INSPIRE Directive implementation in Portugal. The state of play

Implementación de la Directiva INSPIRE en Portugal. Estado actual

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Abstract

The time elapsed after the transposition of the European INSPIRE Directive into Portuguese legislation justifies an analysis about the application of this Directive in Portugal: what has changed, which achievements were obtained, but also what remains to be done. Portugal has a new geoportal for the National Spatial Data Infrastructure – SNIG, developed with GeoNetwork. This geoportal includes new functionalities to make the search and visualization of spatial data easier and more efficient. INSPIRE implementation in Portugal led to the definition of new technical specifications to produce reference cartography at large scales, based in INSPIRE data specifications and technical guidelines. Analyzing the number of Portuguese spatial data metadata reported annually to the European Commission and the number of spatial data available through view and download services it´s possible to verify that there is a significant increase of spatial data shared by public authorities in Portugal. Over the past 10 years a number of barriers have been overcome for a successful INSPIRE implementation, but there are still challenges, namely: having more compliant spatial data shared through download services, having more spatial data compliant with the INSPIRE data specifications and having greater Local Government involvement around this European Directive.

Resumen

El tiempo transcurrido después de la transposición de la Directiva europea INSPIRE a la legislación portuguesa justifica un análisis sobre la aplicación de la presente Directiva en Portugal: lo que ha cambiado, qué logros se obtuvieron, pero también qué queda por hacer. Portugal tiene un nuevo geoportal para la Infraestructura Nacional de Datos Espaciales – SNIG, desarrollado con GeoNetwork. Este geoportal incluye nuevas funcionalidades para facilitar y hacer más eficiente la búsqueda y visualización de datos espaciales. La implementación de INSPIRE en Portugal dio lugar a la definición de nuevas especificaciones técnicas para producir cartografía de referencia a gran escala, basada en las especificaciones de datos y directrices técnicas de INSPIRE. Analizando el número de metadatos de datos espaciales portugueses notificados anualmente a la Comisión Europea y el número de datos espaciales disponibles a través de los servicios de visualización y descarga es posible verificar que hay un aumento significativo de los datos espaciales compartidos por autoridades públicas de Portugal. En los últimos 10 años se han superado una serie de barreras para una implementación exitosa de INSPIRE, pero todavía hay desafíos, a saber: tener datos espaciales más conformes compartidos a través de servicios de descarga, tener más datos espaciales que cumplan con las especificaciones de datos de INSPIRE y una mayor participación de los Gobiernos Locales en torno a esta Directiva Europea.

Palabras clave: INSPIRE, spatial data infrastructures, SDI, SNIG, geographic information, GeoNetwork.

Keywords: INSPIRE, infraestructura de datos espaciales, IDE, SNIG, información geográfica, GeoNetwork.

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1. INTRODUCTION

The INSPIRE Directive was created to promote a European Union (EU) spatial data infrastructure for the purposes of environmental policies and activities which may have an impact on the environment in Europe (Jornal Oficial da União Europeia, 2007). This Directive was published in the official Journal on the 25th April 2007 and entered into force on the 15th May 2007 - Directive 2007/2/EC of the European Parliament and of the Council of 14th March 2007, establishing an Infrastructure for Spatial Information in the European Community -INSPIRE, (Figure 1).

In Portugal the INSPIRE Directive was transposed into Portuguese legislation on the 7th August 2009 by the Decree-law nº 180/2009. After that there were two revisions of this legislation, the last one on the 16th March 2017 by the Decree-law n.º 29/2017, to incorporate changes identified towards a more correct INSPIRE Directive transposition (e.g. the inclusion of the INSPIRE Annexes into the Portuguese legal act itself) and to include other relevant aspects to improve INSPIRE implementation in Portugal, namely, the expansion of SNIG Steering Committee (*Conselho de Orientação do SNIG*) - CO-SNIG. This committee is responsible for the strategic coordination of the national spatial data infrastructure, i.e. *Sistema Nacional de Informação Geográfica* (SNIG). This committee is chaired by Directorate-General for the Territory (DGT). DGT is also the focal point for the INSPIRE Directive in Portugal. DGT is a Central Public Administration entity whose mission is, to maintain and improve the national geodetic references, to promote the cartographic coverage of the Portuguese territory, to pursue public policies on spatial planning and urbanism, to define the national cadastre policy and to coordinate and manage SNIG.

