

# An overview of the INSPIRE implementation in Azores, Portugal

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The Interactive Spatial Data Infrastructure of the Azores (IDEiA), project in progress since 2009, aims to promote the sharing of geographic information about the Azores between the various entities responsible for its production. The IDEiA was formerly established by the Regional Legislative Decree No. 42/2012/A, of October 8, which also adapted the INSPIRE Directive to the Azores (Portugal).

In this context, a number of regional thematic working groups have been set up to analyze and implement the standards and technical specifications resulting from the INSPIRE Directive, in conjunction with the national working groups. These working groups integrate the various regional public entities that produce geographical information within the various themes listed in Annexes I, II and III to Directive 2007/2/EC.

These working groups are making several efforts to harmonize spatial data sets using the Humboldt Alignment Editor tool and the INSPIRE data model developed for the Region. This model identifies the spatial data and tables that constitute the INSPIRE themes applied to the Azores, as well as the relationship existing between them. For those datasets, thematic working groups published their respective view and download services, in accordance to the OGC standards.

In addition to these tasks, INSPIRE metadata was created for spatial data sets and spatial data services with the Azorean Metadata Manager, which is a multifunctional tool that allows the production and edition of metadata files. This tool was developed by the Government of the Azores to ensure the conformity of the metadata files to the INSPIRE rules as well to the Portuguese Metadata Profile. Given its characteristics and functionalities, most metadata managers in Portugal use this tool.

Since the IDEiA determines the need to make the metadata files available to the public, the Government of the Azores also developed another functionality called Metadata System of the Azores, which is available online and allows any user to view the existing metadata for the Azorean spatial data and spatial data services.

Because of the work being carried out, it is noted that the Azores have played an important role in monitoring of the INSPIRE implementation in Portugal. The Region has contributed to the delivery of positive results for indicators related to the existence and compliance of metadata for the spatial data sets and services and to their accessibility through discovery services.

## **KEYWORDS**

INSPIRE, dataset, services, metadata, monitoring, IDEiA, GeMA, Azores, Portugal

## INTRODUCTION

The IDEiA, the spatial data infrastructure (SDI) for the Autonomous Region of the Azores, implemented in 2009 by the department of the Government of the Azores with competence in geographical information (GI) has the objective of promoting the sharing of GI about the Azores between the various entities responsible for GI production.

This project also involved the creation of the IDEiA Portal (Figure 1) through which various spatial data sets and services about the Azores are available to the public.

This Portal also provides information about other GI projects developed in the Region, as well as the listing of regional, national and international events related to GI and a monthly newsletter. This newsletter contains several articles related to remote sensing, GI, open source software and the Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007, which establishes an Infrastructure for Spatial Information in the European Community (INSPIRE).



Figure 1: Main page of the IDEiA Portal, available at <http://www.ideia.azores.gov.pt/>

The IDEiA was formerly established by the Regional Legislative Decree No. 42/2012/A, of October 8, which also defines the legal framework that transposes, to the internal legal order and in the Autonomous Region of the Azores, the INSPIRE Directive.

The specific objectives of the IDEiA are, among others, the development of actions of articulation with regional, national and international GI programs and the guidance of public entities in the operationalization of GI platforms.

The provisions of this law apply to all public entities in the Region and to third parties who hold GI concerning the territory of the Region, including maritime areas and the water domain. With the entry into force of this law, public entities with responsibility for GI production shall become available all spatial data sets and services in accordance with the INSPIRE Directive.

Therefore, the department of the Government of the Azores with competence in GI can provide, upon request, technical support to public entities and third parties in order to take the actions leading to compliance with the obligation of each body to ensure the interoperability of services and geographic data.

The above-mentioned diploma also provides for:

- The creation of a geographical information register in order to list and make known the existing spatial data sets in the Azores, through their metadata;
- The implementation of the Metadata System of the Azores in order to make the metadata files available to the public;
- The development of the Azorean Metadata Manager (GeMA) to allow the production and the edition of metadata for the existing spatial data sets and services about the Azores.

