National register for geographic data and the new SNIG GeoPortal

Registro nacional de datos geográficos y el nuevo GeoPortal SNIG

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Abstract

SNIG is the Portuguese Spatial Data Infrastructure and Directorate-General for the Territory (DGT) is responsible for its operational coordination. In 2015 DGT began a strategic and technological restructuring process of this Spatial Data Infrastructure (SDI) and in 2019 DGT launched the new SNIG GeoPortal and formalized the National Register for Geographic Data (RNDG). This new infrastructure is built on Open Source technology and, in addition to enhancing the platform design to make the interface more dynamic and user-friendly, new functionalities have also been developed to improve spatial data sets searching and visualization processes. This paper reflects on the developments of the new SNIG GeoPortal and the implementation of the RNDG.

Resumen

SNIG es la Infraestructura Portuguesa de Datos Espaciales y la Dirección General del Territorio (DGT) es responsable de su coordinación operativa. En 2015 la DGT inició un proceso de reestructuración estratégica y tecnológica de esta Infraestructura de Datos Espaciales (IDE) y en 2019 la DGT lanzó el nuevo GeoPortal SNIG y formalizó el Registro Nacional de Datos Geográficos (RNDG). Esta nueva infraestructura se basa en la tecnología Open Source y, además de mejorar el diseño de la plataforma para hacer la interfaz más dinámica y fácil de usar, también se han desarrollado nuevas funcionalidades para mejorar la búsqueda de conjuntos de datos espaciales y procesos de visualización. Este documento reflexiona sobre la evolución del nuevo GeoPortal SNIG y la implementación del RNDG.

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1. INTRODUCTION

SNIG is the National Spatial Data Infrastructure (NSDI) that allows the registration and search of all geographic information produced by public and private entities in Portugal. From the SNIG GeoPortal (http://snig.dgterritorio.pt) it is possible to search, explore and view geographic data through OGC (Open Geospatial Consortium) Spatial Data Web Services. SNIG also supports all activities related to the implementation of the INSPIRE Directive in Portugal.

The National Register for Geographic Data (RNDG) is the metadata catalog of all geographic information produced by public and private entities in Portugal and was created by Decree-Law n. 180/2009, August 7th. The RNDG is integrated in the new SNIG and is accessed through the GeoPortal of this infrastructure. The RNDG was formalized in 2018 and at the same time, a deep restructuring was performed on the metadata catalog content. These changes coincided with the implementation of the new SNIG GeoPortal (Figure 1).

SNIG was created in 1990, under the coordination of the National Centre for Geographic Information (CNIG), as a distributed network linking the producers of georeferenced information (graphical and alphanumeric), and it became available to all users through the Internet on May 1995, which placed Portugal as pioneer in spatial data infrastructures. Since then SNIG has gone through several phases, associated with institutional restructuring processes and technology evolution, factors that have had an impact on its role as NSDI and also on its operationalization.

In 1999 the SNIG portal was reformulated and a site based on HTML was launched, GEOCID, as the citizen gate do the NSDI. In 2006 the SNIG GeoPortal was launched, already containing a metadata catalog, an online metadata editor and a viewer, adjusted to the new technologies and challenges (ISO and OGC standards), following the principles that would be established by the INSPIRE Directive (Official Journal, 2007). In 2008 a software update was performed on this GeoPortal.

Since 2012 the coordination of SNIG has been the responsibility of DGT, as entity chairman of the Steering Committee (CO-SNIG) of this infrastructure.

In 2014 a SNIG GeoPortal renovation was carried out, which focused mainly on aspects related to metadata catalog searches and viewer operation and introduced a set of new search functionalities that made this portal easier to use and more adapted to the needs of geographic information users.

In 2015, DGT decided to make a strategic reorientation of this geographic information infrastructure (Patrício et al., 2018) and in 2016 CO-SNIG approved SNIG2020, a vision for 2020 of the NSDI.

In 2016 the Geoportal was redesigned, new content was produced, the news publication was restructured and a blog was created. In this same year DGT started a deeper reorientation of the geoportal, which is described in this paper.

In 2018, CO-SNIG approved the new SNIG geoportal and RNDG prototype. In 2019, the new SNIG geoportal and its RNDG were launched in ENiiG 2019, i.e. the national annual event on spatial data infrastructures.

This paper presents the new SNIG geoportal and the National Register for Geographic Data (RNDG). In Figure 2 we present the two historical logos of SNIG and the most recent one.