The purpose of this article is to make an analysis and an evaluation of INSPIRE Directive application in Portugal, 10 years after the transposition of this European Directive into Portuguese legislation. Special mention will be performed to what happened over the last four years, including not only the positive aspects identified through several of the achievements obtained, but also the difficulties and obstacles encountered during this process. This evaluation will also identify measures and proposals to overcome the remaining obstacles as well as the challenges for the near future to fully achieve in Portugal the goals defined by the INSPIRE Directive.

Figure 1. INSPIRE Directive

2. SNIG EVOLUTION AND INSPIRE IMPLEMENTATION

SNIG, the National Spatial Data Infrastructure (NSDI), was conceived in 1990 as a distributed network linking the main national, regional and local cartographic and alphanumeric information producers. Launched on the Internet five years later, it was considered a pioneer initiative being the first SDI in Europe and one of the first ones in the world.

SNIG was coordinated by the National Center for Geographic Information (CNIG) that provided technical and material support to each node of the system to make its information available through the network.

During the first phase (1990-1995) database connection experiments were performed, efforts to promote the use of GIS and the production of information in digital format were developed as well as negotiation contacts with the producers of geographic information.

In the second phase (1995-1998), SNIG was already available on the Internet, and developments were oriented to the professional user, such as creation of WWW interfaces for existing databases, pilot implementation of mechanisms for online business transactions, promotion of local SNIG nodes and development of the Earth Observation Network (ROT).

The third phase (1998 – 2001) was oriented to the citizen with the development of more appealing user oriented interfaces and citizen-oriented applications (e.g. access to aerial photography, Municipal Master Plans and associated Regulations, production of thematic maps, SNIG-Education). During this phase GEOCID was launched as the citizen gate to SNIG, including an application "*O País Visto do Céu*" that provided access to the complete 1995 orthophotos coverage of the country.

In 2002, CNIG is merged with the Cartography and Cadastral Institute forming the Portuguese Geographic Institute (IGP), who becomes responsible for SNIG coordination. During IGP era, a reorganization of the existing SNIG contents was performed and some user applications were developed. A new geoportal allowing identification, visualization and exploitation of geographic information, as well as the access to thematic databases was created in 2006 and the development of a metadata editor was promoted, MIG, launched in 2005 aiming to contribute to improve the metadata available at SNIG.

The publication of the INSPIRE Directive and its transposition into the Portuguese legislation was later on an important milestone in the access to spatial data in Portugal and in the development of SNIG (Figure 2).

Ever since INSPIRE Directive entered into force in 2007 major efforts have been developed in Portugal to promote INSPIRE implementation activities and since then the evolution of SNIG goes side by side with the INSPIRE Directive application.

Main efforts developed at that time included:

- Setting the main organizational and operational structures involving the geographic data producers and users, most of them already involved in SNIG for several years (e.g. INSPIRE Focal Points Network; Metadata Managers Network; Thematic Working Groups; Horizontal Working Group; M&R Working Group) and creation of the SNIG-INSPIRE team.
- Dissemination and capacity building on INSPIRE issues.
- Metadata creation and compliance – further development of MIG, guarantying that the metadata editor becomes compliant with INSPIRE implementing rules.
- Identification of existing datasets fitting the different annexes of the INSPIRE directive and identification of the corresponding responsible entities.
- INSPIRE monitoring and reporting involving annually the main national geographic information (GI) data producers progressively getting involved in the development of services and in the discussion of data harmonization requirements and problems.

Figure 2. SNIG evolution and the main milestones over the years

In 2012 IGP is merged with the Land Use Planning and Urban Development Agency giving rise to Direção-Geral do Território (DGT), the actual SNIG coordinator and INSPIRE National Focal Point.