## GEOGRAPHIC AND POLITICAL FRAMEWORK

Azores archipelago is located in the Atlantic Ocean (Figure 2), in the Macaronesia biogeographical region, between parallels  $36^{\circ}45'$  and  $39^{\circ}43'$  north latitude and the meridian  $24^{\circ}45'$  and  $31^{\circ}17'$  west longitude [1]. The archipelago make up an area of 2 322.3 km<sup>2</sup> and are diagonally distributed by approximately 66 000 km<sup>2</sup>, with a NW-SW orientation over nearly 600 km long [1].



Figure 2: Geographic framework of the Azores archipelago

There are nine Azorean islands, in three main groups. These are the Eastern Group (Santa Maria and São Miguel islands), the Central Group (Terceira, Graciosa, São Jorge, Pico and Faial islands) and the Western Group (Flores and Corvo islands). The archipelago is about 850 km away from the coastline of mainland Portugal.

The Eastern Group is composed by seven municipalities, in which, according to the 2011 Census, the majority of the Azorean population resides, that is 143 277 inhabitants. The Central Group has nine municipalities, in which resides 99 141 inhabitants, and finally, the Western Group, that has three municipalities, had 4 223 inhabitants in 2011 [2].

The Azores, officially the Autonomous Region of the Azores, is one of the two autonomous regions of Portugal, and has its own government and autonomous legislature within its own political-administrative statute and organic law.

Given the geographical dispersion of the Azores archipelago and the consequent population distribution across the nine islands, it is observed that the head offices of the different departments of the Government of the Azores are spread among the islands with the highest population density and economic development, which are the São Miguel, Terceira and Faial Islands.

The head offices of the departments that constitute the Government of the Azores are distributed by the three islands mentioned above, as follows [3]:

- In São Miguel, namely in the city of Ponta Delgada, are located the departments with competence in Employment and Competitiveness Business, Transport and Public Works, Energy, Environment and Tourism and External Relations;
- In Terceira, namely in the city of Angra do Heroísmo, are located the departments with competence in Social Solidarity, Education and Culture, Health and Parliamentary Affairs;
- In Faial, namely in the city of Horta, are located the departments with competence in Sea, Science and Technology, and Agriculture and Forestry.

## **STRATEGIES ADOPTED FOR THE IMPLEMENTATION OF INSPIRE DIRECTIVE IN THE AZORES**

In view of the fact that the INSPIRE Directive has been transposed into the regional internal legal order, the Government of the Azores decided to proceed with the implementation of a set of strategies that would permit the inventorying, organization and sharing of the existing GI. As mentioned above, this GI concerns to the islands territory, maritime areas and water domain, owned by the regional public entities and third parties.

### *IMPLEMENTATION OF THE IDEIA PROJECT*

The first work strategy went through the implementation of the IDEiA project, through which was established the reference SDI for the Region, as well as the respective Internet Portal for access to the geographic content shared within the project.

In order to promote the sharing of GI in Azores, several formal contacts were established with the departments of the Government of the Azores and with local authorities that already had GI about the Azores. To ascertain which governmental departments could possibly have GI, it was necessary to assess their legal competences and request for a point of contact. Several meetings were held with these entities, in order to integrate them into the IDEiA project, as well as encouraging the treatment and sharing of their GI.

### *IMPLEMENTATION OF THE INSPIRE PROJECT*

At the same time, the Government of the Azores decided to develop the GeMA's application, shown in Figure 3, which is a multifunctional tool that allows the production and edition of metadata files for spatial datasets and services.

