IDE-OTALEX: The First Crossborder SDI Between Portugal and Spain

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Abstract

IDE-OTALEX is the first crossborder spatial data infrastructure between contiguous Portuguese (Alentejo and Centro) and Spanish (Extremadura) regions. IDE-OTALEX was implemented to share official geographic information, from Alentejo and Extremadura, and now Centro region, with everyone. This is the most effective way to have a distributed and flexible system to be used as a territorial observatory for sustainable development and environment protection in these rural and low populated regions. It also contributes to territorial cohesion, one of the tree main pillars of the European Cohesion Policy.

IDE-OTALEX is characterized for being a distributed, decentralized, modular and collaborative system, based on standards (OGC, W3C, ISO) and open source technology, developed to guarantee interoperability between the different GIS provided by each project partner. The geoportal is multilingual (Portuguese, Spanish and English) and integrates a Map viewer, Metadata Catalogue and Gazetteer. It consists of central and local nodes which communicate through WMS (Web Map Services), CSW (Catalogue Service Web) and WFS (Web Feature Services). It is now implementing SOS (sensor observation services) and WPS (web map processing).

The geographic information available on it results from an extensive work of data harmonisation adapted to INSPIRE Directive (D 2007/2/EC, of the European Parliament and Council, of March 14, 2007). It integrates basic cartography, socio-economic and environmental indicators.

1 Introduction

OTALEX C is the Territorial and Environmental Observatory of the crossborder region composed by Alentejo and Centro regions of Portugal and Extremadura region of Spain (figure 1), built up on the close cooperation between several Portuguese and Spanish entities who collaborate in the fields of landscape management and geographic information systems since 1997. Along these 16 years, several projects where developed with the cofinancing of the Crossborder Cooperation Programmes for Spain-Portugal of the European Regional Development Fund (ERDF).

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It aims to monitor and analyse territorial and environmental changes and to pressure on both sides of the Spanish-Portuguese border. The project area is composed by three administrative units (NUTSII): Alentejo and Centro in Portugal, and Extremadura in Spain, involving about 92.200 km2 and having the same geographic area of the European region EUROACE – Alentejo-Centro-Extremadura, created in 21 September 2009, as an organizational structure that aims to reinforce cooperation between these three regions that share a common border and problems.

These are sparsely populated regions (less than 37 inhabitants per km^2) with a generalised high aging index and low natural growth, which has been partially contradicted by immigration. The main economic activities are agriculture and services. They are also quite rich in natural, built and landscape heritage, including several nature conservation sites and protected areas (Natura2000, SPAs and National Parks). However these regions are also threatened by different kinds of pressures: urban and industrial expansion, abandonment of traditional land systems, impacts of Common Agriculture Policy (CAP), soils contamination, erosion and loss of fertility, climate changes, and others, which are causing increasing impacts on the environment, biodiversity and local populations.

Sensitive to these problems and to the difficulty of having quality geographic information (GI) available for all this territory, project partners decided to create in 2007 the first non-pilot crossborder Spatial Data Infrastructure – SDI-OTALEX (www.ideotalex.eu), which integrates national, regional and local administrations levels, as the first GI sharing platform of Alentejo, Centre and Extremadura. Despite different data sources (Portuguese and Spanish and different entities), SDI is fed by harmonized information of the whole area (ÁLVAREZ et al. 2010, BATISTA 2009).

OTALEX is the first cross border non-pilot and multilingual SDI project in Europe. Thought all this time, it has consolidated an inter-institutional and multidisciplinary work team that works together until today.

Fig. 1: OTALEX C project area

2 IDE-OTALEX C

Spatial Data Infrastructures are, in general, for their characteristics the best technological tool to publish sustainability data in the web. They can synthesize, calculate and analyse spatial data through interoperable web based services. SDIs are essential to manage natural resources, economic development and environment protection in a way to follow the changes of the territory.