In 2015, a new strategy is adopted towards this DGT mission and strong emphasis is given to participated and collaborative processes for SNIG development and INSPIRE implementation.

Twenty-five years after the creation of SNIG and almost 10 years after the publication of the INSPIRE Directive, DGT prepared a diagnosis, *Diagnóstico SNIG 2015*, assessing the current SNIG and its use by the community, and coordinated a collaborative process to define what is expected from the NSDI (Caetano et al., 2015a). This study included an on-line public consultation on the use of SNIG and knowledge on INSPIRE (Caetano et al., 2015b), a SWOT analysis (Fonseca et al, 2015) and the examination of INSPIRE monitoring indicators (Gomes et al., 2015).

A five-year Vision for the NSDI and INSPIRE implementation in Portugal, SNIG2020, was defined (CO-SNIG, 2015). SNIG2020 was built by collaborative and participatory processes and resulted from a broad national debate about what is expected from the NSDI in the medium term.

SNIG2020 established what should be done to democratize the access to spatial data in Portugal, which in the end would contribute to have a more sustainable development of the National territory. SNIG 2020 main pillars were open and interoperable data; simple, intuitive and efficient data discovery; empowerment of GI community (awareness, training); creation of open tools to enhance GI interoperability and exploitation; articulation with eGov.

SNIG 2020 Vision and the corresponding Action plan were approved by CO-SNIG and the vision stated that SNIG should evolve to "*A Spatial Data infrastructure based on an open data policy ensuring the free of costs sharing of geographic information produced by public administration entities*". Since 2016 every year a new Action Plan is prepared and approved by CO-SNIG as well as each entity action plan (PA SNIG2020 and INSPIRE.PT).

Following SNIG 2020 principles, a study on data policies in Public Administration was developed (Saraiva, 2017) intending to lay the groundwork for discussion of this matter in CO-SNIG, the steering committee that approves SNIG's strategic orientations and general objectives and the operational and effective SNIG work programme, providing also advice on the setting of fees for data sharing proposed by the public authorities involved.

In 2017 INSPIRE transposition legal document, *Decreto-Lei do SNIG*, was improved to incorporate the INSPIRE Annexes and also to include other relevant aspects benefiting INSPIRE implementation in Portugal, namely the expansion of CO-SNIG and the articulation of SNIG with the other different level SDI (e.g. national, regional, local, thematic).

Following SNIG 2020 orientations, in 2019 SNIG geoportal was migrated into an Open Source solution. The platform interface design was renewed (Figure 3), new functionalities were developed and existing ones were improved, particularly the National metadata catalogue (Patrício *et al*, 2018).

Figure 3. SNIG Geoportal – www.snig.dgterritorio.gov.pt

SNIG renewal procedures were also carried out through a participatory process involving several types of stakeholders and obtaining feedback from the geographic information community (GI) (Furtado *et al*, 2018).

The new SNIG geoportal, developed using GeoNetwork open source software, is more user-friendly and allows a simplified way to search and find spatial data. It is possible to search data using the several interactive filters available, with the definition of more precise and specific search criteria (Ferreira *et al*, 2018). For each one of the results obtained in the search it is possible to access the metadata, the URL of the download or view service and even visualize the spatial data using the platform viewer. All these features make SNIG geoportal become a state-of-the-art engine to search and view spatial data.

The strategic coordination of SNIG done by CO-SNIG, chaired by DGT and co-chaired by the Portuguese Environment Agency (APA), involves presently representatives from 37 public authorities.

SNIG operational coordination (Figure 4) evolved over the years and in 2018 a new reorganization occurred to ensure effective cooperation of all public authorities, producers and providers of spatial data as well as the involvement of key users.

