ETMS – Final Report

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1 Conceptualisation

1.1 Aim of the ETMS

The Project Specifications describes the objective as providing “a continuous monitoring of territorial trends and structures able to provide policy relevant information to target groups on key trends occurring for European regions, specific type of territories, metropolitan regions, cities and towns in relation to the policy aims and priorities of the Europe 2020 Strategy, EU Cohesion Policy and the TA 2020”.

ETMS covers the entire ESPON space, and is capable of continuous interpretation, assessment and communication of territorial development trends in relation to policy objectives related to Territorial Cohesion (in particular the Territorial Agenda 2020 and the EUROPE 2020 Strategy).

The work is to be understood as a practical and statistical exercise, a first step towards an operational Monitoring System at European for policy makers and policy analysts.

The ETMS is a system allowing the monitoring of the most important development trends for different types of regions, cities and territories, along time.

The ETMS has a thematic dimension (indicators), a policy dimension (policy questions) and a dimension directly related to the EUROPE2020 Strategy. In particular, the monitoring includes as far as possible headline indicators at regional levels.

1.2 Seven Steering Principles

1. **A fully working ETMS system**. The goal of the ETMS is to deliver a fully working monitoring system by October 2014 based on data available today in ESPON, EURSTAT, and other reference data providers (e.g. EEA, World Bank…). All necessary actions are being taken to accomplish this objective.

2. **Inheriting the experience of previous ESPON research**. The ETMS has considered the themes and sets of monitoring indicators developed in past research projects to draw its own monitoring architecture: INTERCO and SIESTA are at the beginning of this process, taking advantage of their intense work with stakeholders, and in order to include the EU2020 dimension.

3. **Drawing synergies with ESPON Monitors under development**. Themes and Indicators in ETMS are defined based on the findings and the experience of the BSR-TEMO project. CityBench is used as a reference for the inclusion of indicators at LUZ/MR levels.

4. **Assembling a robust database**. ETMS does not generate new data. Data in ETMS is obtained from reference data providers like ESPON DB, Eurostat and the World Bank.

5. **Making ETMS Indicators fully sustainable along time**. Indicators are computed on-house by the ETMS based on datasets imported from external data providers. In doing so, the system ensures sustainability (i.e. indicators are available) and consistency (i.e. indicators are computed always with the same methodology), as long as basic datasets remain available from providers (e.g. population, GDP…)

6. **A fully ESPON DB compliant ETMS database**. The ETMS database is ESPON DB compliant, meaning that if API interfaces became sufficiently mature it would be possible to import basic datasets into the ETMS database “on-the-fly” from ESPON DB.

7. **An adaptive ETMS system to new policy debates**. ETMS will discuss in-depth in its Sustainability Plan the necessary steps to allow adaptive monitoring activities in ESPON to ever evolving policy debates in Europe.

1.3 Conceptual development

Departing from the analysis of key policy concepts and priorities, based on the critical reading of official policy documents and past ESPON projects, a limited number of indicators is proposed to streamline the monitoring of most relevant trends in Europe in relation to today's basic territorial uncertainties, the so-called Compass Indicators.

The 36 Compass Indicators cover the following basic dimensions:

- **Economic competitiveness** (innovative, effective, resilient and open economies)
- **Environmental qualities** (energy efficiency, managing environmental quality, land and resource potentials)
- **Human capital** (people on move, ageing society, skills and education)
- **Social inclusion** (creating new jobs for all, living standards / territorial attractivity, promoting social and spatial inclusion, efficient modes of service provision)
- **Access to territory and services** (functional integration and accessibility, denser cooperation patterns, completing the digital infrastructure)

The ETMS has produced 4 products aimed at monitoring the evolution of these indicators in different territorial dimensions. The basic products and services provided by the ETMS are the following:

- **Facts&Figures booklet**. Intended for (a relatively frequent) publication in a standardised format integrating key figures and tables, and brief policy messages. It is based on the 5 Indictor Themes.

- **State of the Territory report**. Intended for (less frequent) publication as a longer in-depth analysis of territorial evolutions in Europe, from the different perspectives of the Territorial Agenda and in the framework of the EU2020 Strategy.

- **Data Analysis in Maps**. It allows interactively generating maps for the indicators in ETMS, and graphically exploring and benchmarking data online based on different territorial typologies defined at NUTS level and for territories with specificities.

- **Data Analysis in Timelines**. It allows exploring trends along time for indicators of the ETMS. It is integrated by 3 modules:

    - European Trends by Typology: An analytic module displaying temporal evolution of indicators for European regions aggregated according to different typologies or regional features: central&eastern and western regions; urban and rural regions; typologies of metropolitan regions; regions according to their geographical features (mountains,islands,SPA,…); regions by eligibility to structural funds; regions according to their EU2020S performance; typologies of scientific regions; regions belonging to a European transnational strategy; by countries.

- ESPON Forecasts 2030: for the same regional typologies as previous module, this shows 2030 forecasts for a number of socioeconomic indicators produced by the ESPON Scenarios project (2013)

- Europe in the World Context: displaying the temporal evolution of a number of macroeconomic indicators for the ESPON area, for Advanced Economies (a set integrated by non-European G7 members), for the BRIC countries, and for the European Neighborhood (northern Africa, middle east and eastern Europe).

All these products are integrated in the ETMS online web platform (http://81.47.175.201/etms-project/)

All materials available from the project website http://81.47.175.201/etms-project/.

2 An Indicator System for ETMS

2.1 Introduction

- In section 2.2 of this chapter the set of Compass indicators is presented, including indicators descriptions, source datasets and data providers, available updates and time scopes.
- The geographic dimension of Compass indicators is shown in section 2.3 with a discussion on which indicators can be expected at each territorial scale and for which territorial typologies.
- The policy dimension of Compass indicators is shown in section 2.4, mostly how they relate to the main policy debates currently ongoing
- The EU2020 dimension of Compass indicators is shown in section 2.5, mostly indicators fit in the framework of the strategy (pillars & headline indicators)
- In section 2.6, the choice of Compass indicators in ETMS is contrasted to past and ongoing research projects in ESPON

2.2 ETMS Compass indicators

2.2.1 Overview

The ETMS Compass Indicators incorporate in the ETMS are presented in the next table.

Table 1. COMPASS Indicators for Territorial Monitoring

Theme	Indicator
Economic Competitiveness	Central Government Debt
	Public cash surplus/deficit
	Domestic credit to private sector
	Balance of Accounts
	Foreign Direct Investment
	Exports of Goods and Services
	R&D expenditure
	GDP per capita
	GDP per person employed
	Employment in primary sector
	Employment in secondary sector
	Employment in tertiary sector
Environmental Qualities	Share of Renewable Energy in Final Energy Consumption
	Air pollution: PM10
	Degree of soil sealing
	Landscape fragmentation
	Nature protection area

Human Capital	Net migration rate
	Total population change
	Birth rate
	Old age dependency ratio (ODR)
	Persons aged 30-34 with tertiary education attainment
Social Inclusion	Total employment rate
	Employment rate 20-64 years
	Elderly employment rate (55-64 years)
	Difference between female and male employment rates
	Young unemployment rate (15-24 years)
	Disposable household income per capita
	At-risk-of-poverty rate
Access to territory and services	Population potential with 45 minutes drives
	Air connectivity with 45 minutes drives
	Accessibility to airport hubs: availability of intercontinental flights
	Accessibility to ports: availability of extra-EU container services
	Air traffic at major airports
	Container traffic at major ports
	Households with broadband access
	Cooperation intensity (ETC)

2.2.2 Indicator descriptions

Economic Competitiveness

Central government debt: Central government debt is defined as total amount of public debt as percentage of Gross Domestic Product (GDP). The unit of the indicator is percentage (%) and source data are from Eurostat and World Bank. This indicator is only available at country level.

Public cash surplus/deficit: Public deficit / surplus refer to difference between government receipts and government spending in a single year, defined as percentage of Gross Domestic Product (GDP). The term deficit is used when the government spending exceeds revenues over a period of time defined. The terms surplus is used then the government revenues overcome spending, during the same period of time. The unit of the indicator is percentage (%) and source data are from World Bank. This indicator is only available at country level.

Domestic credit to private sector: Domestic credit provided by the banking sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government. The unit of the indicator is defined as percentage of GDP (%) and source data are from World Bank. This indicator is only available at country level.

Balance of Accounts: Current account balance is the sum of net exports of goods and services, net primary income, and net secondary income. The unit of the indicator is defined as percentage of GDP (%) and source data are from Eurostat and World Bank. This indicator is only available at country level.

Foreign Direct Investment: this indicator is defined as investment into production or business in a country by an individual or company of another country, either by buying a company in the target country or by expanding operations of an existing business in that country. The unit of the indicator is defined as percentage of GDP (%) and source data are from World Bank. This indicator is only available at country level.