IDE-OTALEX C (figure 2) was implemented to share official geographic information, from Alentejo and Extremadura, and now Centro region, with everyone. This is the most effective way to have a distributed and flexible system to be used as a territorial observatory for sustainable development and environment protection in these rural and low populated regions. It also contributes to territorial cohesion, one of the tree main pillars of European Cohesion Policy.

It's characterized for being a distributed, decentralized, modular and collaborative system, based on standards (OGC, W3C, ISO) and open source technology, developed to guarantee interoperability between the different GIS provided by each project partner. The geoportal is multilingual (Portuguese, Spanish and English) and integrates a Map viewer, Metadata Catalogue and Gazetteer. It consists in central and local nodes which communicate through WMS (Web Map Services), CSW (Catalogue Service Web) and WFS (Web Feature Services).

The geographic information on it available results of an extensive work of data harmonisation adapted to INSPIRE Directive (D 2007/2/EC, of the European Parliament and Council, of March 14, 2007). It integrates basic cartography, socio-economic and environmental indicators.

Fig. 2: Home page of the website IDE-OTALEX C– www.ideotalex.eu

OTALEX developed also an Indicator System – SI-OTALEX, to identify and measure, monitor and evaluate human pressures and its dynamics in the region. The established set of

indicators has a common and standard structure designed by a multidisciplinary team with experts from both countries. Its main objective is to evaluate the transformations of the territory and help to solve common problems of the territories and their populations.

Following the guidelines of the Sustainable Development Strategy of the European Union (EU-SDS), the national Development Strategies for Portugal and Spain, SI-OTALEX was framed by the conceptual model PSR (Pressure-State-Response), adopted from OECD (1993). Although we know that choices always involve disregarding something (IISD 1999), since there is no universal set established, and there is such a high and diverse number of indicators, the core indicators for SI-OTALEX were built with those that best fit the project objectives, add more relevance and representativeness in the area, and are also easily available and measurable. Furthermore, they should be simple, easy to read and update.

Each of the structure elements was assigned a code number in the hierarchical system comprising by three levels: vectors, themes and indicators. The first one, the widest, integrates five vectors: territory, environment, social, economic and sustainability. These vectors include now twenty two themes such as climate, hydrography, soils, air, water, waste, landscape, land use, population, economic activities, and others (Table 1). The third level is composed of the indicators themselves. Examples of these are water quality, waste management, green spaces in urban areas, landscape units, demographic structure, economic activities, and others (CARRIÇO et al. 2011). Each indicator has an appropriate metadata file that characterizes and explains the method for its calculation, sources of the original data, year, and other important information that allows its application to other regions and periods.

The ultimate goal is to integrate these indicators in the IDE-OTALEX (www.ideotalex.eu), so each indicator was georeferenced and harmonized in terms of geometry, time and spatial scales, so they could be comparable and contiguous in OTALEX C territory.

Table 1: SI-OTALEX main structure

VETOR	THEME
01. TERRITORY	01. Climate
	02. Geology and Geomorphology
	03. Hydrography
	04. Soil
	05. Administrative structure
02. ENVIRONMENT	01. Air
	02. Water
	03. Waste
	04. Pollution sources
	05. Land Use
	06. Environmental performance of urban spaces
	07. Noise
	08. Energy
	09. Nature Conservation
	10. Landscape
	11. Soil Proteccion
03. SOCIAL	01. Population
	02. Demografic structure
	03. Equipment's and Services Network
04. ECONOMIC	01. Economic Activities
05. SUSTAINABILITY	01. Territorial matrix
	02. Sustainable transport

Several developments occurred in the indicators' definitions (figure 3). One of the most interesting ones was the new Rurality Index proposed by MATEOS et al. (2008) in OTALEX project and applied to OTALEX area. This indicator has its roots in the definitions proposed by the Spanish Ministry of Agriculture, Fishery and Food, the OCDE and Eurostat. It also integrates information from other indicators like population dynamics, aging index, main economic activity, health care and education centres, which in general gives better information on the reality in the municipalities, and so has become an useful tool for understanding the OTALEX area.

