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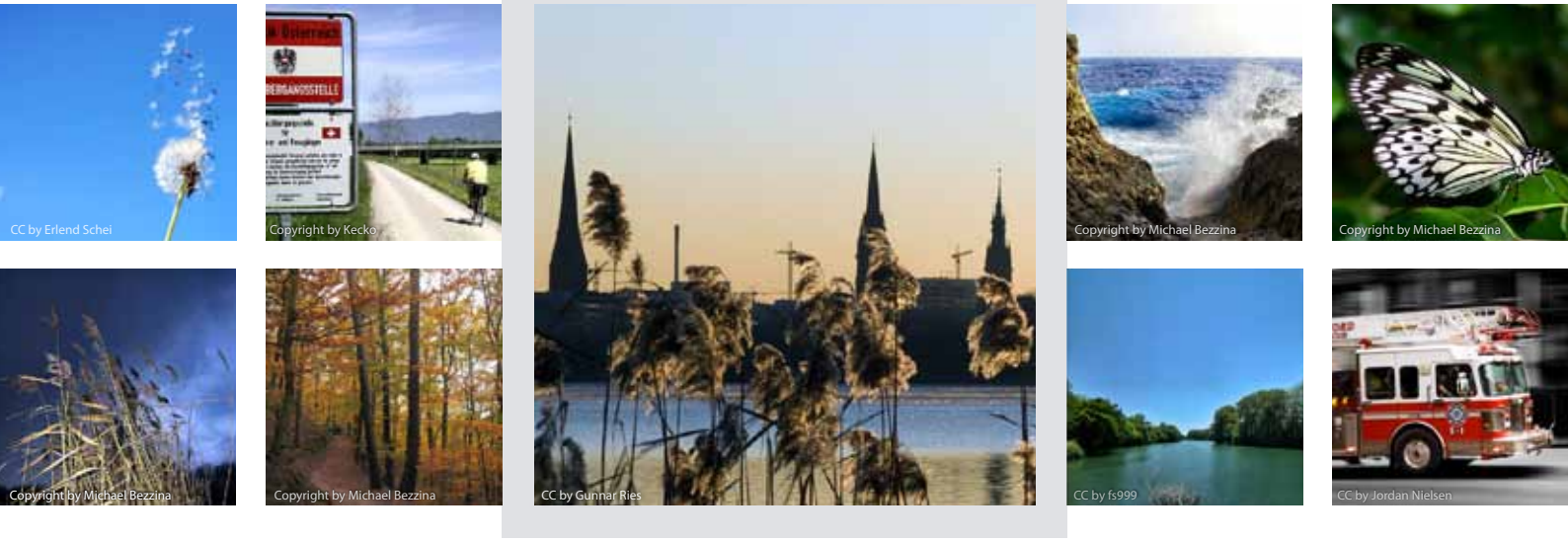


# HUMBOLDT Application Scenario: Sustainable Urban Atlas

## USER REPORT

SUPPORTING THE HARMONISATION OF SPATIAL INFORMATION IN EUROPE

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# Introduction

Urban planning provides one of the most technically demanding applications of the HUMBOLDT framework and yet successful application offers great rewards in terms of policy impact. At the local level, horizontal integration across the sectoral boundaries of the policy themes allied with vertical integration between the levels of governance, i.e. Europe, Member States, regional and local levels, presents a myriad of harmonization challenges. Solutions to these challenges provide the key to unlock the prime concerns of the policy end user to secure integrated intelligence that is central to effective decision-making and policy integration.

This document provides user report on the Urban scenario using the template provided by the executive board in EWP 4.2. There are two main applications considered in the HUMBOLDT Urban scenario: 1) Urban planning for Czech Republic case and 2) Urban atlas for the city of Vitoria-Gasteiz. In the following sections we mainly summarize the Urban Atlas scenario.