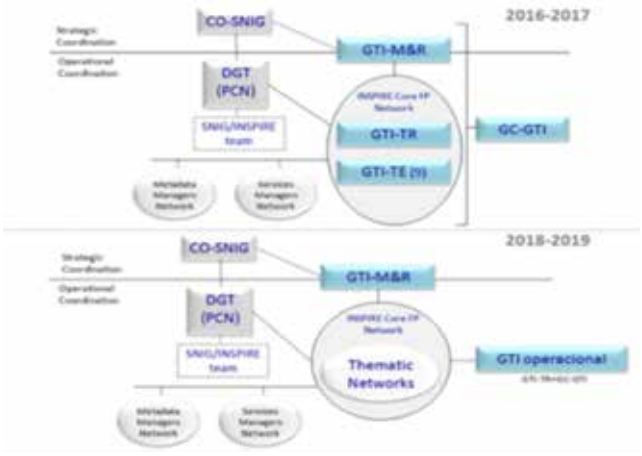

Figure 4. SNIG Coordination Structure in the last four years

It includes the participation of the INSPIRE Core Focal Points Network (public authorities formally responsible for producing national datasets and services regarding the themes of the INSPIRE Annexes), but the number of working groups was substantially reduced, from 12 (GTI-TR; 9 GTI-TE, GC-GTI, GT M&R) to 2 (GT operacional, GTI M&R) plus the 9 Thematic Networks. The Network of Metadata Managers and the Network of Spatial Data Services Managers were maintained.

GTI M&R working group is a CO-SNIG sub-group dedicated to support INSPIRE monitoring and reporting since 2010. The thematic networks correspond to the previous thematic working groups whose leaders are now in the GTI operational.

The INSPIRE Directive contributed to the emergence of several thematic Spatial Data Infrastructures (e.g. SNIAmb - SDI for data on the environment, developed by the Portuguese Environment Agency, SNIMar – SDI for the Portuguese marine environment, developed by the Portuguese Task Group for the Extension of the Continental Shelf – EMEPC) and also to the development of several regional infrastructures (e.g. IRIG – Infraestrutura Regional de Informação Geográfica da Madeira, the SDI of Madeira, IDEiA – Infraestrutura de Dados Espaciais Interativa dos Açores, the SDI of Azores and IDEAlg - Infraestrutura de Dados Espaciais do Algarve, the SDI for the Algarve region) (Figures 5, 6).

These thematic and regional SDIs contribute significantly to the number of spatial data registered in SNIG. A new article in SNIG diploma was introduced in 2017 to consider the articulation of SNIG with these other SDI, in order to allow the SNIG metadata catalogue automatic loading.

Over the years the implementation of INSPIRE and the awareness of GI community was pursued through several types of actions, namely:

- Creation of support documents and videos on good practices for data harmonization and services creation;
- Organization of workshops and other events involving

Figure 5. Thematic SDI: SNIAMb - SDI for data about the environment and SNIMar - SDI for the Portuguese marine environment

Figure 6. Regional SDI: IRIG - Madeira SDI and IDEIA - Azores SDI

the SNIG network entities for sharing knowledge and experiences, promoting reflection and debate on the creation, articulation and use of national, regional, local and thematic spatial data infrastructures;

- Capacity building activities including: research, development and production of reports on horizontal issues (e.g. InspireId, atom dowload services, metadata for interoperable SDIs) as well as on spatial data;
- SNIG on the Road – 2015: tour by the Regional Coordination and Development Committees (CCDR) to conduct introductory training for the implementation of the INSPIRE Directive, with particular emphasis on the generic concepts of geographic information infrastructures, the production of geographic information metadata and the use and creation of geographic data services;
- Several events within the country related to the new Cartography specifications were performed in 2018 and included presentations on SNIG and INSPIRE.
- Promotion of an annual event on SDI, ENIIG - *Encontro Nacional de Infraestruturas de Informação Geográfica*, since 2016 to allow dissemination and sharing of knowledge on SDI horizontal and specific issues such as metadata, data and services harmonization;
- Cooperation with Spain reinforcement: continued collaboration around the organization of the Iberian SDI event, JIIDE, and participation in cross-border projects and initiatives;
- Increase of the Portuguese representativeness at European events on SDI and INSPIRE.