Following the guidelines defined in the SNIG2020 Action Plan, the restructuring process of SNIG GeoPortal was developed based on Open Source technology. The main objective of this restructuring was to improve the design of this platform to make the interface more dynamic and user-friendly and to make the search and exploration of geographic information more intuitive, functional and simple for the expert user and also for the common geographic information user (Furtado et al., 2018).

Figure 1. SNIG GeoPortal

Figure 2. The 1990, 2006 and 2018 logos of SNIG. The first logo corresponds to the creation of SNIG, the second one was defined when SNIG geoportal was launched in internet and the third one was defined for the new SNIG geoportal launched in 2018.

Paulo Patrício, Danilo Furtado, Vanda Bica, Alexandra Fonseca, Ana Luísa Gomes, André Serronha, Henrique Silva, Sérgio Ferreira, Mário Caetano

In 2014 the Portuguese Government promoted the creation of the open data portal - iGEO, a simple-to-use Internet portal designed to boost the use of open geographic data and to complement SNIG GeoPortal. After the launch phase of iGEO, DGT became the public entity responsible for its coordination. Initially, this open data portal had the collaboration of four public institutions that prepared their information in order to make it available in an open and transparent way through Spatial Data Web Services, on the iGEO portal: Directorate-General for the Territory, Institute for Nature Conservation and Forests, National Institute of Housing and Urban Rehabilitation and Portuguese Environment Agency.

SNIG GeoPortal new developments made it possible to include iGEO components in its platform and to make the search of open data simpler and very intuitive. Therefore, iGEO will be closed, since all spatial data sets registered on this portal are already available from the SNIG GeoPortal.

2. THE CONSTRUCTION PROCESS

In 2015 DGT started a process for SNIG strategic reorientation (Caetano et al., 2015b). This process has begun with a diagnostic study of the situation, which consisted of an online public consultation among the users of this infrastructure with over 500 participants (Table I).

The monitoring of the INSPIRE Directive implementation in Portugal from 2009 to 2017 was also taken into account for this diagnostic study (Gomes et

Table I – SNIG´s user's online public consultation (Source: Caetano et al., 2015a)

Work sector	Number of respondents	
	Absolut values	%
Public Administration	282	56
Higher Education/Research	123	24
Private Entity	65	13
Public Entity	15	3
Non-governmental Organization (ONG)	12	2
Basic and/or Secondary Education	8	2
Total	505	100

al., 2015). In addition to these actions, this diagnostic phase also included an overall SNIG assessment process conducted by a SWOT analysis that involved 18 public entities which allowed us to evaluate the various aspects of SNIG and to envision what this infrastructure might be in the future (Fonseca et al., 2015).

Following the SNIG diagnostic study, which enabled the characterization of this infrastructure, DGT also held a public discussion through a structured blue-sky thinking event. This event was attended by about 50 guests from the public administration, academia, research centers and private sector. Its main objective was to discuss the future of SNIG and to define a SNIG vision for the year 2020, SNIG2020.

According to this vision SNIG should be "A geographic information infrastructure that enables access to geographic information produced or held by public and private entities, associations and citizens through simple, intuitive and efficient search, visualization and download services". It should also be supported on open data, guarantee simple, intuitive and efficient search, based on open source software, reusable by other infrastructures and articulated with local, regional, international and thematic SDIs.

SNIG2020 resulted from a broad national debate on what was expected from the National Spatial Data Infrastructure. It was endorsed by the SNIG Steering Committee (CO-SNIG) in December 2015.

After the publication of SNIG2020, the SNIG2020 Action Plan - Guiding Principles document was prepared in order to materialize and implement this vision. The action plan identified a set of political, institutional, administrative and technical activities to be undertaken by all entities involved in the coordination, maintenance and operation of SNIG. This Action Plan document was approved by CO-SNIG in early 2016, as the entity responsible for SNIG strategic coordination.

3. METADATA CATALOG IMPROVEMENT

The correct and effective performance of a metadata catalog is extremely dependent on the quality of the metadata records. The new SNIG GeoPortal allows searching metadata through predefined filters, which work based on specific keywords and metadata fields.

An analysis of the existing records in SNIG was made in order to identify which aspects needed improvement, namely which ones were outdated, duplicated or had incomplete metadata, had incorrect

fields filling and, in summary, had metadata that were not compliant with the National Metadata Profile for Geographic Information– MIG (Ferreira et al., 2018).