# Application Context

The city of Vitoria-Gasteiz, with 239,361 inhabitants, is situated in the North of Spain, and it is the current administrative capital of the Basque Country, with 278 km2 area for the Municipality. The city is equipped with socio-economic activities belonging to its demographic strength, industrial activities, recreational activities, urban development, etc. The city, since the 1990's has operated an Environmental Information System (SI@M) that has been developed by the Environmental Studies Centre (CEA). The aims of this system include supporting decision-taking and policy evaluation and enhancing public access to environmental information – for example: a sample output is shown in Figure 1. The system is based on the principle that decision-taking is a shared responsibility that requires the sharing of knowledge between citizens, planners and political representatives. In general, the SI@M is conceived originally as an instrument to facilitate the environmental management of the city. The Urban Atlas scenario mainly is related to the following aspects of the system:

**Context:** i) Metadata harmonization – INSPIRE, Spanish Metadata profile – NEM, ii) production of sustainable mobility related local environmental indicators using harmonized sources, and iii) investigation for participation in „Land Monitoring" theme of GMES domain

**Global objective:** Support bottom up-integration of environmental related geodata at the local, regional, european and global level

**Particularities:** Making an existing local SDI interoperable by ensuring compliance to INSPIRE and OGC standards

**Data involved:** Transport networks, Pedestrian network, Population distribution, others like green areas, industrial areas, points of interest, economic activities, etc.

**Data Sources:** Vitoria-Gasteiz municipal information system, Environmental Information System, Municipal Census Bureau (for resident people), Municipal Taxes Bureau (for car census and underground parking), Economic activity census (classified according to the sections defined in the IAE or CNAE), IT Department (for parcel layer), TUVISA, Traffic & Mobility Unit

**Harmonisation issues:** Metadata profiles, Data formats, Spatial reference systems, Conceptual schemas (data models), Classification schemes, Terminology / vocabulary, Scale / resolution, Portrayal, Multilinguality, Consistency between the features in different datasets representing the

same real-world entity, Consistency between the features in different datasets representing different real-world entities


Figure 1: An example output - noise information from the existing system SI@M (*Source: Asier Sarasua, SI@M - Environmental Studies Centre (CEA), Vitoria-Gasteiz)*

# Summary of pre-HUMBOLDT state

In general, the existing system offers no standardized geo services and hence needs to adapt to the INSPIRE Directive, which would require harmonization of geographic digital information in order to be utilized by other SDI initiatives at local, regional or national scales. Thus, it is planned to develop a new online application (as front end), which will meet necessary requirements and data harmonization needs in particular harmonizing existing metadata with added requirement to maintain the existing data and visualize sustainable mobility indicators including public transport model towards INSPIRE by using the Humboldt Framework tools.

This scenario offers a set of very common problems before the usage of HALE is possible mainly originated from the existing system and the data structures being utlised:

- Data is poorly documented
  - The available documentation is incomplete
  - The terms used for fields differ from documentation
- Data structure incomplete
  - Data is delivered in various formats e.g. in case of SI@M, Access dump file.
  - The relations of the original system are not kept violating the referential integrity constraints
- Data delivered as non-XML data
  - Data is delivered as Access Database
  - No XML Schema available where as HALE requires GML format to process

The actual running Metadata application for Victoria-Gasteiz 'SI@M' uses a proprietary database system for the storage of the Metadata. For the scenario, only a data export in form of an Microsoft access file is available. This file does not contain any foreign key references and got slight structural

and naming differences to the original documentation, which was created in the initial phase of 'SI@M'. For the usage of HUMBOLDT tools, a XML dataset and an according XML schema should be provided.

## Integration of Humboldt Solutions

In general, the handling of SI@M data (spatial and non-spatial) is characterized based on the new user requirements acquired from Vitoria-Gasteiz and HUMBOLDT Urban Atlas scenario offers added value for the intended use cases as follows:

1. Transforming existing metadata to INSPIRE compliant metadata service with added functionality to manage and browse the metadata catalogue. This includes both spatial and non-spatial data for the Sustainability Observatory of Vitoria-Gasteiz.

2. To monitor and evaluate the Sustainable Mobility and Public Space Plan of Vitoria-Gasteiz based on the calculations performed on previously identified indicators and INSPIRE compliant transport model. This monitoring enables end users to visualise specific information based on the data acquired from various data sources in the city.