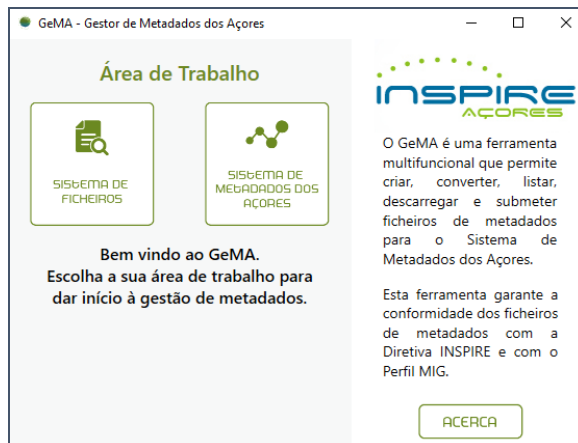


Figure 3. GeMA's start window

These metadata refers to the set of thematic categories listed in Annexes I, II and III of the diploma that creates the IDEiA, which also correspond to the Annexes of the INSPIRE Directive. Therefore, this tool allows the creation of metadata according to the rules defined by the Commission Regulation No. 1205/2008, of December 3, regarding metadata (Figure 4). This Regulation defines a number of metadata elements, their multiplicities and the value domains to use in the metadata. The metadata elements defined in the Implementing Rules for Metadata are usually called discovery metadata [4].

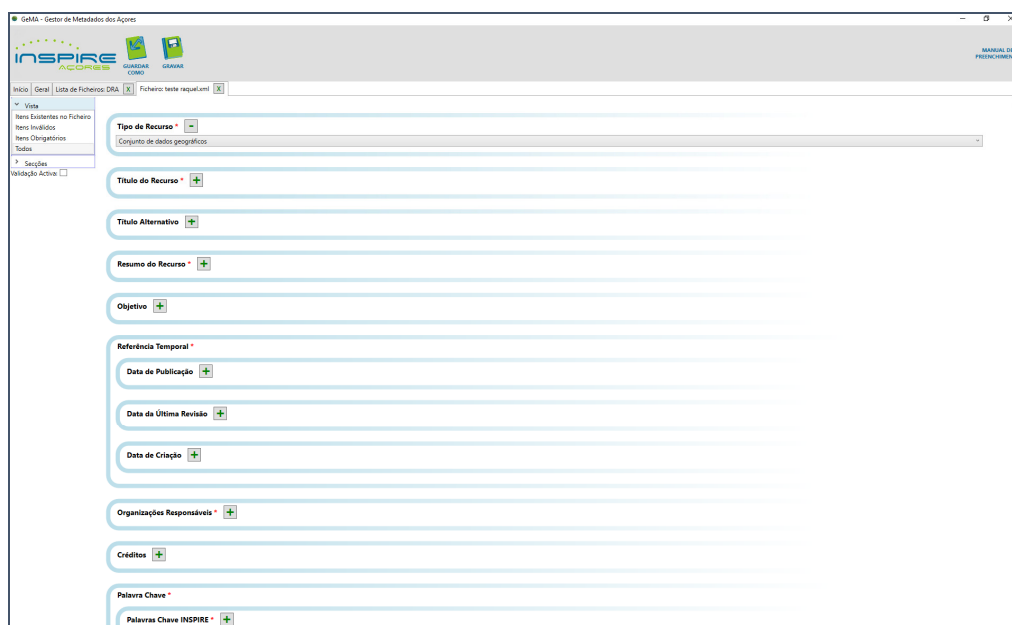


Figure 4. Metadata creation form

In view of the existing rules at the Directive level, as well as the need to comply with the National Metadata Profile (MIG Profile), the development of the GeMA aimed the creation of metadata in accordance with all these applicable rules.

Given its characteristics and functionalities, most metadata managers in Portugal use this tool to produce their metadata. This tool is available online for free download at the IDEiA Portal (<http://www.ideia.azores.gov.pt/Paginas/gema.aspx>). As already shown above, the decision to create this tool meets one of the assumptions established in the legal diploma that creates the IDEiA

SDI in the Azores.