The entities that produce geographic information submit to SNIG the metadata of the spatial data sets and the metadata of the services (only for INSPIRE report) they produce. After the metadata analysis mentioned above, it was requested to these entities to make improvements in their metadata.

To support metadata changes, DGT produced a document describing the rules for changing and improving the metadata of spatial data sets. This document was used as a guide to all entities that have metadata in SNIG. The changes performed consisted essentially of introducing new keywords and improving the completion of several metadata fields such as data policy, geographic location, distribution formats, among others. The main goal of these changes was to ensure an effective response for searches made through the filters available in RNDG.

It should be noted that in the new GeoPortal two metadata catalogs coexist:

Figure 3. SNIG GeoPortal main page

1. The RNDG metadata catalog, which is the basis for the searches and contains all spatial data sets metadata records;
2. The INSPIRE metadata Catalog, a virtual catalog from the first one, which guarantees the fulfillment of Portugal's obligations under the INSPIRE Directive, namely the harvesting mechanism to the INSPIRE GeoPortal, and contains the spatial data sets and services metadata, referenced with the keyword "INSPIRECORE".

4. SOFTWARE

The new SNIG platform is built on Open Source technology and has an improved design to make the interface more dynamic and user-friendly. It was developed using several modules from different open source packages. The integration of these components was made through their APIs.

The base software used is described in Table 2.

The GeoPortal interface has been customized in order to optimize search and access to geographic information and plug-ins have been created to extend GeoNetwork capabilities. Changes have been made in the Geonetwork Core to allow searches only in data sets, however, the support for other types of records was kept (e.g. service). A schema plugin for the MIG Profile was created to apply its specific rules and structure in the catalog metadata.

5. SNIG GEOPORTAL

SNIG most visible part is the GeoPortal (Figure 3), where the main functionalities expected from a Spatial

Table II Software used to create the new SNIG geoportal.

Software	Description
Operating System	Ubuntu Server
PostgreSQL/PostGIS	Object-relational database management system for GeoPortal and RNDG. PostGIS adds support for geographic objects to the PostgreSQL database.
Drupal	Content Management System for the SNIG GeoPortal.
GeoNetwork	Catalog application to manage spatially referenced resources. Supports the National Geographic Data Register (RNDG). Provides powerful metadata editing and search functions as well as an interactive web map viewer.
OpenLayers	Javascript library for implementing map features in the Map Viewer.
ReactJS	Javascript library for implementing map features in the Map Viewer.

Paulo Patrício, Danilo Furtado, Vanda Bica, Alexandra Fonseca, Ana Luísa Gomes, André Serronha, Henrique Silva, Sérgio Ferreira, Mário Caetano

Figure 4. Back-office administration console

Data Infrastructure are implemented. SNIG GeoPortal has three major components: Access, Share and Learn More.

The Access component (*Aceder*) is the entry point to the National Register for Geographic Data in which the metadata catalog is implemented. The search function with auto-complete is available from this component, as well as thematic and structured searches performed through different filters and search by geographic area. Search results can be aggregated and sorted according to various relevance criteria defined by the user.

The Share component (*Partilhar*) explains how to share geographic information and how to promote its interoperability.

The Learn More component (*Saber mais*) enables a deeper understanding of SNIG, namely: legislation matters, SIG evolution, the different levels of SNIG coordination, the existing networks and groups, Portuguese regional and local spatial data infrastructures and the implementation of the INSPIRE Directive in Portugal. This component also entails a section with News and an Archive that contains documents such as technical reports, legislation or group meetings
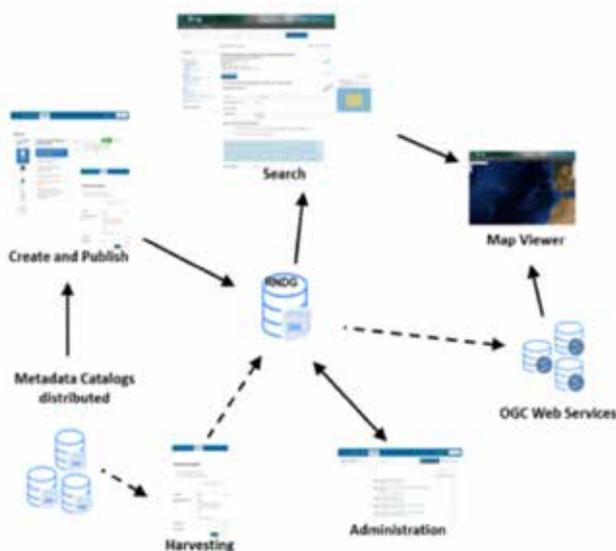
Figure 5. SNIG components

Figure 6. SNIG search functionalities "What…" and "Where…"

reports.