3. Maintain existing data with added interoperability with other INSPIRE compliant information systems.

From HUMBOLDT perspective, the following steps are performed:

a. Data acquisition and related documentation from CEA,

b. Data cleansing and preparation to be used in HALE

c. Conceptual mappings between SI@M metadata, INSPIRE, ISO 19115, NEM (Spanish metadata profile) are performed.

d. Using HALE, mappings between SI@M XML based schema and ISO 19139 schema are performed which could be utilised for data transformation using CST or other methods such as XSLT, etc. The use of CSW is demonstrated using the Geonetwork.

e. Selected set of indicators are implemented using OGC WPS and the output are expected to be linked with other on-going local initiatives such as MUGAGABE.

## Summary of HUMBOLDT-enabled state

An INSPIRE compliant metadata service is linked with the SI@M and selected indicators are calculated and published using the WPS services. In general, this scenario provides a foundation for the following potential benefits and exploitation:

i) Other European cities, more or less face similar challenges (as demonstrated in the case of the city of Vitoria-Gasteiz) to deepen effective integration in the decision-making and participatory processes, to adapt to the new technological and legal scenarios arising from the INSPIRE Directive, and to go beyond the environmental aspects and thereby contribute to the local implementation of the EU Urban Thematic Strategy. In case of Vitoria-Gasteiz, the SI@M aims to analyze the city as a complex system, stressing especially at the urban scale, the social and economic as well as environmental issues, and using this knowledge to support local planning in an effective way. But SI@M lacks interoperability in terms of adapting new standardized geoservices and metadata standards such as OGC, INSPIRE, and national standards such as NEM (Spanish Metadata profile) etc and in this HUMBOLDT scenario, it is demonstrated at local scale (i.e. city level) that what HUMBOLDT

processes and tools needs to be adapted to harmonize SI@M's spatial data and enable SI@M to contribute towards National and European ESDI.

ii) The adaptation to INSPIRE and OGC standards enable the local SDI to contribute towards integrated monitoring at European scale for various reasons such as climate change adaptation and mitigation, etc. The integrated monitoring priority to ensure that climate change adaptation and mitigation is consistent with, and promotes healthy and economically viable urban communities, is a prime driver of initiatives to secure the full integration of environmental information in the context of integrated urban management, and the view that effective solutions must be based on better land use policies as part of an integrated policy response. However, managing risk is far from straightforward, as cities are extremely complex and isolated systems mostly without following standard practices, and the various drivers of change, impacts and responses are strongly interrelated, support, alter or compete with each other.

Failure to integrate policy can be attributed to a variety of factors including notably organizational and procedural barriers between horizontal sectoral responsibilities for land-use and environment, primarily at the local level, and between agencies responsible for policy development at local, regional, national and EU levels in a vertical dimension. These failures underpin the concerns of the policy-making community for integrated urban management frameworks are reflected in the demand for new assessment methodologies for urban and regional development that connect the key political drive for climate change mitigation and adaptation, with associated priorities to ensure a healthy and economically viable urban communities.

Improved integrated intelligence offers a major opportunity to address and overcome these deficiencies in policy responses necessary to secure the outcomes that combine the delivery of sustainable urban development, and climate change amelioration.

However, a further casualty of this lack of connectivity in both vertical and horizontal policy dimensions is the fragmentation of the information and intelligence essential to support integrated policy definitions and policy implementation.