As stated above, this tool has two different workspaces, one for creating and editing metadata in a file system environment and another for editing e submitting datasets and services metadata related to Azorean GI. The evaluation of the metadata files submitted through this last workspace is done by the IDEiA project team and, in case of approval, are automatically integrated in the Metadata System of the Azores, which is available online to the public.

The implementation of the Metadata System of the Azores is also foreseen in the legal diploma that created the IDEiA. It determines the need to provide online the list of all the existing metadata files for spatial datasets and services (Figure 5) related with Azorean GI (<http://www.ideia.azores.gov.pt/smacores/Paginas/ListMetadados.aspx>).

The screenshot shows the 'Sistema de Metadados dos Açores' interface. At the top, there is a navigation bar with links for 'Presidente', 'Governo Regional', 'Notícias', 'Contactos', and 'Agenda'. Below this is a search bar and the title 'Sistema de Metadados dos Açores'. A secondary navigation bar includes 'IDEiA', 'Geo-Serviços', 'Metadados', 'Ferramentas', 'Serviços: WMS e WFS', and 'Autenticação'. The main content area is titled 'Metadados do SMA' and displays a table with the following columns: 'Título', 'Entidade', 'Tipo do Recurso', and 'Identificador do Ficheiro'. The table lists several metadata entries, including 'Espaços TIC da Região Autónoma dos Açores', 'Associações Juvenis da ilha do Corvo', 'Associações Juvenis da ilha do Flores', 'Associações Juvenis da ilha do Faial', and 'Associações Juvenis da ilha da Graciosa'.

Título	Entidade	Tipo do Recurso	Identificador do Ficheiro
Espaços TIC da Região Autónoma dos Açores	DRCT	dataset	520718e2-3b3e-46e2-95e2-e5816db04684
Associações Juvenis da ilha do Corvo	DRJ	dataset	4dc65b3e-ad28-4c27-9e66-fd66869d3c55
Associações Juvenis da ilha do Flores	DRJ	dataset	e47c8ea2-06b4-430d-9eE1-9c6d7c5c2405
Associações Juvenis da ilha do Faial	DRJ	dataset	91a9a7a3-00ec-49eb-a193-df20eab13041
Associações Juvenis da ilha da Graciosa	DRJ	dataset	eFad9119-6ca7-4190-8bc9-eb73063c6634

Figure 5. Example demonstrating the metadata listing in the Metadata System of the Azores

Through the Metadata System of the Azores, the user can also perform simple and advanced searches, as shown in Figure 6, based on a set of metadata elements that correspond to the mandatory fields defined in the EN ISO 19115 and EN ISO 19119, in the INSPIRE Profile and in the Portuguese Metadata Profile.

The screenshot shows the 'Pesquisa avançada' (Advanced Search) interface. It features a search bar labeled 'Incluir estes termos:' and two filter rows. The first filter row is set to 'Filtro 1: Título' with a dropdown menu, 'Contém' with a dropdown menu, and the search term 'orto'. The second filter row is set to 'Filtro 2: Título' with a dropdown menu, 'Contém' with a dropdown menu, and the search term 'são miguel'. Below the filters are buttons for 'Adicionar filtro de pesquisa', 'Remover filtros', and 'Pesquisar'. The results section, titled 'Resultados', displays two search results. The first result is 'Serviço de visualização (WMS) do ortofoto da ilha de São Miguel - Região Autónoma dos Açores', which includes a description of the service, the date of the metadata (12/03/2017), and the responsible organizations. The second result is 'Áreas dos Portos - São Miguel (SMG)', which includes a description of the vectorial delimitation, the date of the metadata (27/09/2017), and the responsible organizations.

Figure 6. Results obtained by carrying out an advanced search in the Metadata System of the Azores

Besides the creation of the GeMA and the Metadata System of the Azores, it was also implemented by the Government of the Azores a INSPIRE Data Model for the Region, adapted to the reality of the Azorean territory. It means that a relational database was constructed based on the technical specifications of all the thematic categories listed in Annexes I, II and III of the INSPIRE Directive.