Following the transposition of the INSPIRE Directive in Portugal, DGT decided to update existing technical specifications for the production of reference cartography at large scales. The INSPIRE themes considered relevant for creating the new technical specifications were: Geographical Names, Transport Networks, Hydrography, Elevation, Land Cover, Orthoimagery, Buildings, Production and Industrial Facilities and Utility and Governmental Services.

Figure 7. New technical specifications for the production of reference cartography at large scales

This procedure was carried out in a widely participated way, with the purpose of producing specifications (Figure 7) which will give answers to the multiple uses of spatial data nowadays. These specifications are available in www.dgterritorio.gov.pt/cartografia/ETC.

It is expected that the new technical specifications for reference cartography meet the needs of the different users, and, in this way, will contribute to a more widespread use of Portuguese spatial data.

In spite of the significant progress, the INSPIRE implementation in Portugal have also been constrained by several technical issues, namely:

- Responsibilities on the provision of spatial data essential for the SDI are not clearly defined through the legislation;
- Articulation between the entities technical implementation departments and the entities Head Offices is not easy - awareness was and is still needed;
- The lack of qualified human resources in the public entities that needed to cope with all the technical requirements involved in SDI & INSPIRE implementation: metadata creation, spatial data services development, spatial data harmonization;
- Open source and proprietary software are not yet prepared to deal with some of INSPIRE interoperability specifications creating interoperability issues that generate problems on accessing data and services through the

INSPIRE Geoportal;

- Complexity of data harmonization specifications generate difficulties on using data harmonization tools to obtain validated harmonized datasets;
- Some public entities don't have the information systems infrastructures (e.g. servers, software) to provide access to its data.

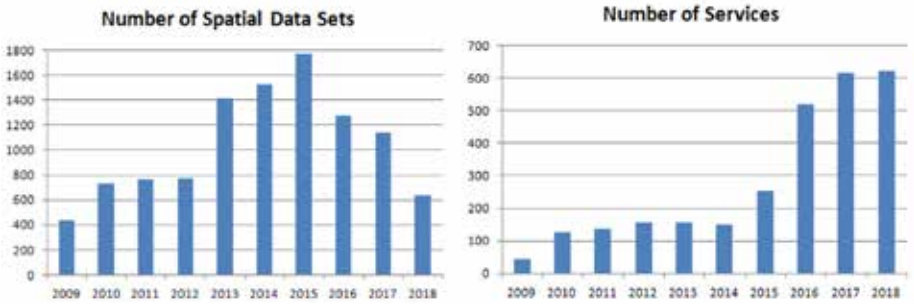

Figure 8. Number of Spatial Datasets and Services (2009-2018)

3. MONITORING INSPIRE IMPLEMENTATION IN PORTUGAL

EU Member States must report annually to the European Commission a set of indicators for monitoring the INSPIRE implementation. These indicators refer to a subset of the spatial datasets and services registered in the NSDI. The reported datasets are from national level entities (RPF INSPIRE Core) as the information from local authorities is less relevant in the context of the analysis at the European level. Consequently, only data from Central Public Administration and from the Autonomous Regions are part of this process.

The graphs in Figure 8 show the number of Spatial Data Sets and the number of Services reported since the beginning of INSPIRE monitoring. From 2009 to 2015 Portugal reported an ever-increasing number of Spatial Data Sets (SDS), as a result of the Entities involvement and their awareness into this issue. It was in 2016 that a turning point took place when a new information gathering process for INSPIRE monitoring started directly from the SNIG metadata with the keyword INSPIRECORE. In 2018 the Autonomous Regions were asked to report GI by Region and not by Island as they were doing, this was reflected in the decrease in SDS reported that year.

Since 2009, there has always been an increase in the number of services that allow access to the reported SDS, but a very evident increase occurred in 2016, when it more than doubled, largely due to the dynamism induced by CO-SNIG in RPF Core Entities.

The number of view and download spatial data services has increased considerably, over the past three years, but this still remains a challenge for future monitoring, as all spatial data sets must be accessible throw view and download services.

These results reflect not only the efforts developed in Portugal towards INSPIRE implementation but also the existing constraints at the technical, social/organizational and political level, that affect the performance of the public entities responsible for INSPIRE spatial data.