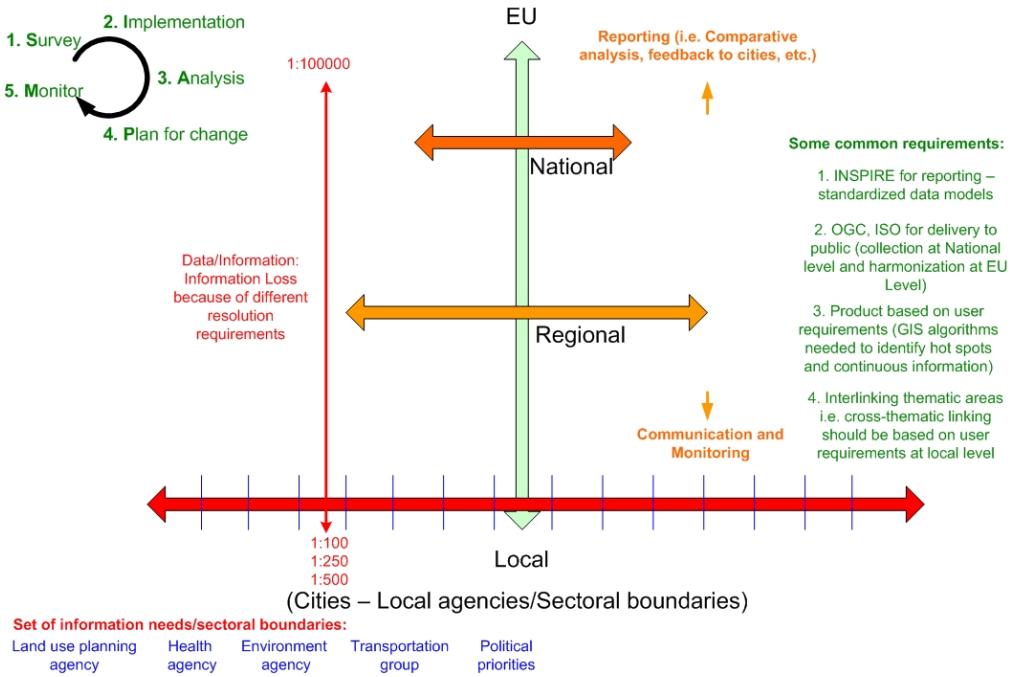


Figure 2: Vertical and Horizontal Information Integration

In the above context, this research challenge can be tackled by integrated intelligence with new methods and technological solutions. However, one of the outstanding characteristics and paradoxes of the spatial data community is the fragmentation of the various communities, so that initiatives promoting the development of INSPIRE compliant formulations, OGC standards, for example, are not fully compliant to other related initiatives such as GMES. The paradox in this is that these initiatives are fundamentally integrating yet they remain as separate islands of developments in a sea of common interest.

For example, at the local level agencies addressing the management of urban regions have a critical need to integrate data across the sectoral domains of land-cover and land-use in order to respond to the political demands for climate change adaptation and mitigation, that at the same time ensures economic vitality and quality of life for these regions. In this process of connectivity active communication and data integration between the levels of governance from local to EU is vital. Accordingly a model of both horizontal and vertical integration of land, risk and biosphere management etc is defined in which the integration of necessary data flows is a prime objective, as depicted in Figure 2. The Vitoria-Gasteiz case study in the HUMBOLDT Urban Atlas scenario is a suitable example of demonstrating harmonization activities at local level and as a first step towards harmonizing and integrating environmental data from local to National, European and global scale.

iii) The Sustainable Mobility indicators contribute towards evaluating periodically the advancement and improvement of municipal performance management and sustainable mobility related to the Vitoria-Gasteiz Public Space Plan objectives. In addition, the standard WPS interfaces of the indicators can be linked with enable other local initiatives, such as MUGAGABE, etc.

## HUMBOLDT tools in action: Application examples

The following Figure 3 depicts the general scope of Urban Atlas scenario. The metadata and mobility indicator user stories in the context of the HUMBODLT Urban Atlas scenario represent real needs and are integrated into existing projects in Vitoria-Gasteiz. This scenario transforms all existing metadata into INSPIRE and Spanish metadata requirements with the additional services for the management of the new metadata. HUMBOLDT Alignment Editor (HALE) was mainly used to perform mappings between the existing metadata and ISO19139 schema[1] for further transformations as depicted in Figure 4. The new harmonized metadata is utilised for the calculation of sustainable mobility and public space indicators and the output is published using Web Processing Service (WPS) interface, with the objective to monitor and evaluate the compliance of actions and their conformity towards municipal performance management and sustainable mobility e.g. the output is expected to be linked with another ongoing MUGAGABE initiative. Technically, it demonstrates standardized transformation of the cartographic and non-cartographic information, where data is being generated from different administrative sources within the municipality of Vitoria-Gasteiz.