Exports of Goods and Services: this indicator represents the value of all goods and other market services provided by a country to the rest of the world. The unit of the indicator is defined

as percentage of GDP (%) and source data are from World Bank. This indicator is only available at country level.

R&D expenditure: this indicator is defined as total amount of investment (both public and private investment) in research and experimental development (R&D). The unit of the indicator is defined as percentage (%) of Gross Domestic Product (GDP in PPS) and source data are from the World Bank and Eurostat, completed with Swiss Statistics, OECD Regional Database, ESPON M4D, institute of Statistics of Albania and statistical Office of the Republic of Serbia. This indicator is available both at regional and country level.

GDP per capita: it is the ratio between the level of gross domestic product (GDP), expressed in purchasing power standards, and total population. The unit of the indicator is euros per capita (in PPS) and source data are from Eurostat, Swiss Statistics, OECD Regional Database, ESPON M4D, institute of Statistics of Albania, Statistical Office of the Republic of Serbia and World Bank. This indicator is available at regional level and country level.

GDP per person employed: it is the ratio between the level of gross domestic product, expressed in purchasing power standards, and persons employed. The unit of the indicator is euros per person employed and source data are from World Bank. Bank as well as from Eurostat, Swiss Statistics, OECD Regional Database, ESPON M4D, Institute of Statistics of Albania, Statistical Office of the Republic of Serbia and Amt für Statistik Liechtenstein. This indicator is available at regional level and country level.

Employment in primary sector: this indicator is defined as employed persons aged 15 and over who works in the primary sector. The unit of the indicator is percentage (%) and source data are from Eurostat, Landesverwaltung Fürstentum Liechtenstein, Statistical Office of the Republic of Serbia and Albanian Statistics,

Employment in secondary sector: this indicator is defined as employed persons aged 15 and over who works in the secondary sector. The unit of the indicator is percentage (%) and source data are from Eurostat, Landesverwaltung Fürstentum Liechtenstein, Statistical Office of the Republic of Serbia and Albanian Statistics.

Employment in tertiary sector: this indicator is defined as employed persons aged 15 and over who works in the tertiary sector. The unit of the indicator is percentage (%) and source data are from Eurostat, Landesverwaltung Fürstentum Liechtenstein, Statistical Office of the Republic of Serbia and Albanian Statistics.

Environmental Qualities

Share of Renewable Energy in Final Energy Consumption: This indicator is calculated on the basis of energy statistics covered by the Energy Statistics Regulation. The unit of the indicator is percentages and source data are from Eurostat and Swiss Statistics.

Air pollution: PM10*:* Average number of days in the year where pollutants concentrations exceed limit/target values, figures are shown at city level (time serie). Pollutants that have been taken into account are PM10, SO_2 and O_3. Indicators included are: Number of average days where PM10 concentrations exceeds 50 µg/m^3, Number of average days where SO_2concentrations exceeds 125 µg/m^3 and Number of average days where O_3 concentrations exceeds 120 µg/m^3. The data source is the EEA

Degree of soil sealing*:* Soil sealing (imperviousness) area and percentage for the years 2006 and 2009, plus soil sealing change by municipalities (LAU2). The information comes from the soil

sealing data calculated from photointerpretation at 20m resolution and aggregated at 100m. Originally defined in % of sealed surface. The data source is the EEA

Landscape fragmentation: Level of landscape fragmentation caused by anthropogenic and natural barriers for 2009. Complex calculation using MESH index that gives a precise idea on how the landscape is fragmented. It includes landscape fragmentation caused by major anthropogenic barriers (major roads, urban areas and railways), landscape fragmentation caused by major and minor anthropogenic barriers (major roads and minor roads, urban areas and railways) and landscape fragmentation caused by natural barriers (major lakes and rivers, high mountains) and all anthropogenic barriers (major roads and minor roads, urban areas and railways). The data source is the EEA.

Nature protection area: Share of land under a protected Natura 2000 status.

Human Capital

Net migration rate*:* It is a general estimation of the net migration based on the difference between population change and natural change between two dates. The unit of the indicator is the number of persons and source data are from Eurostat, ESPON M4D, Statistical Office of the Republic of Serbia, Institute for Statistics of FB&H, Turkstat, Statistics Norway, Statistics Netherlands, Kosovo Agency of Statistics and Statistics Iceland.

Total population change*:* It is the amount of total population in both sexes. The unit of the indicator is inhabitants and source data are from Eurostat, ESPON M4D, Statistical Office of the Republic of Serbia, Institute for Statistics of FB&H, Turkstat,Kosovo Agency of Statistics and from Institute of Statistics of Albania.

Birth rate*:* it is the ratio between total numbers of births and thousand of population each year. The unit of the indicator is ‰ and source data are from Eurostat, ESPON M4D, Statistische Amter des bundes und der Länder, Statistics Denmark, UK National Statistics, Turkstat, Statistic Office of the Republic of Serbia, Kosovo Agency of Statistics, Institute for Statistics of FB&H, Kosovo Agency of Statistics, and STATBE.

Old age dependency ratio (ODR)*:* ODR indicator is defined as share of >64 in relation to total population aged 15-64. The unit of the indicator is % and source data are from Eurostat, ESPON M4D, Institute for Statistics of FB&H, Turkstat,Nordregio, Kosovo Agency of Statistics, Institute of Statistics of Albania and Statistical Office of the Republic of Serbia.

Persons aged 30-34 with tertiary education attainment*:* The percentage of the population aged 30-34 years who have successfully completed university of university-like (tertiary-level) education with and education level ISCED 5 or 6. The unit of the indicator is percentage (%) and source data are from Eurostat, Amt für Statistik Fürstentum Liechtenstein, and Statistical Office of the Republic of Serbia.

Social Inclusion

Employment rate 20-64 years*:* Percentage of people between 20-64 years employed in relation to total population 20-64 years. The unit of the indicator is percentage (%) source data are from Eurostat, Amt für Statistik Liechtenstein and ESPON ETMS.

Elderly employment rate (55-64 years): Percentage of people between 55-64 years employed in relation to total population 55-64 years. The unit of the indicator is percentage (%) and source data are from Eurostat, Amt für Statistik Liechtenstein and ESPON ETMS.

***Difference between female and male employment rates**:* Percentage of female employed in relation to total female population and male in relation to total male population. The unit of the indicator is percentage (%) and source data is from Eurostat, Amt für Statistik Liechtenstein and ESPON ETMS.

Youth unemployment rate (15-24 years): Percentage of unemployed population aged 15-24 years in relation to total labour force aged 15 -24 years old. The unit of the indicator is percentage (%) and source data are from Eurostat and Amt für Statistik Liechtenstein.

***Disposable household income per capita**:* It is the amount of money left available within the household sector for spending or saving, after expenditure associated with income. The unit of the indicator is euros per capita and source data is from Eurostat and Swiss Statistics.

***At-risk-of-poverty rate**:* Percentage of population at risk of poverty or social exclusion in relation to total population. The unit of the indicator is a percentage (%) of total population and source data is from Eurostat and ESPON BSR-TeMo project.

Accessibility

***Population potential with 45 minutes drives**.* The population potential at one place is the sum of the ratios of population at all other points to the distances from the place in question to those points to less than 45 minutes. This indicator accounts for the share of population living within 45 minutes drive to a 750.000 inhabitants urban agglomeration (FUA). The limit of the urban agglomeration is here considered as the border of its inner urban continuum (MUA). The unit of the indicator is population and source data is from Geospecs.

***Air connectivity with 45 minutes drives**:* This indicator accounts for total population living within 45 minutes drive to an airport having more than 150.000 passengers per year. It represents the connectivity between each region with their outside through the air. The unit of the indicator is population and source data is from Geospecs (ESPON 2013).

***Accessibility to airport hubs (intercontinental flights)**:* this indicator is a proxy to the availability of intercontinental air seats reachable from each NUTS2 in Europe. It refers to the possibilities to travel to global destinations from each NUTS2 in Europe. The unit of the indicator is "weighted passengers" and source data is from ESPON Database.

Accessibility to ports (extra EU containers): this indicator is a proxy to the availability of intercontinental maritime transport services reachable from each NUTS2 in Europe. It refers to the possibilities of territories across Europe of having convenient transport services for global exports. The unit of the indicator is “weighted TEUs” and source data is from ESPON Database.

***Air traffic at major airports**:* This indicator accounts for air passengers at airports are in Europe during one year. Both landing and departing passengers are considered. The unit of the indicator is total passengers and the source data is from EUROSTAT.

Container traffic at major ports: This indicator accounts for freight container throughput at ports during one year, measured in TEUs (twenty feet equivalent units). The unit of the indicator is thousands of tonnes and source data is from EUROSTAT.