As an example of the adaptation of these thematic categories to the reality of the regional territory, a mention should be made to the transport network theme, for which the implementation of the rail transport network was not carried out, since it is non-existent in the Region.

The INSPIRE data model developed for the Region is available for free download at the IDEiA Portal (<http://www.ideia.azores.gov.pt/Paginas/modelos-dados.aspx>), in several formats, like file geodatabase (ESRI format) and PostGIS (spatial database extender for PostgreSQL), in order to permit its reutilization by the users that want to harmonize their spatial datasets in conformance with the INSPIRE Directive.

The decision to create a data model adapted to the Region is justified by the fact that, at the time, practical guidance on the harmonization of data sets were practically nonexistent at Community and Nacional levels. Since it was necessary to start working towards fulfilling the obligations under the INSPIRE Directive, the solution found was that so entities with GI could start working on the harmonization of their data in accordance with the provisions of the INSPIRE Directive.

The way this data model was constructed facilitates the process of treatment and harmonization of the datasets by the entities that have GI, since the features classes, tables and relationships defined in the data specifications for the spatial data themes identified in the INSPIRE Directive are already established in the relational database.

It permits the entities to organize and fit their data in these relational database, thereby ensuring compliance with the objectives of the INSPIRE which are, among others, interoperability and harmonization of spatial data sets and services in Europe.

#### *CREATION OF REGIONAL INSPIRE THEMATIC WORKING GROUPS*

Another measure put in place to promote the implementation of the INSPIRE Directive in the Region, concerned to the creation of several regional INSPIRE thematic working groups, integrating the public entities that have been identified as holding GI within the thematic categories defined on the Annexes I, II and III of the INSPIRE Directive.

These groups aim to study the implementation arrangements for the data specifications of each theme and to apply them to the spatial data sets and services for which those entities are responsible, taking into account the target dates defined in the INSPIRE Directive. These working groups also analyze and disseminate new guidelines related to the Directive, publicize events related to it and follow the issues discussed under the INSPIRE thematic clusters.

These thematic working groups were set up in line with those already created at the national level, which are nine and in line with the thematic clusters created by the European Commission, whose structure is presented below:

- The working group GT01RAA is dedicated to the Elevation, Orthoimagery, Reference Systems and Geographical Grids Cluster and covers the themes “Elevation”, “Orthoimagery”, “Coordinate reference systems” and “Geographical grid systems”;
- The working group GT02RAA is dedicated to the Biodiversity and Management Areas Cluster and covers the themes “Protected sites”, “Bio-geographical regions”, “Habitats and

biotopes”, “Species distribution” and “Area management / restriction / regulation zones & reporting units”;

- The working group GT03RAA is dedicated to the Earth Science Cluster and covers the themes “Energy resources”, “Mineral Resources”, “Soil”, “Natural risk zones” and “Geology”;
- The working group GT04RAA is dedicated to the Statistical Cluster and covers the themes “Statistical Units”, “Population distribution (demography)” and “Human health and safety”;
- The working group GT05RAA is dedicated to the Marine and Atmosphere Cluster and covers the themes “Meteorological Geographical Features”, “Atmospheric conditions”, “Sea regions” and “Oceanographic Features”;
- The working group GT06RAA is dedicated to the Environmental Monitoring and Observations Cluster and covers the themes “Environmental Monitoring Facilities” and “Observations and Measurements”;
- The working group GT07RAA is dedicated to the Land Cover and Land Use Cluster and covers the themes “Land Cover” and “Land Use”;
- The working group GT08RAA is dedicated to the Facilities, Utilities and Public Services Cluster and covers the themes “Utility and Governmental Services”, “Production and Industrial Facilities” and “Agricultural and Aquaculture Facilities”;
- The working group GT09RAA is dedicated to the Topographic and Cadastral Reference Data Cluster, covering the themes “Administrative Units”, “Addresses”, “Buildings”, “Cadastral Parcels”, “Geographical Names”, “Hydrography” and “Transport Networks”.