[1] The target schema for the scenario is the actual ISO-19139 Schema. This schema can be downloaded from http://schemas.opengis.net/iso/19139/20070417 and the 'root' document to be opened as HALE target schema is gmd.xsd

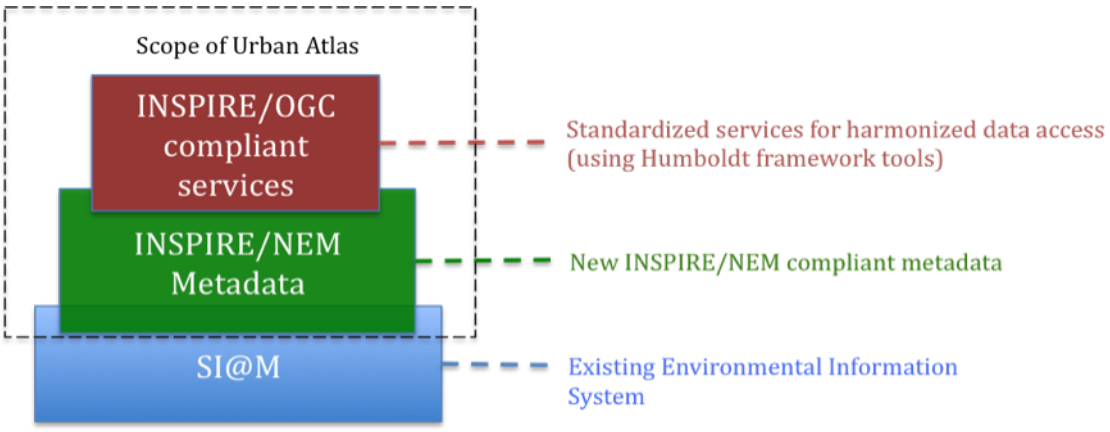


Figure 3: Scope of the Urban Atlas scenario

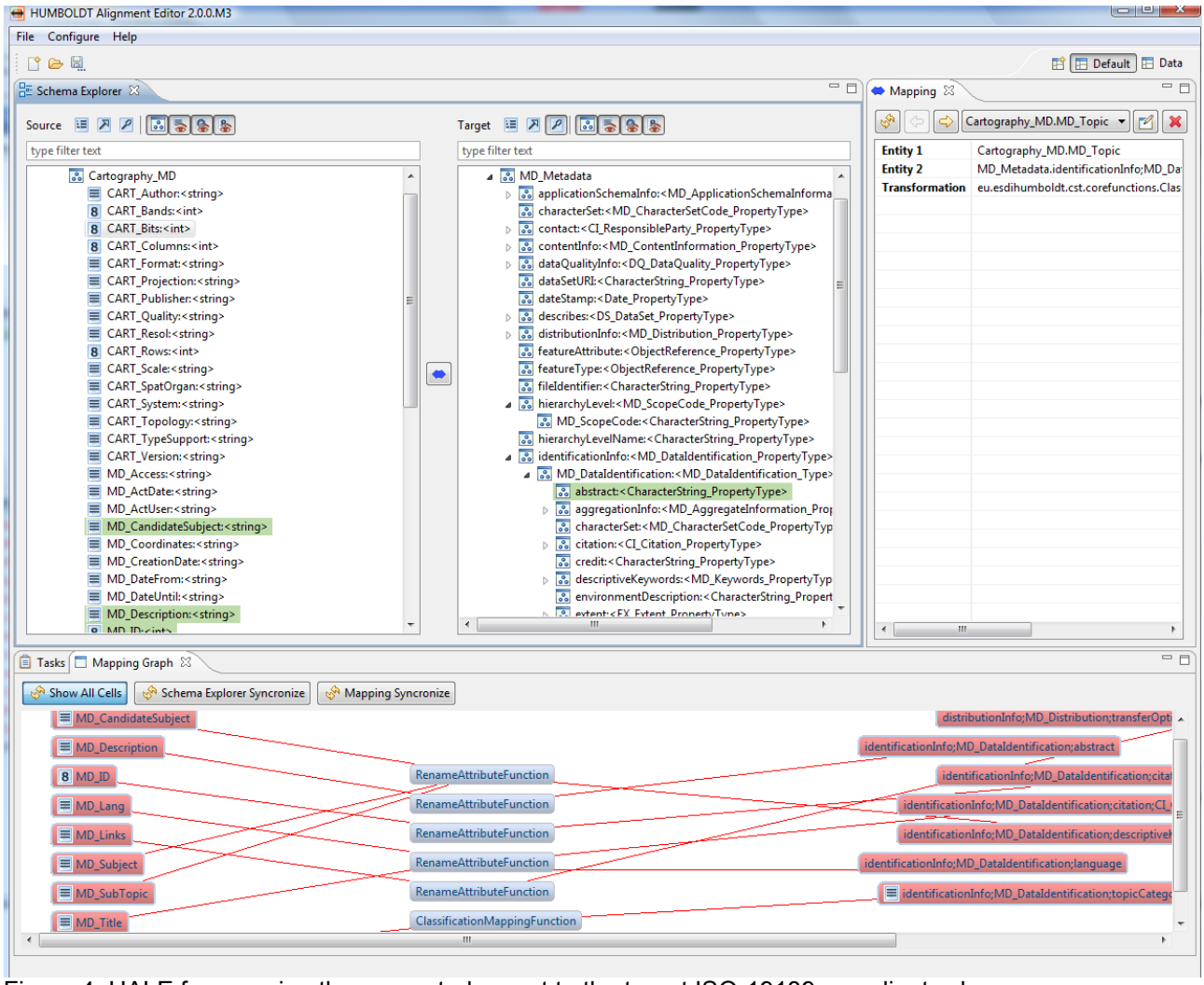


Figure 4: HALE for mapping the generated export to the target ISO-19139 compliant schema.

# Summary and Conclusions

With the development of new methodologies, technologies, approaches and increase in computing capacities to unprecedented levels, it has now become possible to take monitoring and assessment to next levels to get real-time information about our environment for better decision making and policy development. In general, environmental data e.g. land use, socio-economic, transport, green spaces, population census, etc is generated and preserved at local levels but local policy and technology adoption varies across Europe. However the vision of integrated monitoring cannot be achieved without using specialized tools and a general framework to systematically facilitate the monitoring process by enabling consistent flow of harmonized cross-thematic spatial data and information across the scales between EU and local levels. The feasibility of such information flow heavily depends on the availability of technology and tools to perform standardized harmonization - in compliance to known standards - of environmental data across the departmental boundaries at local levels. The HUMBOLDT Urban Atlas scenario demonstrates that the HUMBOLDT framework components and tools provide an affective foundation to identify necessary technological gaps and political barriers and suggests a roadmap to mitigate such challenges.