Households with broadband access**:** This indicator accounts the number of houses with broadband access. The unit of the indicator is percentage (%) and source data is from EUROSTAT and Swiss Statistics.

Cooperation intensity (ETC): This indicator refers to the number of common projects within INTERREG B programme (III and IV). The Source is the ESPON TERCO project

2.2.3 Full Data Specifications

Indicator	Source datasets	Data provider	Last update	Spatial level for indicator	(Best) Time extent[1]
ECONOMIC COMPETITIVENESS					
Central Government Debt	Central government debt, total in constant US$2005	World bank	12/05/2014	NUTS0	(2001)2005-2011
	Total GDP in constant US$2005	World bank	12/05/2014		1961-2012
Public cash surplus/deficit	Cash surplus/deficit in constant GDP US$2005	World bank	23/01/2014	NUTS0	1991-2011
	Total GDP in constant US$2005	World bank	12/05/2014		1961-2012
Domestic credit to private sector	Domestic credit to private sector in constant US$2005	World bank	27/01/2014	NUTS0	1994-2012
	Total GDP in constant US$2005	World bank	12/05/2014		1961-2012
Balance of Accounts	Current account balance in constant US$2005	World bank	27/01/2014	NUTS0	2005-2012
	Total GDP in constant US$2005	World bank	12/05/2014		1961-2012
Foreign Direct Investment	Foreign direct investment, net inflows in constant US$2005	World bank	15/09/2014	NUTS0	(1995)2002-2011(2012)
	Total GDP in constant US$2005	World bank	12/05/2014		1961-2012
Exports of Goods and Services	Exports of goods and services in constant US$2005	World bank	18/12/2013	NUTS0	(1961)1990-2011(2012)
	Total GDP in constant US$2005	World bank	12/05/2014		1961-2012
R&D expenditure	Total intramural R&D expenditure (GERD) in millions of PPS	EUROSTAT / World Bank	10/04/2014	NUTS2/0	2002-2011
	GDP in mill. PPS - Current prices	EUROSTAT / ESPON / OECD / NSI	29/09/2014		2000-2011
GDP per capita	GDP in mill.	EUROSTAT / ESPON / OECD / NSI / World Bank	29/09/2014	NUTS2/3/0	2000-2011
	Total population (demo_r_pjangroup)	EUROSTAT / ESPON / NSI	29/09/2014	NUTS3	(1990)2002-2012(2013)
GDP per person employed	GDP in mill.	EUROSTAT / ESPON / OECD / NSI / World Bank	29/09/2014	NUTS3/2/0	2000-2011
	Total number of employed persons	EUROSTAT / NSI / ESPON	10/04/2014	NUTS3/2/0	2001(2007)-2012
Employment per sector*	Employment per sector (NACE; 1 digit)	ESPON	28/01/2014	LAU2 / Territories	2008
		EUROSTAT / NSI	07/08/2014	NUTS2 for EU-wide analysis	(2008)2009-2012

[1] Total time span where data is available for an indicator is expressed in this column. Without parenthesis, optimal data in terms of data completeness; in parenthesis, additional years where data is available, but incomplete for a number of territorial units.

Indicator	Source datasets	Data provider	Last update	Spatial level for indicator	(Best) Time extent[1]
HUMAN CAPITAL					
Net migration rate	Net migration in persons per year	EUROSTAT / NSI / ESPON	09/15/2014	NUTS3	(2002)2007-2012
Net migration rate	Total population (demo_r_pjangroup)	EUROSTAT / ESPON / NSI	10/04/2014	Various NUTS	(1990)2002-2011(2012)
Total population change	Total population (LAU)	DG REGIO	14/04/2014	LAU2 / Territories	1961-2011
	Total population (demo_r_pjangroup)	EUROSTAT / ESPON / NSI	29/09/2014	NUTS3	(1990)2002-2012(2013)
Birth rate	Total number of births	ESPON / EUROSTAT / NSI	10/04/2014	NUTS3	(1990)2002-2011(2012)
	Total population (demo_r_pjangroup)	EUROSTAT / ESPON / NSI	29/09/2014	NUTS3	(1990)2002-2012(2013)
Old age dependency ratio	Total population in main age groups (under15; 15-59; 60+)	GEOSPECS (updated)	28/01/2014	LAU2 / Territories	2001 and exceptions
	Total population in main age groups (under15; 15-64; 65+) (demo_r_pjangroup)	EUROSTAT / NSI / ESPON	10/04/2014	NUTS3	(1990)2002-2012
Share of Persons aged 30-34 with tertiary education attainment	Persons aged 30-34 with tertiary education attainment (ready calculated indicator by Eurostat)	EUROSTAT / NSI	17/10/2014	NUTS2	(2000)2007-2013
SOCIAL INCLUSION					
Total employment rate	Employed persons aged 15&over Years (NACE Tot)	GEOSPECS	03/02/2014	LAU2 / territories	2008
	Population aged 15 and over	GEOSPECS	03/02/2014		2001 and exceptions
Employment rate 20-64 years	Employed persons aged 20-64 years	EUROSTAT / NSI	10/04/2014	NUTS2	(2001)2007-2012
	Population aged 20-64 (lfst_r_lfsd2pop)	EUROSTAT	16/07/2014		(2003)2007-2013
Elderly employment rate	Total number of employed persons aged 55-64 years	EUROSTAT / NSI	10/04/2014	NUTS2	(2001)2007-2012
	Population aged 55-64 (lfst_r_lfsd2pop)	EUROSTAT	16/07/2014		(2003)2007-2013
Difference between female and male employment rates	Employed males aged 20-64 years	EUROSTAT / NSI	10/04/2014	NUTS2	(2001)2007-2012
	Males aged 20-64 (lfst_r_lfsd2pop)	EUROSTAT	16/07/2014		(2003)2007-2013
	Employed females aged 20-64 years	EUROSTAT / NSI	10/04/2014	NUTS2	(2001)2007-2012
	Females aged 20-64 (lfst_r_lfsd2pop)	EUROSTAT	16/07/2014		(2003)2007-2013
Young unemployment rate	Total number of persons in labor force aged 15-24 years	EUROSTAT / NSI	10/04/2014	NUTS2	(2001)2007-2012
	Total number of unemployed persons aged 15-24 years	EUROSTAT	10/04/2014		(2001)2007-2012
Disposable household income	Income as PPS based on final consumption per inhabitant	EUROSTAT / NSI	10/04/2014	NUTS2	(2000)2006-2010(2011)
At-risk-of-poverty rate	At-risk-of-poverty rate (% of total population; Eurostat)	EUROSTAT / ESPON	10/04/2014	NUTS1/2	2008-2011(2012)

Indicator	Source datasets	Data provider	Last update	Spatial level for indicator	(Best) Time extent[1]
ENVIRONMENTAL SUSTAINABILITY					
Share of Renewable Energy in Final Energy Consumption	Share of Renewable Energy in Final Energy Consumption (ready calculated indicator by Eurostat)	EUROSTAT / NSI	10/04/2014	NUTS0	(2004)2006-2012
Air pollution: PM10	Interpolated air quality data	EEA	09/03/2014	URAU_CITY	(2000)2005-2011 More recent=more measurement
Degree of soil sealing	Degree of soil sealing	EEA	25/02/2014	LAU / Territories	2006&2009
Landscape fragmentation	Major anthropogenic and/or natural fragmentation	EEA and GISAT	05/02/2014	NUTSX / Coasts, massifs, LUZ	2009
Nature protection	Ready indicator from previous ESPON projects	EEA	28/01/2014	LAU / Territories	2010/2011
CONNECTEDNESS					
Population potential within 45 min	Ready indicator from previous ESPON projects	GEOSPECS	28/01/2014	Territories LAU2 and NUTS3	2006
Air connectivity (with 45 minutes drives)	Ready indicator from previous ESPON projects	GEOSPECS	28/01/2014	LAU / Territories	2008
Accessibility to airport hubs (intercontinental flights)	Ready indicator from previous ESPON projects	ESPON ET2050	31.04.2013	NUTS2	2010 & 2030
Accessibility to ports (extra EU containers)	Ready indicator from previous ESPON projects	ESPON ET2050	04.31.2013	NUTS2	2010 & 2030
Air traffic at major airports	International extra-EU air passenger transport by main airports in each reporting country and partner world regions and countries	EUROSTAT	07/04/2014	Airport	(2001)2003-2012
Container traffic at major ports	Maritime transport - Goods -Main ports - Containers only	EUROSTAT	07/04/2014	Port	(2000)2005-2012
Households with broadband access	Households with broadband access as % of all households. Ready calculated indicator by Eurostat	EUROSTAT / NSI	10/04/2014	NUTS1/2	(2006)2008-2012(2013)
Cooperation intensity (ETC)	ESPON TERCO	ESPON TERCO	10/04/2014	NUTS2	2008&2012

2.3 The Geographic Dimension of Compass Indicators

2.3.1 Overview

Compass indicators are calculated based on basic core data sets imported from reference data providers, e.g. ESPON DB, EUROSTAT, World Bank. Indicators are calculated at the lowest territorial scale possible allowed by available core data sets (LAU2, NUTS3 or NUTS2). Higher territorial scales are then calculated from these former, following addition criteria specifically determined for each indicator.