Each group have a coordinator and a deputy coordinator who have the responsibility of organizing the working group meetings, convening the participants and establishing the annual working plan for the group. The coordinator is also responsible for disseminating relevant information by the members of the group, as well as to represent the working group in the national working groups meetings.

Now, the nine regional working groups integrate twenty-five departments of the Government of the Azores, nineteen local authorities, three companies with majority public capital and one research center of the University of the Azores, all of which have GI that falls within the thematic categories defined on the Annexes I, II and III of the INSPIRE Directive.

#### *AZORES PARTICIPATION IN NATIONAL INSPIRE COMMITTEES, GROUPS AND NETWORKS*

The department of the Government of the Azores with competence in GI, which is the Regional Contact Point for the INSPIRE Directive in the Azores, participates in several INSPIRE National Committees, groups and networks like:

- The Guidance Council of the National GI System (CO-SNIG), in which the Region has the right to vote with regard to the adoption of strategic guidelines for Portugal concerning cartography and GI;
- The Network of Focal Points INSPIRE CORE, in which is one of the contact points of the public institutions that produce spatial data sets and services;
- The Metadata Management Network, in which represents the regional metadata managers;



- The Services Management Network, in which represents the regional public institutions with responsibilities in the implementation of the Directive in Portugal, namely in the creation and/or management of data set services;
- The Transversal Working Group, which is a technological group comprised of INSPIRE CORE Focal Point entities representing the diversity of technological solutions available in the market;
- The INSPIRE Monitoring and Reporting Working Group, set up under CO-SNIG, which supports The National Contact Point for the INSPIRE Directive in annual monitoring and preparation of the triennial Report on the implementation of the Directive in Portugal.
- The Working Group Coordination Group INSPIRE-PT (GC-GTI), as an observer only.

The Region participates actively in the working group meetings, in the activities promoted by the working groups referred above, issues opinions, and provides suggestions on documents and new guidelines related to cartography and geographical information.

## RESULTS

All the actions taken by the Government of the Azores contributed to the inventory, treatment and sharing of the existing GI in the Region.

It was equally important for the process of identifying the regional public entities that hold GI within the thematic categories defined on the Annexes I, II and III of the INSPIRE Directive. These actions also contributed to the approximation and contact between these entities that are, in some cases, territorially distant and dispersed.

Between the years of 2009 and 2016, the implementation of the infrastructure and the IDEiA portal made possible the storage of GI about the Azores, its sharing among the several regional entities, as well as its availability to the public through Geographical Information System online viewers.

Through the implementation of the INSPIRE project it was possible to comply with some of the provisions set out in the Regional Legislative Decree No. 42/2012/A, of October 8, namely the ones related to the creation of the a geographical information register, the implementation of the Metadata System of the Azores and the creation of GeMA.

Since that time, approximately 1.500 metadata files about Azorean spatial data sets and services were created by their competent authorities, and are available online in the Metadata System of the Azores.

Of these 1.500 metadata files, six of them are related to metadata created by companies with majority public capital, six are metadata created by a national public entity that produces GI for the Azores, sixty-one are metadata created by three local authorities, and the remaining 1.491 metadata files are responsibility of several departments of the Government of the Azores. Of these 1.491 metadata files, the department of the Government of the Azores with competence in environment, energy and tourism created and submitted about 1.200 metadata files.

Given the high number of metadata files submitted through the Metadata System of the Azores, it is possible to conclude that a large number of metadata managers in the Region use GeMA to create metadata for their spatial data sets and services.

It is also known that many users in mainland Portugal use GeMA to create their metadata, since the tool guarantees not only compliance with the INSPIRE Directive, but also with the Portuguese Metadata Profile. The fact that this tool is updated whenever new metadata filling rules are defined

is a good point for its users, as the compliance of their metadata with the standards in force is guaranteed.