Based on the development of the HUMBOLDT Urban Atlas scenario, the following lessons are learnt:

- Requirement gathering and analysis needs stakeholder engagement throughout the development of the system to understand the elements of the existing system as well as to mitigate the language barriers;

- Harmonized and interoperable data could be utilised for the development of new models for prediction and decision-making such as production of environmental indictors;

- The application of Urban atlas can enable further investigation of the relationship between various thematic areas - e.g. biodiversity, urban sprawl, health, climate change, security, socio-economics, demographics, etc.

- The Urban atlas scenario provides a suitable example to demonstrate how to bridge the gap between existing systems in adapting new initiatives such as INSPIRE, etc.

In order to attain the objectives of the Urban Atlas scenario, the HUMBOLDT HALE for mapping and harmonization, GeoNetwork for CSW and 52N WPS have been utilised which can serve to have a control about system of mobility and public space, thereby the conflict between pedestrian, cyclist and vehicle traffic is expected to be reduced. The results of this stucy contributes towards the public space gains and can also be orientated towards everyday uses and functions for the citizens of the city. In addition, city streets recover their role as places for meeting and relating to others; pollution and noise will be reduced and the introduction of new concepts in urban design orientated towards improving habitability conditions becomes possible.

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http://www.esdi-humboldt.eu/scenarios/sustainable_urban_atlas.html

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