The first studies were conducted on the effects of air pollution by the presence and distribution of wet acid deposition resulting from industrial emissions on OTALEX area (CABEZAS et al. 2011), and on CORINE land cover and cartography 1:10000 for Central Alentejo (GUIOMAR et al. 2009, BATISTA 2011). Within the latter activity a map based on lithology, slope and vegetation of OTALEX area was created that later was used to collect soil samples. New maps of several soil parameters such as pH, soil colour, organic carbon, and others will be produced as final results.

SI-OTALEX is a geographic information platform designed to be flexible and open, populated with updated information through each of the local nodes, and available to everyone. It has not been easy to work with different definitions, criteria, and information sources, and still obtain good results. But the team is committed in developing a reliable and consistent tool that will help to evaluate environmental performance to pressures and understand the territory and its dynamics.

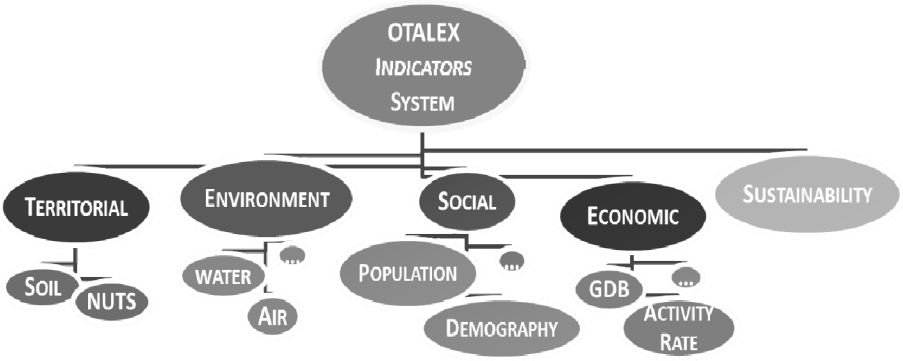

Fig. 3: OTALEX Indicator System

3 Results

The main results are available in www.ideotalex.eu including several images of the different functionalities developed in IDE-OTALEX.

In the successive developments of the platform different tools have been added that allow the users to take advantage of the information therein. These tools are:

- WPS (Web Processing Services), which enable the execution of geoprocessing of the information. Some of the WPS that are already available are (figure 4):
  - Calculation of the number of bands of the layer that receives raster as an input;
  - Calculation of the maximum and minimum value of the raster band;
  - Multipart to Singlepart operations;
  - Buffering;
  - Indication if a layer WFS is in contact with another WFS layer;
  - Maps Intersection operations;
  - Calculation of the maximum and minimum value of a raster map;
  - Symmetric difference of two vector maps;
  - Conversion of GML layer to shape format;
  - Polygon generalization;
  - Combination of vector maps;
  - Bonding of maps;
  - Distance between two maps;
  - Mathematical operations of: cross, disjoint, contains, equal, within, contact and superimposed.