After 2016, INSPIRE data model for the Region, whose development begun in 2009, was completed and updated in 2017 based on the release of new versions of some data specifications of the the spatial data themes identified in the INSPIRE Directive.

The completion and improvement of the INSPIRE regional data model made possible the beginning of the work of treatment and harmonization of the GI existing in the Azores by the public entities with responsibilities in the execution of these tasks.

Also, the participation of some members of the INSPIRE regional working groups in various workshops, trainings and conferences related to INSPIRE Directive, allowed the acquisition of more knowledge about the existing tools and processes that can facilitate the implementation of the INSPIRE Directive in the Azores.

With regard to the tools previously mentioned, it should be noted that the software Humboldt Alignment Editor and GeoServer have also been used, in conjunction with the INSPIRE regional data model, since their joint use allow better outputs in terms of data sets harmonization and subsequent services publication, in accordance to the INSPIRE Directive requirements.

It should be noted that the regional working groups are playing an important role in this area, since in the context of their activities they have been promoting the utilization of those tools by all its members.

In terms of web services, it is important to refer that they are currently 219 web services published in the Metadata System of the Azores, mostly Web Map Services and Web Features Services. Some of these web services respect to GI that does not fall under the INSPIRE Directive themes. Those that fall under the INSPIRE Directive themes are not yet compliant with it.

However, all datasets whose harmonization was considered by the Regional Government to be a priority, will be duly published in accordance with the INSPIRE Directive until 23 November. This is the target date imposed by the Commission Regulation (EU) No. 1089/2010, of 23 November 2010, regarding interoperability of spatial data sets and services for Annex I spatial data sets.

## **DISCUSSION AND CONCLUSIONS**

After the publication of the INSPIRE Directive, and taking into account the stages and target dates defined in the INSPIRE roadmap, the Regional Government of the Azores decided to start participating actively in the activities led by the national level working groups and to define a set of strategies for the implementation of the Directive in the Azores Region.

The Government of the Azores started by creating the IDEiA and the INSPIRE Projects, which aimed to implement a reference SDI for the Region, as well as a set of functionalities that would permit the execution of all the tasks imposed by the INSPIRE Directive.

In this context, besides the creation of the IDEiA and its Portal, an INSPIRE data model was developed for the Region, taking into account the reality of the island territory.

The creation of a SDI, a Portal and a INSPIRE data model adapted to the Region aimed the promotion of the treatment and the sharing of the existing GI about the Azores Region, in conformance with the INSPIRE requirements and between all the regional public entities. Through the execution of this tasks, the harmonization and interoperability of the spatial data sets would be resolved and be in accordance to the INSPIRE Directive's requirements.

In parallel with the execution of these tasks, a metadata manager for the Azorean spatial data sets and services was developed, resulting in the current GeMA's application, which is widely used by metadata managers in Portugal. This tool allows the creation of metadata in accordance to the INSPIRE Directive as well as with the Portuguese Metadata Profile.

This tool has a direct relationship with the Metadata System of the Azores, which is another functionality developed under the INSPIRE Project that allows the listing and search of all the data set and service metadata existing in the Azores.

Another project was executed in the Azores Region related to the implementation of the INSPIRE web services without the expected results. This project aimed the execution of several tasks that could not be fulfilled since there was not enough knowledge about the matter. The positive aspect of this project was the creation of catalog services, which are currently in use under the IDEiA Portal.

In the Azores Region were also created several regional working groups, dedicated to the analysis and implementation of the technical guidelines related to the GI harmonization, services publication metadata creation and validation in accordance to the INSPIRE requirements.

All these governmental actions, some of them successfully implemented, endowed the Region with a vast knowledge in this field. Nowadays it is possible to better understand what is the main goal of the INSPIRE Directive and in which terms the Region want to adopt its requirements.