The major SNIG functionalities allow end users to:
- Search and discover metadata records of data sets and series;
- View and create maps from OGC Web Services;
- Create, edit and publish metadata;
- Metadata harvesting.

The back-office administration console (Figure 4) provides quick access to the system configuration. It's possible to manage user and group accounts, classify systems from the web interface, create metadata reports and schedule metadata harvesting. Harvesting is the process to retrieve metadata information from other remote sources like the thematic, regional or local repositories and to store it locally for fast searching. From this console it's also possible to run a scheduled process, so local metadata and remote metadata are always kept aligned.

The following sources can be harvested in SNIG GeoPortal:
- CSW services,
- Local File System,
- WAF (Web Access Folder).

The core of SNIG GeoPortal is the National Register for Geographic Data. It has tools for metadata creation and publication, a tool to search geographic information and to open it in the Map Viewer through a Web Map Service, a tool for metadata administration for Metadata Managers and also a tool for the harvesting

Figure 7. Free search with auto-complete

Figure 8. Some search results using the following criteria for the filters: "Open Data", "View and Download Services" and "Portugal Mainland"
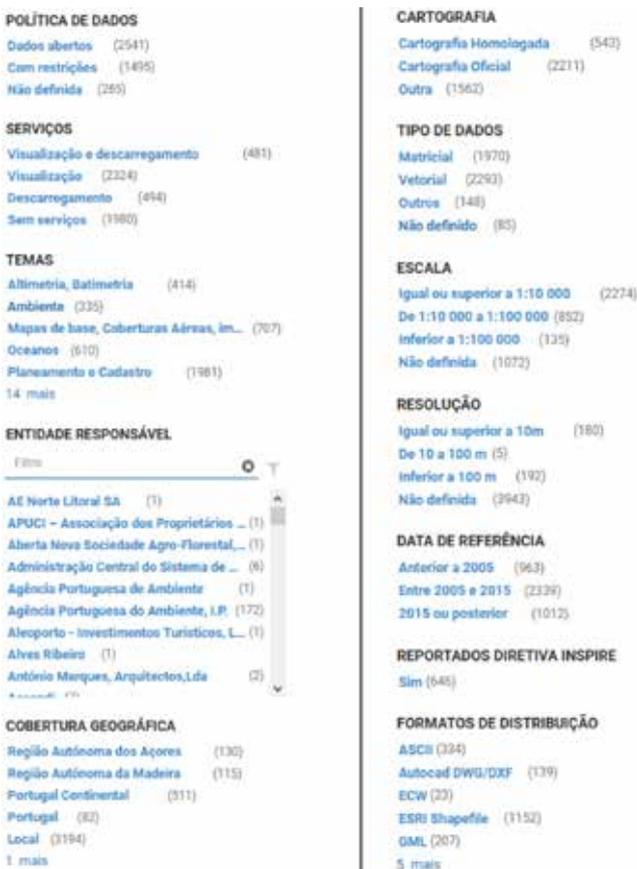
Figure 9. Filters available for SNIG GeoPortal

process (Figure 5).

6. ACCESS TO GEOGRAPHIC INFORMATION THROUGH RNDG

Information search is the main component of the new GeoPortal. SNIG GeoPortal allows users to search for data by two criteria "What…"- searches for text in

the following metadata fields "Title" and "Keyword", and "Where…" - searches the text considering its geographic location (Figure 6).

The SNIG Metadata Catalog, which is the basis for the searches, contains only Data Sets metadata records, not allowing a direct search for Spatial Data Services metadata, as these metadata are associated with the first ones.

The metadata catalog allows users to perform free searches with auto-complete, thematic and structured searches performed through filters, as well as searches by geographic area. Search results can be aggregated and ordered using several relevance criteria (Figure 7).

Searches can be done through the use of several filters, which were created using specific keywords and/or using some fields defined in the Metadata Profile (Figure 8).

SNIG GeoPortal has the following filters (Figure 9):

DATA POLICY - Data Policy identifies resource restrictions on data access and data use. "Open data" means that the resource has no access restrictions and spatial data services are available. On the other hand, "With restrictions" means there are access or use restrictions and spatial data services are not available. "Not defined" means that the spatial data doesn't have a data policy defined. This filter is a combination of Legal Restrictions and Online Access metadata fields.