A number of macro-economic indicators are analysed at NUTS0 level.

For indicators at NUTS level the ETMS allows analysis based on existing NUTS-based territorial typologies. The following are currently implemented in the system (in maps and/or in timelines):

- Urban-rural classifications (according to OECD "predominantly urban, predominantly rural, intermediate"; according to DG Regio "urban, intermediate close to a city, intermediate remote, rural close to a city, rural remote")
- Metropolitan Regions (according to Eurostat "Capital cities, 2nd Tier Cities, Small metros and other metros")
- Structural Funds Eligibility (according to 2014-2020 budgetary programme, "less developed, transition and more developed" regions; according to 2007-2013 programme, "convergence, phasing-out, regional competitiveness / employment regions, phasing-in")
- Transnational Cooperation Areas (according to 2014-2020 budgetary programme, e.g. Baltic, Danube, Alpine space, Adriatic-Ionian; and according to 2007-2013 programme)
- EU2020 Strategy performance (according to ESPON Siesta project, 2013, "GDP leaders, performance regions, "on the move" regions, and EU2020S challenging regions")
- Scientific Regions (according to ESPON KIT project, 2013, "scientific, research intensive, human capital intensive, no specialisation in knowledge" regions)
- Regions according to their geographical location (north, south, central&east, west)

For indicators were territorial resolution is available at LAU, the ETMS will also provides figures for other territories with geographical specificities as defined in the GEOSPECS project[2]:

- Mountains, islands, coastal areas and sparsely populated areas

Data at city level is based on data available at LUZ level.

[2] Dijkstra L., Poelman H. (2008); *Remote Rural Regions: how proximity to a city influences the performance of rural regions*, Regional Focus nº01/2008. http://ec.europa.eu/regional_policy/sources/docgener/focus/2008_01_rural.pdf

Table 2. Geographic dimension of Compass Indicators

ETMS Indicator	Rest of World	NUTS0	NUTS2	NUTS3	LAU2	Urban-rural based on DG Regio *(predominantly urban, intermediate close to a city / remote, predominantly rural clc / remote)*	Metropolitan Regions based on Eurostat (Capital city region, second-tier metro, smaller-metro, non-metro)	Structural Funds Elegibility 2014-2020 *(less developed, transition, more developed)*	Structural Funds Elegibility 2007-2013 *(convergence regions, phasing-out regions, phasing-in regions, competitiveness and employment regions)*	EU2020 Strategy Performance based on ESPON SIESTA *(GDP leaders, performing, on the move, challenging)*	Scientific Regions based on ESPON KIT *(scientific, research intensive, human capital intensive, non-specialised)*	Regions with territorial specificities *(mountains, islands, sparsely populated areas, coastal areas)*	Cities as defined by Urban Audit (LUZ)	Transnational Cooperation Areas 2014-2020 *(Baltic, Danube, Alps, Adriatic-Ionic)*	Transnational Cooperation Areas *2007-2013 (Northern Periphery, Baltic Sea, North West Europe, Mediterranean, ...)*
Central Government Debt	x	x													
Public cash surplus/deficil	x	x													
Domestic credit to private sector	x	x													
Balance of Accounts	x	x													
Foreign Direct Investment	x	x													
Exports of Goods and Services	x	x													
Total R&D expenditure	x	x	x			x	x	x	x	x	x			x	x
GDP per capita in PPS	x	x	x	x		x	x	x	x	x	x			x	x
GDP per person employed in PPS	x	x	x			x	x	x	x	x	x			x	x
Employment in primary sector		x	x		x	x	x	x	x	x	x	x	x	x	x
Employment in secondary sector		x	x		x	x	x	x	x	x	x	x	x	x	x
Employment in tertiary sector		x	x		x	x	x	x	x	x	x	x	x	x	x
Share of Renewable Energy in Final Energy Consumption		x													
Air pollution: PM10					x								x		
Degree of soil sealing					x							x	x		
Landscape fragmentation					x							x	x		
Protected natural areas					x							x			
Net migration rate				x		x	x	x	x	x	x			x	x
Total population change	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Birth rate		x	x	x		x	x	x	x	x	x			x	x
Old age dependency ratio (ODR)		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Persons aged 30-34 with tertiary education atteinment		x	x			x	x	x	x	x	x			x	x
Total employment rate		x	x			x	x	x	x	x	x			x	x
Employment rate 20-64 years		x	x			x	x	x	x	x	x			x	x
Elderly employment rate (55-64 years)		x	x			x	x	x	x	x	x			x	x
Differences between female to male employment rates		x	x			x	x	x	x	x	x			x	x
Young unemployment rate (15-24 years)		x	x			x	x	x	x	x	x			x	x
Disposable household income per capita		x	x			x	x	x	x	x	x			x	x
At-risk-of-poverty rate		x	x			x	x	x	x	x	x			x	x
Population potential within 45 minutes drives					x							x			
Air connectivity within 45 minutes drives					x							x			
Accessibility to airport hubs (availability of intercontinental flights)			x			x	x	x	x	x	x			x	x
Accessibility to ports (availability of extra-EU container shipping services			x			x	x	x	x	x	x			x	x
Air traffic at major airports					x								x		
Container traffic at major ports					x								x		
Households with broadband access			x			x	x	x	x	x	x			x	x
Cooperation intensity (ETC)			x			x	x	x	x	x	x			x	x

2.3.2 Typology Descriptions

2.3.2.1 Urban/rural Regions

Typology entry point: Administrative regions

Typology name: urban/rural

Author: DG Regio

Defined at geographical level: NUTS3

Adoption to other geographical levels: at NUTS 2 by Netherlands Interdisciplinary Demographic Institute (NIDI)

Typology types:

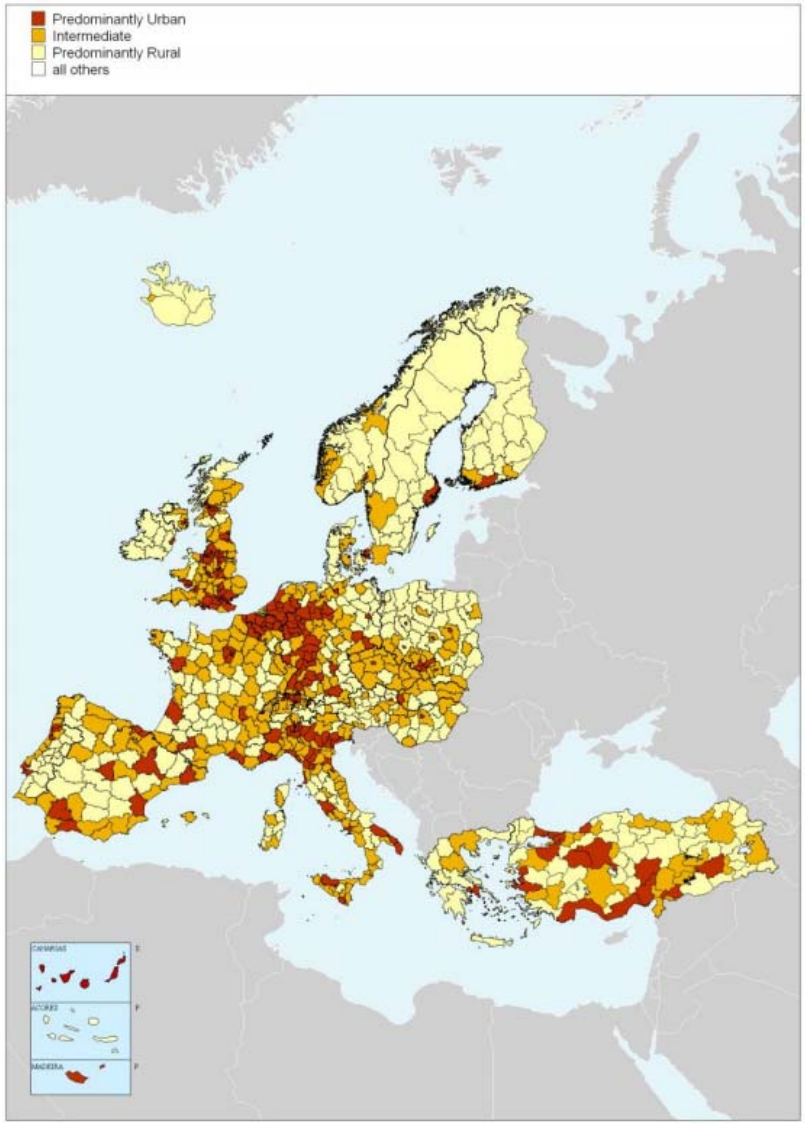
- Urban *(<20% LAU2 are rural)*
- Intermediate close to a city *(between 20% to 50% LAU2 are rural & >50% LAU2 are less than 45 minutes drive from 50.000 inhabitant city)*
- Intermediate, remote regions *(between 20% to 50% LAU2 are rural & <50% LAU2 are less than 45 minutes drive from 50.000 inhabitant city)*
- Rural close to a city *(>50% LAU2 are rural & >50% LAU2 are less than 45 minutes drive from 50.000 inhabitant city)*
- Rural, remote regions *(>50% LAU2 are rural & <50% LAU2 are less than 45 minutes drive from 50.000 inhabitant city)*