The Government of the Azores already knows which is the work strategy to adopt in the near future, in order to preserve the structure of the existing geographical information databases and, at the same time, share the GI in accordance to the INSPIRE requirements.

It is important to understand that the INSPIRE Directive shall be implemented in a way that do not compromise all the work that has already been done in the Region, in terms of Geographic Information Systems.

It is also important that the Azorean public entities, which have GI related to the thematic categories listed in the Annexes I, II and III of the INSPIRE Directive, think about INSPIRE as a way of inventorying and organizing their data in order to be able to share it with other entities. The creation of web services for the geographic information that those entities want to become available to the public is the better way to promote the GI sharing in the Azores, whether it is within the thematic categories listed on the Annexes of the INSPIRE Directive or not.

There are several ways to publish these web services and to integrate them in data portals of eventual interest for those entities. The web services publication contributes to the dissemination of the existing data in the Region, as well as to promote and stimulate the various areas of activity of the Government of the Azores.

The harmonization of the GI, held by the several regional public entities, and their availability through web services, is the only way to guarantee the interoperability requisites that are defined in the INSPIRE Directive, as well as in the legal diploma that created IDEiA in the Region.

For now, the strategy of the department of the Government of the Azores with competence in GI is to motivate and to help the regional public entities that have data sets to harmonize and publish until 23 of November. At the same time, this department also has to harmonize and publish their GI in accordance to the INSPIRE Directive and, thus, comply with the referred target date.

Some regional public entities are harmonizing their GI with the Humboldt Alignment Editor, which is a tool for defining and evaluating conceptual schema mapping. This tool allows the mapping

between a set of source data and different target schemas, like the ones that are defined for the thematic categories listed in the Annexes I, II and III of the INSPIRE Directive.

In this tool, the transformation of the data sets is possible through the definition and running of several mapping functions that relate the existing fields in the source schema with the ones listed on the target schema.

The resulting file from this operation is a GML file, which can be published directly to the GeoServer. This solution is just one of the several existing solutions for the harmonization and publishing processes, needed to fulfill the INSPIRE Directive requirements, in terms of interoperability of data sets and services. This work methodology has been applied by several European bodies, as verified in the INSPIRE Conference 2017, held in France and Germany.

One of the most important aspects of this work methodology is the fact that it allows the creation of mapping tables for the data transformation. Therefore, there is no longer a need to have two databases with the same information, one with the original information and another one with the GI harmonized in accordance to the INSPIRE Directive.

Despite the existence of more and better technological solutions for the implementation of the INSPIRE Directive in Europe, what is observed in the Azores, in Portugal and in the rest of the European countries, is the lack of human resources with the necessary training to carry out this type of tasks.

The lack definition of work strategies for the implementation of the INSPIRE Directive as well as the lack of guidelines and technical support from the European Commission led to the need to make changes to the work methodology initially defined by the Government of the Azores.

Another difficulty experienced in the implementation of the INSPIRE Directive in the Region concerns to the involvement of the local authorities in this process. They generally do not attend meetings of regional working groups, do not respond to emails sent by the coordinators of these groups, show no interest in sharing their GI or meeting the INSPIRE Directive requirements. For that reason, it will be necessary to define a new strategy to involve the local authorities in the implementation of the INSPIRE Directive in the Region.

Despite all these difficulties, and because of all the work that is being carried out, it is noted that the Azores have played an important role in monitoring of the INSPIRE implementation in Portugal. The Region has contributed to the delivery of positive results for indicators related to the existence and compliance of metadata for the spatial data sets and services and to their accessibility through discovery services.

In order to maintain and improve the Region's current contribution to the INSPIRE Policy implementation in Portugal, the Government of the Azores intend to make some investments. Those investments aim the improvement of the current GI storage conditions, the development of new functionalities and the improvement of the map services performance.

The Government of the Azores also intends to train their human resources in the GIS field, in order to increase the number of technicians with capacity of developing the work required for the INSPIRE implementation in the Azores.

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