. The Plan4all metadata profile is currently tested and validated (December 2010).

2.2.2 Plan4all Data Models

Plan4all develops conceptual data models for seven selected themes from Annexe II and III of the INSPIRE Directive. The themes are land cover, land use, utility and government services, production and industrial facilities, agriculture and aquaculture facilities, area management/restriction/regulation zones and reporting units, and natural risk zones. The data models refer to the INSPIRE documents „Generic Conceptual Model (GCM)" and „Methodology for the development of data specifications" which set basic rules for the development of data models. The document GCM describes the basis of Plan4all data models, the General Feature Model, which is a meta-model for the specification and description of spatial object types and their properties. It defines the concept of spatial object type (note that ISO 19101 uses the term "feature type" instead) and several types of properties (attributes, association roles and operations) as well as constraints. It also serves as a meta-model for feature catalogues by providing the structure for representing the semantics of geographic information in these terms (INSPIRE GCM 2010). In addition Plan4all data models respect the requirements of national conceptual models. The object-oriented Plan4all data models are

flexible enough to be extended easily with further objects. Each object has a unique identity which is immutable and used only once, even if an object is removed its identity is not assigned to other objects. Also code lists and nomenclatures are extendable. To specify the models in diagrams UML is used. The data models are published on the Plan4all website[6] and are open for validation by affiliated partners. Further, the Plan4all data models will be an input for the development of the INSPIRE data models by the INSPIRE thematic working groups. Especially, there is strong cooperation concerning the land use theme.

2.2.3 Plan4all geoportal

Spatial planning data from pilot regions are being published on the Plan4all geoportal (http://www.plan4all.eu). The geoportal presents geographic information from various sources in a unified way. The Plan4all geoportal has two features that are map and catalogue. The catalogue client allows searching for metadata using OGC Catalogue Service for Web (CSW). The map client allows viewing maps based on OGC Web Services and other formats (Google maps, KML, MapServer, GML). The basic functions are viewing web services (OGC WMS, WFS) selected by user from the catalogue or directly by address; saving user defined map projects on local hard drive a re-loading of this saved composition (OGC WMC); distance and area measurement; searching in the map; inserting user defined objects into the map, large format printing in PDF; showing legends, metadata and querying in the map. The Plan4all geoportal will enable to search and view harmonised spatial planning data from the Plan4all partners with the aim to further extend the network with affiliated partners.

3 CONCLUSION & OUTLOOK

The three main objectives of Plan4all are the definition of standards for spatial planning data harmonisation according to INSPIRE, the implementation of the Plan4all geoportal that consists of harmonised spatial planning data that can be shared and third, to contribute to a European spatial data infrastructure. Plan4all is a testbed for INSPIRE and supports the distribution of the INSPIRE ideas which are the development of a European spatial data infrastructure and the rising of awareness for this topic to support holistic spatial planning in Europe and its regions. Plan4all develops tools that support geographic information infrastructures; these are the Plan4all metadata profile, data models for seven selected themes from INSPIRE Annex II and III and the Plan4all geoportal. These tools are currently (December 2010) being tested and validated by Plan4all affiliated partners who are external experts. In addition there is an internal verification of results. Validation and verification processes will test if there are any problems with the developed Plan4all standards. It is expected that the Plan4all data models will be an important input for the ongoing activities in the development of INSPIRE data models for the themes from Annex II and III. Plan4all is in close cooperation with INSPIRE Thematic Working Groups.

The implementation of GIT in the spatial planning process faces several challenges. GIT without data, the willingness as well as the knowledge to share it is not fully sufficient. For future developments in SDI bigger efforts are necessary in data collection (quantity and quality) as there are still big disparities between different European Union regions (Plan4all D.2.2 2009). Especially, much metadata information is still incomplete and not collected according to certain 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 successful data harmonisation. It is of high importance to strengthen the awareness of data providers as well as data users that SDI and data harmonisation are necessary for holistic planning and to point out the advantages of data harmonisation initiatives to keep networks stable and to gain new partners for the future. The planning process depends on continuous input (socio-demographic data, economic data, changes in infrastructure, agriculture and aquaculture, natural risks etc.) to monitor urban, regional and environmental developments, to detect changes and to be able to

[6] http://www.plan4all.eu/simplecms/?menuID=37&action=article&presenter=Article

find strategies to react on these changes. Spatial planning depends on up-to-date geodata. Spatial data infrastructures, consisting of common data models and metadata standards, can contribute as it aims at offering wider access to geospatial data across Europe. Besides promoting the idea of data sharing within the circle of SDI experts, a challenge is to promote new services and technologies also to the users. The big challenge is to bring new GIT, relevant software and services to a wide group of users, which in spatial planning usually are actors from public administrations on all levels – mainly on the local level. Actors working at one of the more than 10.000 municipalities plus public administrations on regional and national level are the end users of GIT.

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