Technical issues such as the difficulties brought by open source and proprietary software that are not yet prepared to deal with some of INSPIRE interoperability specifications or social issues related to the lack of qualified human resources are some of those constraints.

Table 1 presents some of the INSPIRE monitoring results for Portugal since the first monitoring process in 2009, namely the indicators of Spatial Data Sets with Metadata, Spatial Data Sets with View services and Spatial Data Sets with Download services.

All spatial datasets and services reported have metadata with 100% INSPIRE compliance levels since 2015.

Despite the annual increase in the number of services, SDS percentage values for visualization and download services are not always increasing, partly as a result of the redefinition of the concept of visualization services, removing all SDS that existed in webmapping viewers and available for download, only considering WMS, WCS and WFS network services. However, in the last 3 years, Portugal has made a significant effort to make SDS available through network services, reaching 75% for view services and 60% for download services. These percentage values could be higher because several services are created according to INSPIRE specifications (JRC, 2017), but problems during validation occur due to software interoperability issues that need to be solved.

Moreover, Portugal participated in the EC priority datasets (PDS) voluntary effort to identify, tag and provide access through spatial data services to PDS in the INSPIRE Geoportal PDS viewer (MIWP 2016.5, 2018). This involvement was promoted after the bi-lateral meeting with the EC that took place in Lisbon in February 2015, aiming to analyze INSPIRE implementation in Portugal identifying the main gaps.

In 2018 it was requested to SNIG entities to enrich the Portuguese contribution to the Priority Data set Viewer by tagging metadata with the PDS for e-Reporting keywords (PDS Codelist). Since then, within INSPIRE monitoring Portugal also reports to the EU the PDS related to environmental reporting, which should be made available in

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Number of Spatial Data Sets	435	728	770	774	1414	1529	1771	1277	1136	638
% of Spatial Data Sets with Metadata	68	93	94	95	86	88	100	100	100	100
% of Spatial Data Sets with View service	25	32	33	33	19	14	11	70	70	75
% of Spatial Data Sets with Download service	9	11	11	11	6	3	6	25	48	60

Table 1 – Portuguese list of indicators for the INSPIRE Monitoring 2009-2018

the first place. Progress on the availability of PDS occurred through the work developed in the Thematic Working Groups (GTI-TE).

The identification of PDS for e-reporting was performed and its availability through the INSPIRE Geoportal Thematic Viewer was promoted, although several difficulties emerged and are still occurring related to spatial data services interoperability. PDS are identified in the INSPIRE Geoportal but not all are yet available through interoperable download services. Moreover, to go further in this area, DGT and APA organized in June 2018 an event for INSPIRE focal points and national e-Reporting focal points aiming to promote articulation among both sectors. In the future Portugal will continue to increase the number of PDS reported.

4. CONCLUSIONS

All SNIG developments made since INSPIRE Directive was created were motivated by the goals defined by this Directive, mainly the promotion of an open access to data and the purpose to have interoperable spatial data as part of a larger European Interoperability Framework.

The major benefit from the INSPIRE implementation in Portugal is the awareness on its importance among spatial data producers and GI users. Today almost all producers became conscious that it is not enough to produce spatial data if not shared through internet services using an open data policy. On the other hand, the number of GI users requesting access to spatial data from internet services is increasing and will continue to increase in the future.

In the last years all public authorities, producers and providers of spatial data made efforts and have taken measures to meet INSPIRE standards, and the monitoring numbers reflect that endeavor. Nevertheless, there is still a substantial way to go to achieve all goals set by the INSPIRE Directive. The number of compliant download services needs to be improved, the number of spatial data compliant with the INSPIRE data specifications as well and Portugal should now also invest on having a greater involvement of the municipalities in the INSPIRE implementation process to increase the availability of this type of data through SNIG.

To achieve a greater involvement of Local Government in INSPIRE, a working group recently created, *SNIG-Local*, which involves the municipality's communities, will promote the development of local SDIs and try to raise awareness on local users towards INSPIRE.

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