References:

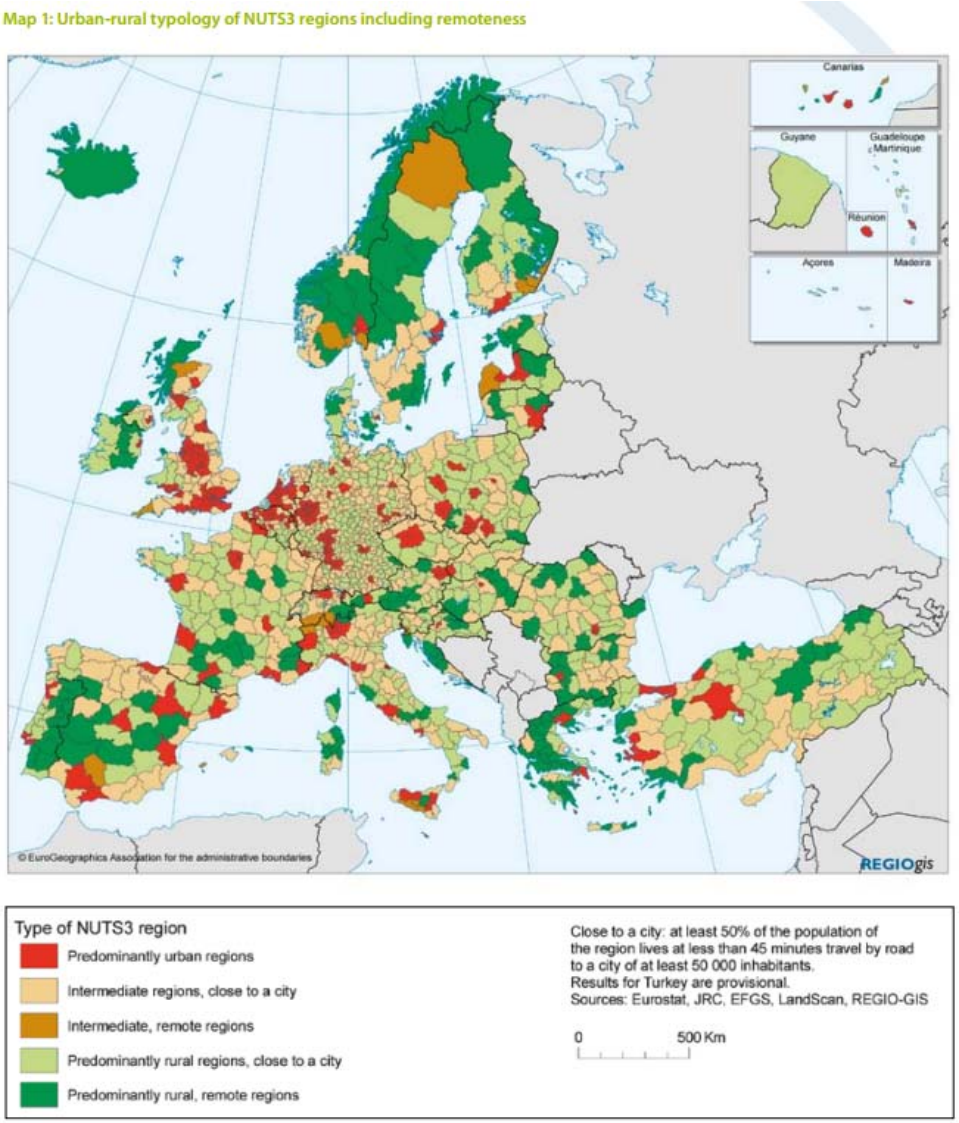
- OECD regional typology
- Regional Focus by Lewis Dijkstra & Hugo Poelman
- Classification of urban/rural NUTS 2 by NIDI

Comments: -

Urban Rural typology by OECD



Urban Rural typology by DG Regio



2.3.2.2 Metropolitan Regions

Typology entry point: Administrative Regions (NUTS)

Typology name: Typology on Metropolitan Regions

Author: DG Regio

Defined at geographical level: NUTS3

Adoption to other geographical levels: ESPON ETMS

Typology types:

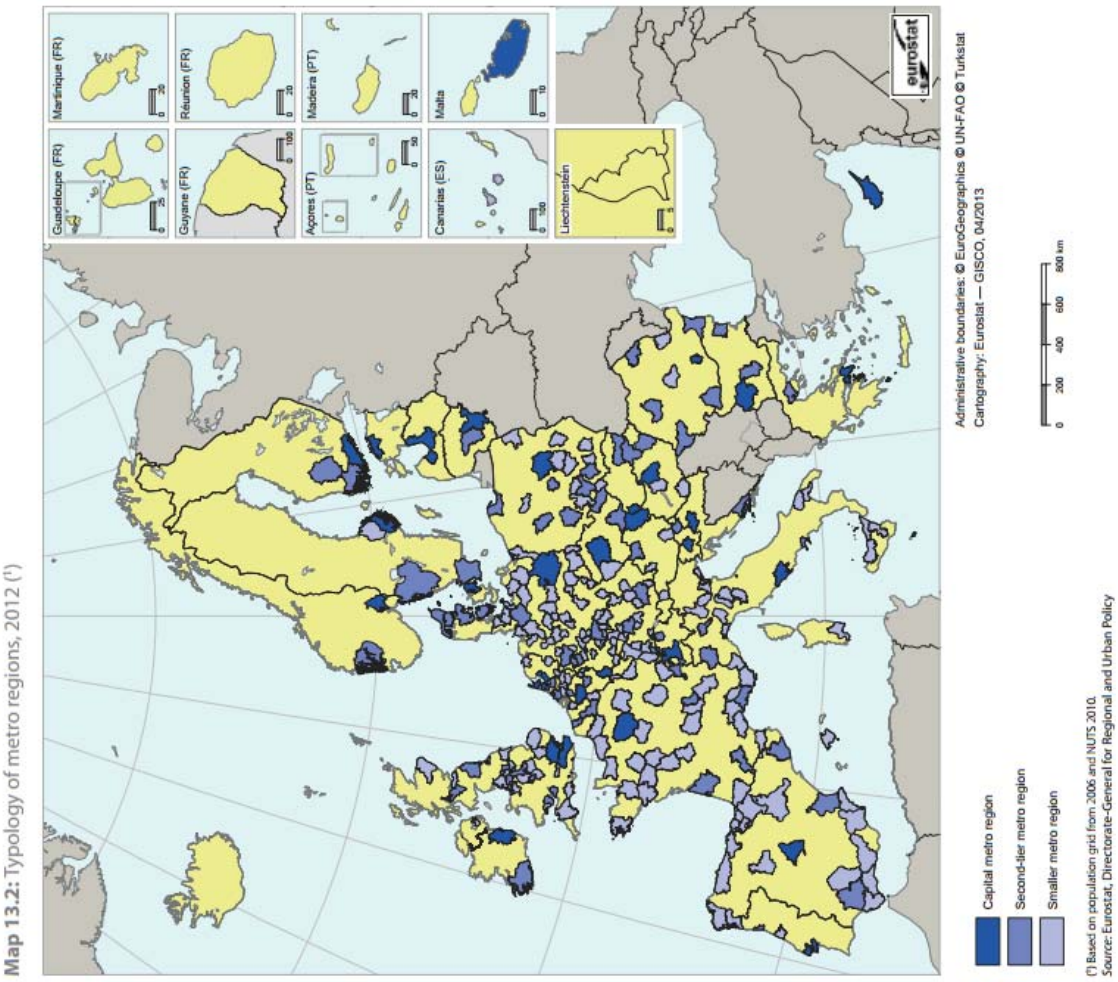
- Capital metro region *(national capital)*
- Second-tier metro region *(group of largest cities in a country, excluding the capital)*
- Smaller metro region *(a natural break served the purpose of distinguishing the second tier from the smaller metro regions)*
- Other metros *(all other not included in one of the previous categories)*

References:

- Focus on cities and metro regions by Eurostat

Comments: Based on population grid from 2006 and NUTS 2010

Metropolitan regions typology by Eurostat



Map 13.2: Typology of metro regions, 2012 (1)

2.3.2.3 Structural Funds

Typology entry point: Administrative regions

Typology name: Structural Funds (ERDF & ESF) eligibility

Author: DG Regio

Defined at geographical level: NUTS 2

Adoption to other geographical levels: -

Typology types:

- Less developed regions *(GDP/head <75% of EU-27 average)*
- Transition regions *(GDP/head between 75% and 90% of EU-27 average)*
- More developed regions *(GDP/head >= 90% of EU-27 average)*

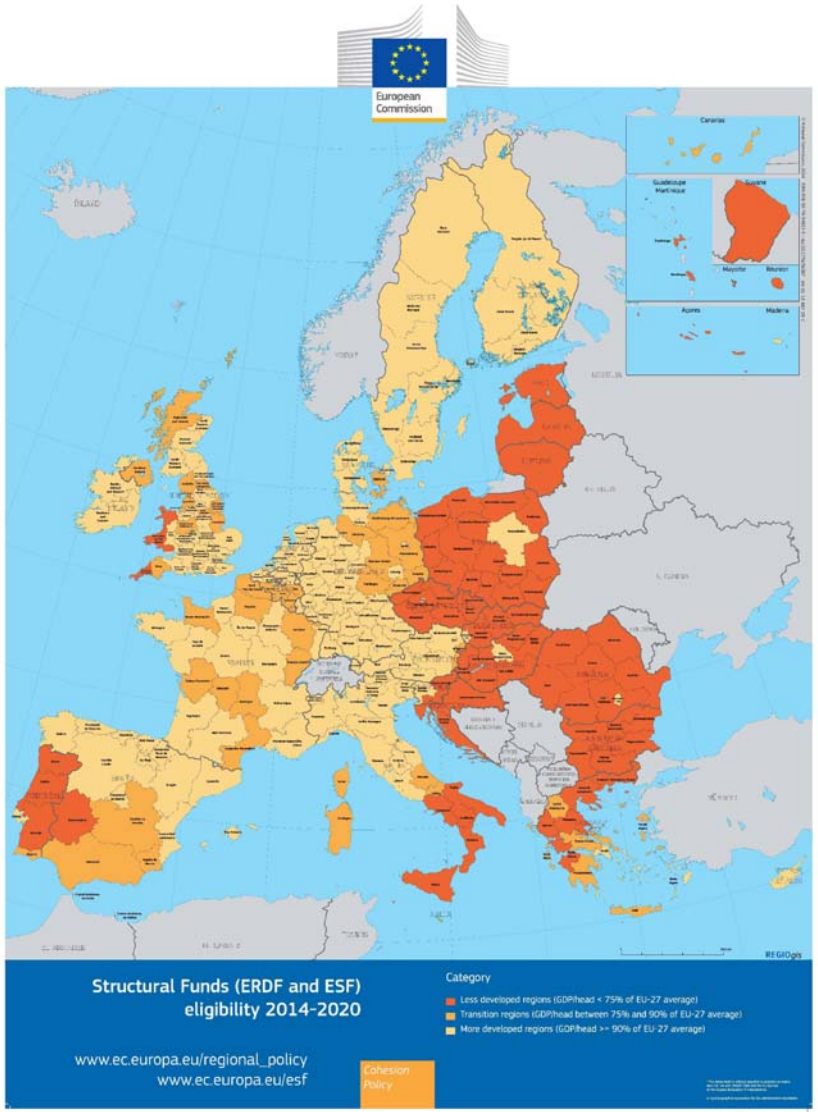
References:

- NSRF (National Strategic Reference Framework)
- ERDF (European Regional Development Fund)
- ESF (European Social Fund)

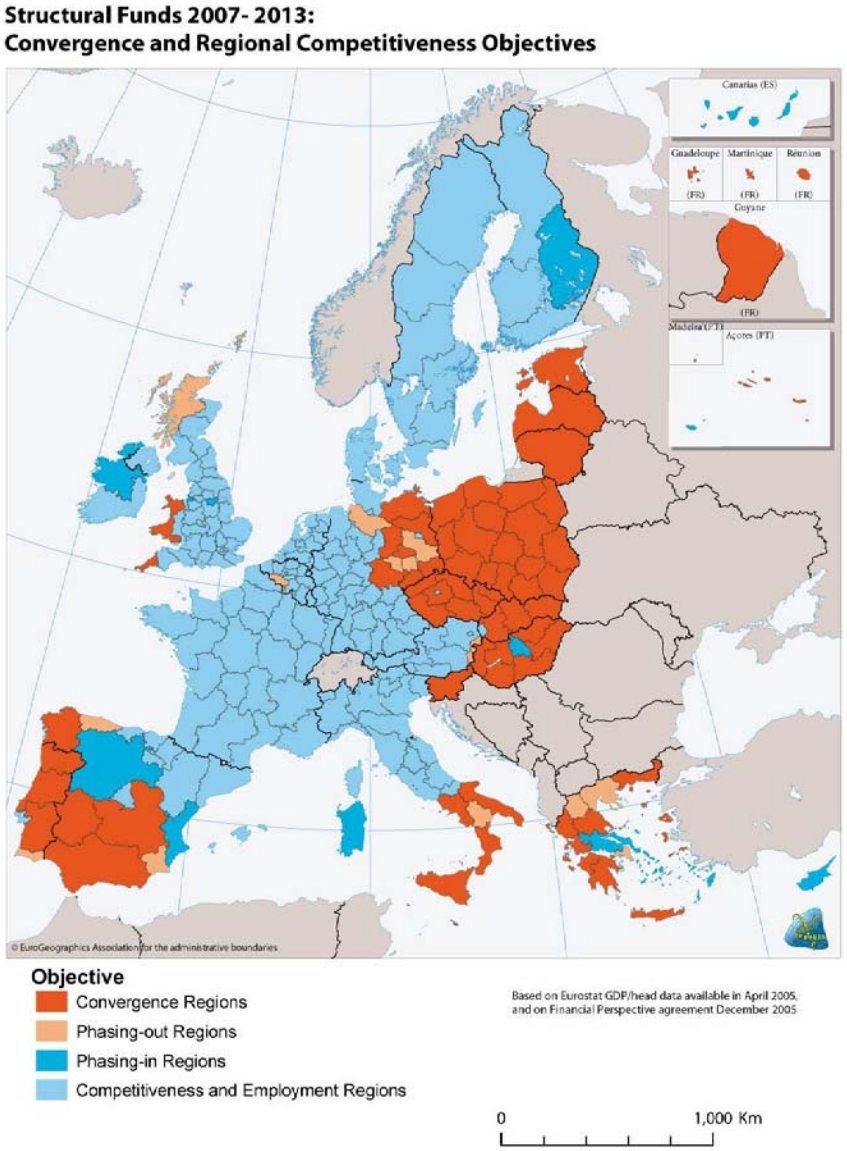
Comments: also included as a reference the eligibility typology of the budgetary period 2007-2013, including the following typology types:

- Convergence Regions
- Phasing-out Regions
- Phasing-in Regions
- Competitiveness and Employment Regions

Structural Funds Eligibility 2013-2020 Programme



Structural Funds Eligibility 2007-2013 Programme



2.3.2.4 EU2020 Strategy Performance

Typology entry point: Administrative Regions (NUTS)

Typology name: Regions classified according to their EU2020 Strategy Performance

Author: ESPON SIESTA project

Defined at geographical level: NUTS2

Adoption to other geographical levels: none

Typology types:

- Challenging the EU2025 *(countries moving far from the EU2020 strategy targets)*
- EU2020S on the move *(countries in transition between Challenging and Performing regions)*
- EU2020S performance *(regions scoring well in the headline targets set by the EU2020S)*

References:

- ESPON SIESTA Project Final Report by University of Santiago et al.