SERVICES - This filter identifies spatial data services types available for the resource. "View" means that the resource can only be accessed for visualization. "Download" means that the resource can be accessed for download or direct access. "View and download" means the resource can be accessed for visualization or download. On the other hand, "Without Services" means no visualization or download services are available. This filter is a combination of Service Type and Keywords metadata fields.

THEMES - This filter identifies the main theme of the dataset. It's a general thematic classification used to support the dataset search. Themes are classified using the ISO 19115 in Thematic Category Code list.

RESPONSIBLE ENTITY - Responsible entity identifies the Organization Name responsible for the resource. This is the organization to be contacted for information or resource request. This filter corresponds to "Organization Name" metadata field.

GEOGRAPHICAL COVERAGE - Geographic coverage identifies the area covered by the resource and is defined by geographic identifiers. "Portugal" is the highest level which means that represents a coverage of the whole national territory. "Mainland Portugal", "Azores Autonomous Region" and "Madeira Autono-

Paulo Patrício, Danilo Furtado, Vanda Bica, Alexandra Fonseca, Ana Luísa Gomes, André Serronha, Henrique Silva, Sérgio Ferreira, Mário Caetano

Figure 10. Spatial Data Services access

mous Region" are in the middle level which means the coverage of the respective areas. "Local" is the lowest level and means the coverage of a local area (e.g. municipality). This filter corresponds to the "Geographic Identifier" metadata field.

CARTOGRAPHY - This filter identifies the Cartography situation. "Ratified Cartography" means that has been recognized as meeting the technical standards. "Official Cartography" means that has been produced by an official public organization according to the legislation. "Other" means the cartography does not fit in Official or "Ratified Cartography". This filter corresponds to a Keywords metadata field.

SCALE - Scale identifies the level of detail of the resource, expressed as a scale factor, used for Vector data. The 1:10 000 or more scale means large scales. "Between 1:10 000 and 1:100 000" means that it is between large and small scales. The "Less than 1:100 000" scale means that resources have a small scale resolution. This filter corresponds to the "Spatial Resolution" metadata field.

RESOLUTION - Resolution identifies the level of detail of the resource, expressed as a ground distance, used for Matricial data. "10 m or more" means a high resolution. "Between 10 and 100 m" means that it is between high and small resolution. "Less than 100 m" means that the resource has a small resolution. This filter corresponds to the "Spatial Resolution" metadata field.

DATE (OF REFERENCE) - Reference Date identifies the creation or collection date of the resource. This filter corresponds to the "Citation date" metadata field.

INSPIRE DIRECTIVE REPORTS - INSPIRE Directive Re-
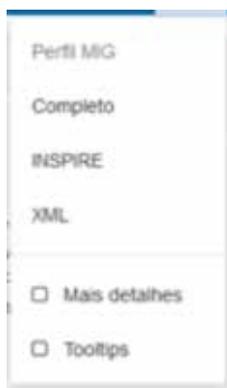
Figure 11. Metadata profiles view
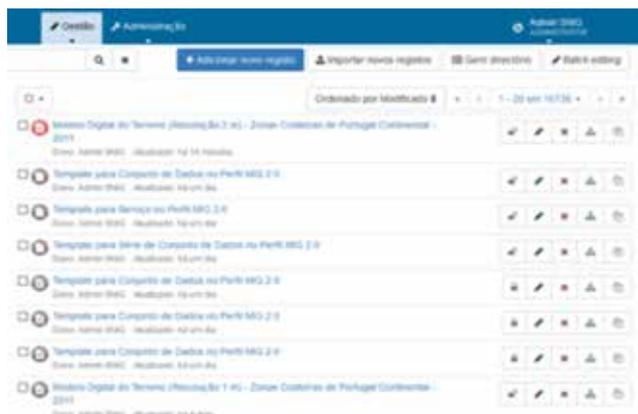
Figure 12. Metadata editor dashboard

ports identifies resources that are reported under the INSPIRE Directive. Uses the INSPIRECORE keyword and corresponds to the "Keywords" metadata field.

DISTRIBUTION FORMAT - Distribution Format identifies the format in which the resource is available for the users. This filter corresponds to the "Format Name" metadata field.

The information included in SNIG is cataloged to allow an easy and fast access to the data. When provided by the producer, View and Download services are accessible and the users can obtain its URL or view the data directly using the SNIG Map Viewer (Figure 10).