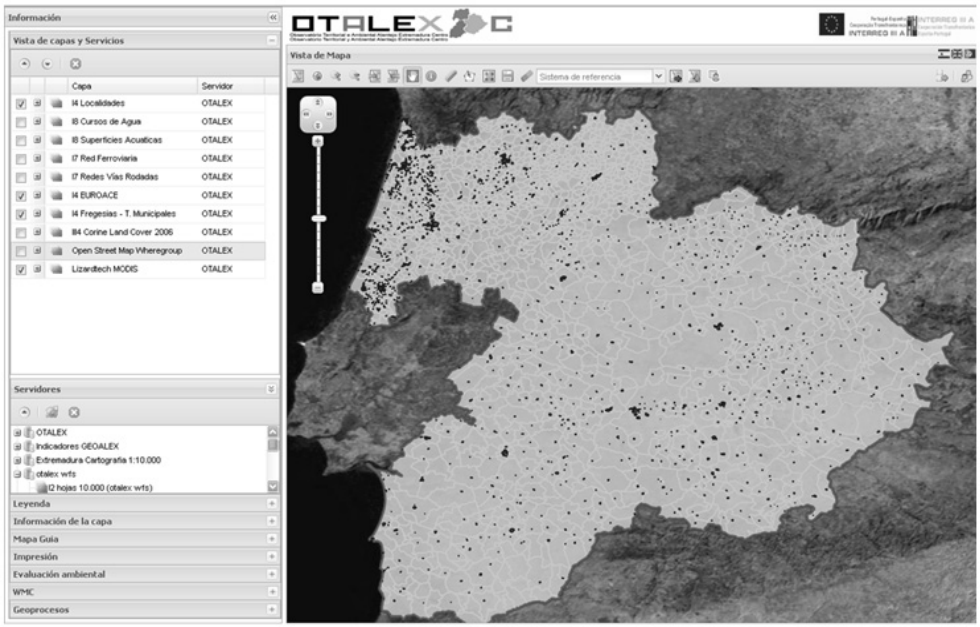

Fig. 4: OTALEX Map viewer

- Environmental Monitoring (SOS) is responsible for collecting the measurements made by each of the sensors that comprise a network of environmental monitoring, as well as for processing and publishing the resulting data.
- Environmental Evaluation System tool helps to make decisions in spatial planning at different levels allowing concatenation of geoprocessing (WPS).

- Local Nodes Remote Administration remotely enables management of information from different local nodes.

Several books and articles were published referring to the results of this cooperation (AAVV 2011, BATISTA et al. 2011, BATISTA & RODRIGUEZ 2006, 2006a, GUIOMAR et al. 2009, BATISTA 2011, CEBALLOS & VELASCO 2005, CEBALLOS et al. 2007, DGUOT 2008, MATEOS et al. 2008).

With a service-oriented architecture IDE-OTALEX is the platform for sharing spatial data, information and resources for Alentejo, Centro and Extremadura regions, in a very flexible and dynamic way through the web.

5 Conclusion and Outlook

For its particular characteristics, OTALEX has become one distinctive project. It has established a permanent crossborder cooperation channel between the different administration levels. It ranges from local (inter-municipal communities and diputaciones that represent municipalities), regional (Junta da Extremadura and Comissão de Coordenação Desenvolvimento Regional do Alentejo – CCDRA), national (National Geographic Institutes – IGN and IGP), to high education institututions (University of Évora, University of Extremadura and Polytechnic Institute of Castelo Branco), and public enterprises (EDIA) of two different countries, Spain and Portugal. Even after fifteen years, this cooperation keeps on going and it is getting stronger and increasingly useful among users.

OTALEX is chosen as a best practice case of the INTERREG III-A Program of Crossborder Cooperation Spain-Portugal 2000-2006. In 2009 OTALEX was nominated for the SDI Best Practice Award in the eSDI-Net+ project context (eSDI-Net+ – *www.esdinetplus.eu*) and received an honourable mention. In 2011 the project received a honourable mention of the Association of European Border Regions (AEBR) in the context of the AEBR Award of 2011 (*http://www.aebr.eu/en/news/news_detail.php?news_id=41*).

OTALEX is a member of the Spatial Data Infrastructure of Spain since March 29th, 2011, and is one of the three environmental geoportals. It is also a member of the Directive Council of the Spatial Data Infrstructure of Spain and of OSE – Observatorio de Sostenibilidad de España.

As future outcomes, the partnership is committed in extending its main work to the new intervention area Centro of Portugal, consistently with the European strategies of crossborder cooperation, and EuroACE Strategy 2020. It is also developing the interface of IDE-OTALEX, as well as new tools, such as WPS (Web Processing Services), Sensor Observation Services (SOS), linked data studies, SDI OTALEC C to mobile devices (Android), and sustainability indicators.

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