7. METADATA EDITOR TOOL

Metadata are fundamental in a SDI, since they allow users to know if some spatial data exist and if they are accessible and fit for a specific purpose. The metadata submitted to the SNIG GeoPortal must be compliant with the Portuguese Metadata Profile (MIG), based in the standards ISO 19115 / ISO 19119 / ISO 19139, Open GeoSpatial Consortium (OGC) and INSPIRE.

In the SNIG restructuring process, a Geonetwork metadata schema was included to adopt the national (MIG) and the INSPIRE profiles. A metadata manager allows the selection of different views, according to a specific profile (Figure 11).

Figure 11 can be read as follows:
- Perfil MIG – display all fields from the MIG profile;
- Completo – based on the metadata standard and providing access to all descriptors from the standards;
- INSPIRE – display all fields required by INSPIRE;
- XML – displaying the record as an XML document.

The SNIG GeoPortal includes also an advanced online Metadata Editor. The metadata created using this
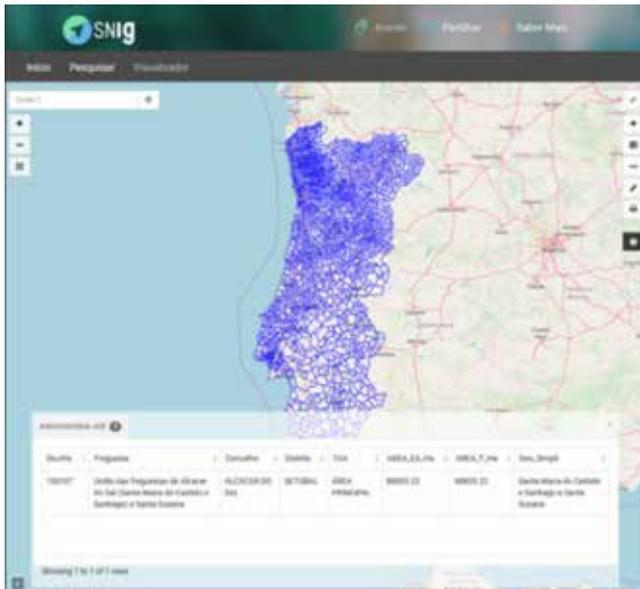
Figure 13. SNIG Map viewer

Editor is compliant with the above standards (Figure 12).

The metadata editor tool describes the spatial data set and allows the following actions:

- Create metadata for data sets, series and services. Metadata creation interface
- Import new metadata entries in the metadata catalogue from another metadata editor. The import new records page allows metadata manager to import records giving four possibilities:
- Upload a file from a local drive.
- Upload a file from an URL.
- Copy/Paste the XML content.
- Import a set of files from a folder on a server.
- Update and manage existing metadata entries in the metadata catalogue
- Delete existing metadata entries in the metadata catalogue
- Metadata validation according to the MIG, ISO and INSPIRE profiles
- Export metadata to XML, ZIP, PDF and CSV format.

8. SNIG GEOPORTAL MAP VIEWER

SNIG GeoPortal Map Viewer is a tool to visualize, interact and overlay maps. It provides advanced capabilities for presenting and querying spatial data from various sources (Figure 13). The Map Viewer contains a basemap (Open Street Map) and provides several interaction tools, navigation tools to pan, zoom and extent map, measurement, location search, draw, printing and add layers through Spatial Data Web Services. This viewer can be used from the SNIG metadata catalog or as standalone application.

9. CONCLUSIONS

The new SNIG GeoPortal is more user-friendly, uses state-of-the-art technology and will definitely contribute to increase the use of Portuguese spatial data sets. RNDG restructuring process, that is intrinsically related to SNIG development, improved and consolidated the metadata catalog content allowing more efficient searches and more effective results.

INSPIRE implementation in Portugal, supported by this new SNIG, can now continue its course using a more intuitive and well-organized platform.

It is expected that with this new SNIG GeoPortal more public entities will register their spatial data sets in this platform and the number of users will consequently also increase. This infrastructure will play a relevant role in the Digital Single Market initiative in Portugal.

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Paulo Patrício is since 2012 the Director of the Geodesy, Cartography and Geographic Information Department at the Directorate-General for the Territory (DGT). He holds a degree in Surveying Engineering from the Lisbon University and he worked for the Portuguese Army Geographic Institute from 1996 until the year 2000.

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