Comments: Based on cluster analysis of progress towards EU2020 quantitative targets

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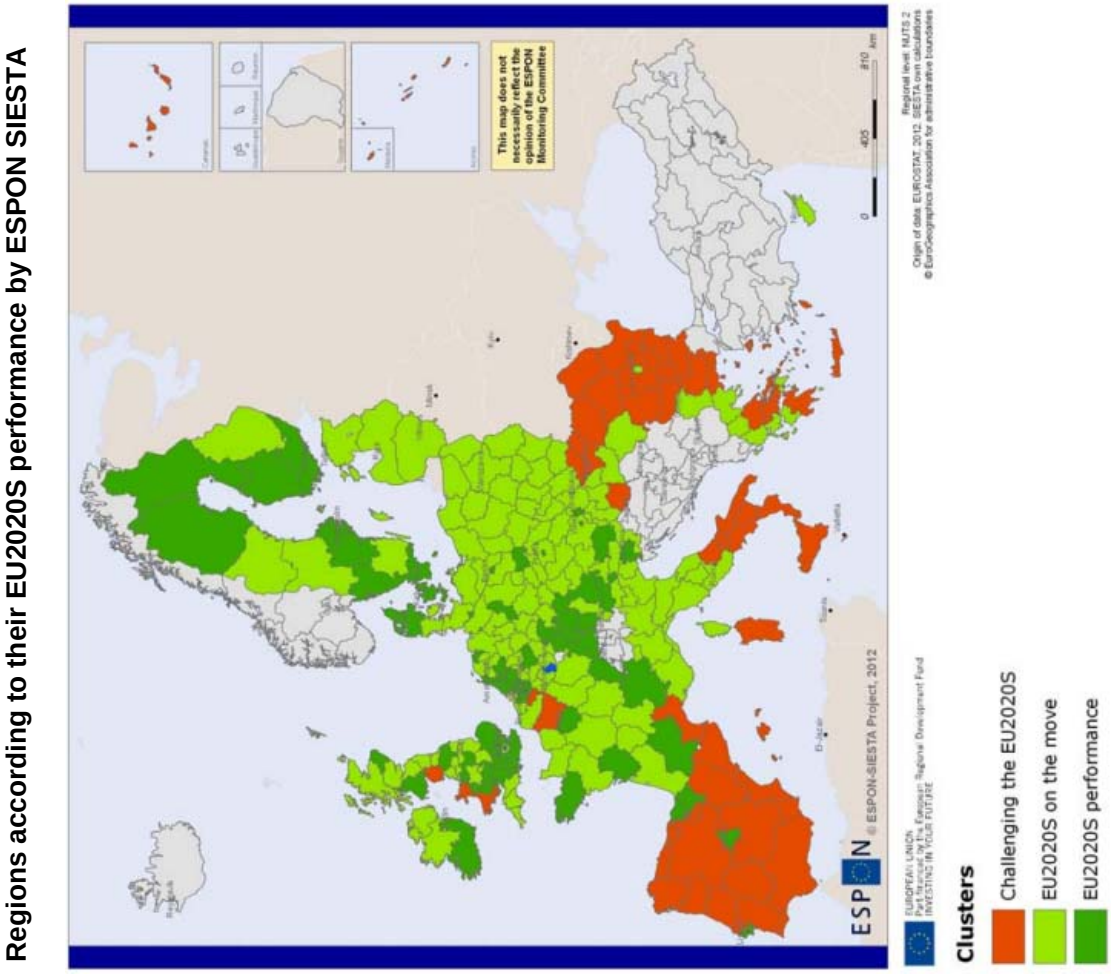

2.3.2.5 Scientific Regions

Typology entry point: Administrative Regions (NUTS)

Typology name: Typology on Scientific Regions

Author: ESPON KIT project

Defined at geographical level: NUTS2

Adoption to other geographical levels: none

Typology types:

- Scientific regions (*"research activity" and "high-quality human capital" above EU average*)
- Research intensive regions (*regions with "research activity" above EU average)*
- Human capital intensive regions *(regions with "human capital" above EU average)*
- Regions with no specialization in knowledge activities (*regions below EU average in "research activity" and "high-quality human capital")*

References:

- ESPON KIT Final Report by Politecnico di Milano at al.

Comments: The EC recognises the territorial dimension of the innovation and knowledge economy and its role in potential territorial development and cohesion in both, the Green Paper on the European Research Area as well as the Green Paper on Territorial Cohesion

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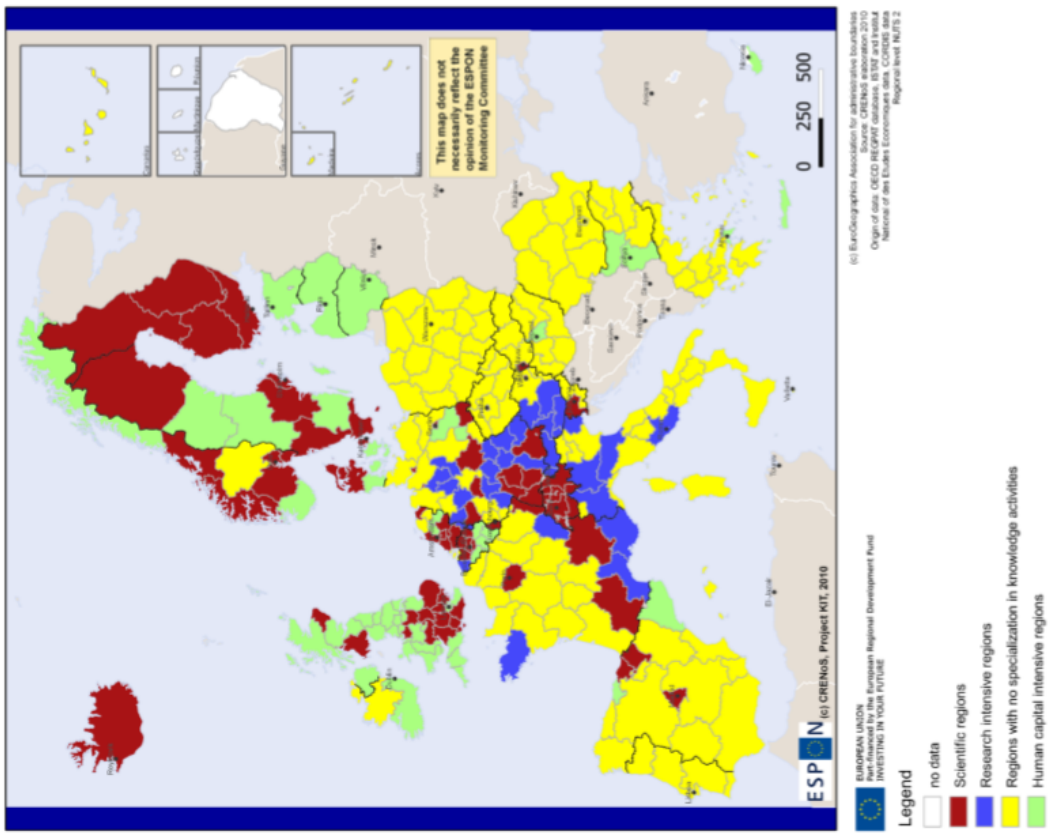
Scientific regions in Europe by ESPON KIT



2.3.2.6 Regions with Geographical Specificities

Typology entry point: Geographical Regions

Typology name: ESPON Typology Compilation

Author: ESPON GEOSPECS (University of Geneva) // ESPON Typology Compilation

Defined at geographical level: aggregation of LAU2 (GEOSPECS) // NUTS3 (ESPON Typology Compilation)

Adoption to other geographical levels: to NUTS2, by ESPON ETMS

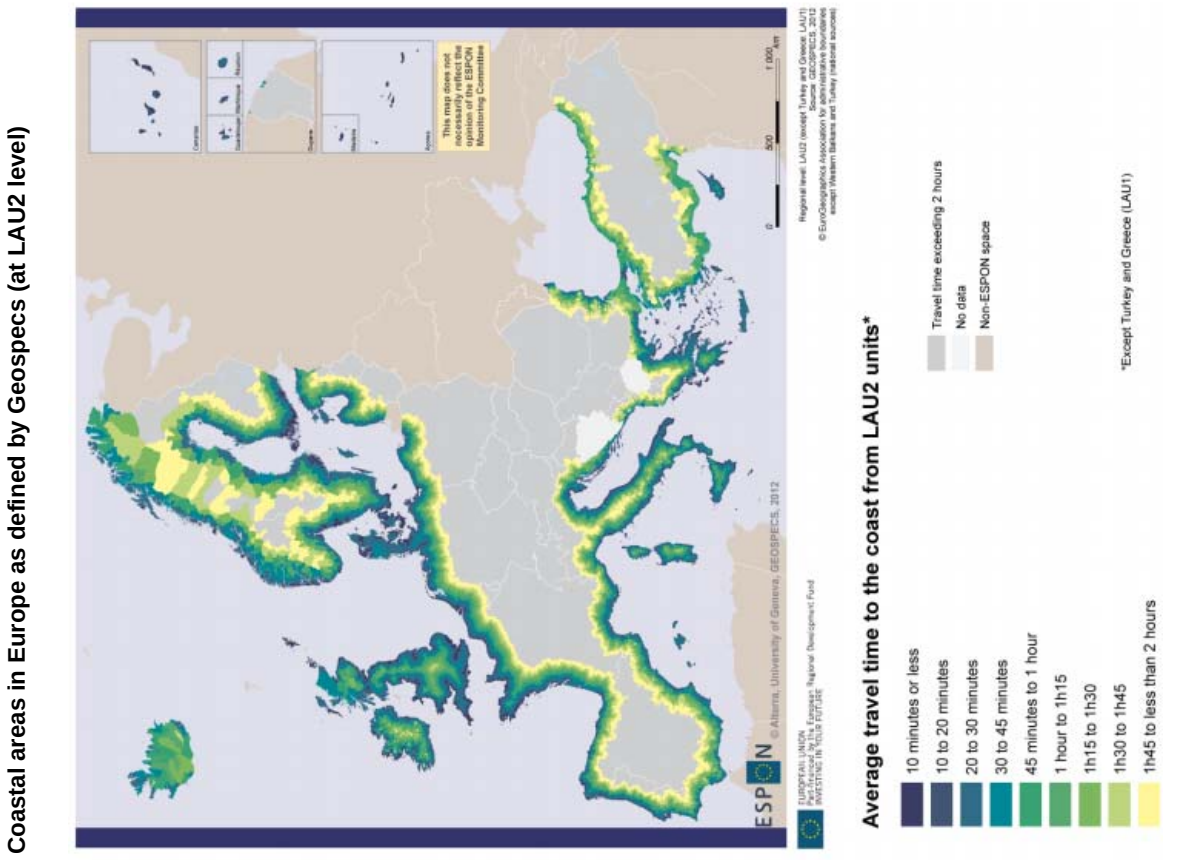
Typology types:

- Mountains
- Islands
- Coastal regions
- Sparsely populated areas (SPA)

References:

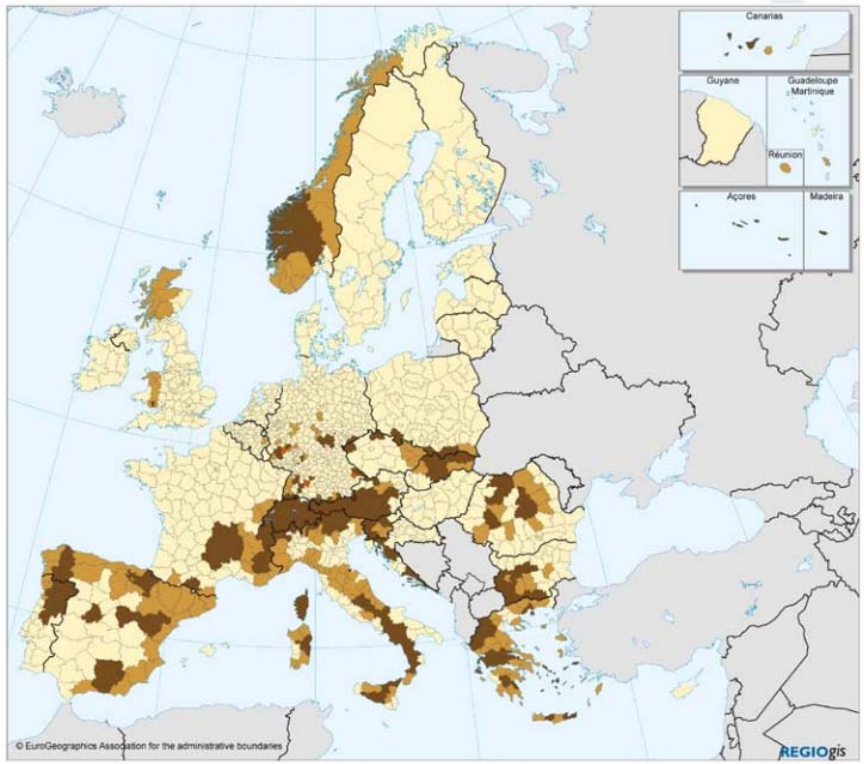
- GEOSPECS (European Perspective on Specific Types of Territories)
- Focus on cities and metro regions by Eurostat

Comments: -



Mountain areas in Europe as defined by the ESPON typology compilation (at NUTS3 level)

Map 4: Typology of mountain regions at NUTS3 level



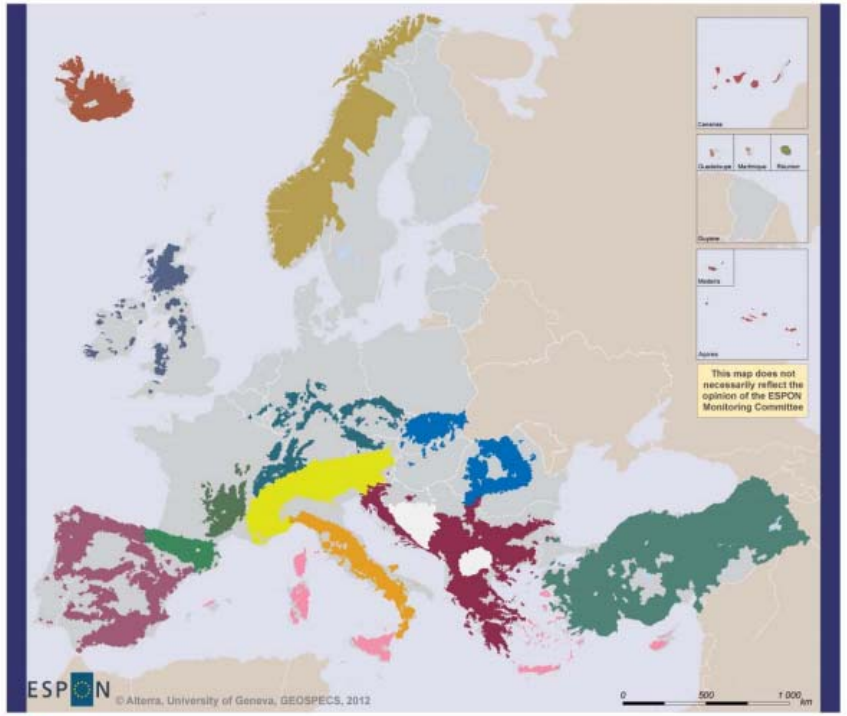
Share of mountain area in NUTS3 region

- > 50 % of population
- > 50 % of surface
- > 50 % of population and 50 % of surface
- Other regions

Sources: Eurostat, JRC, EFGS, DG REGIO

0 500 Km

Mountains in Europe as defined by Geospecs (at LAU2 level)

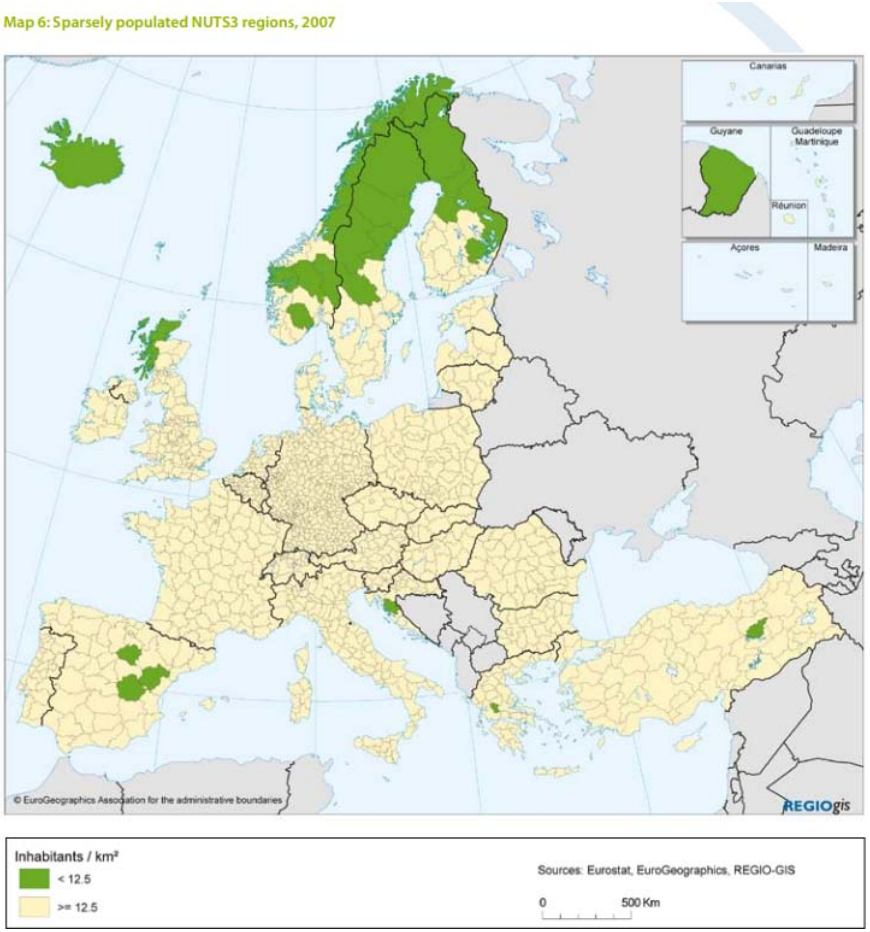


Massif names

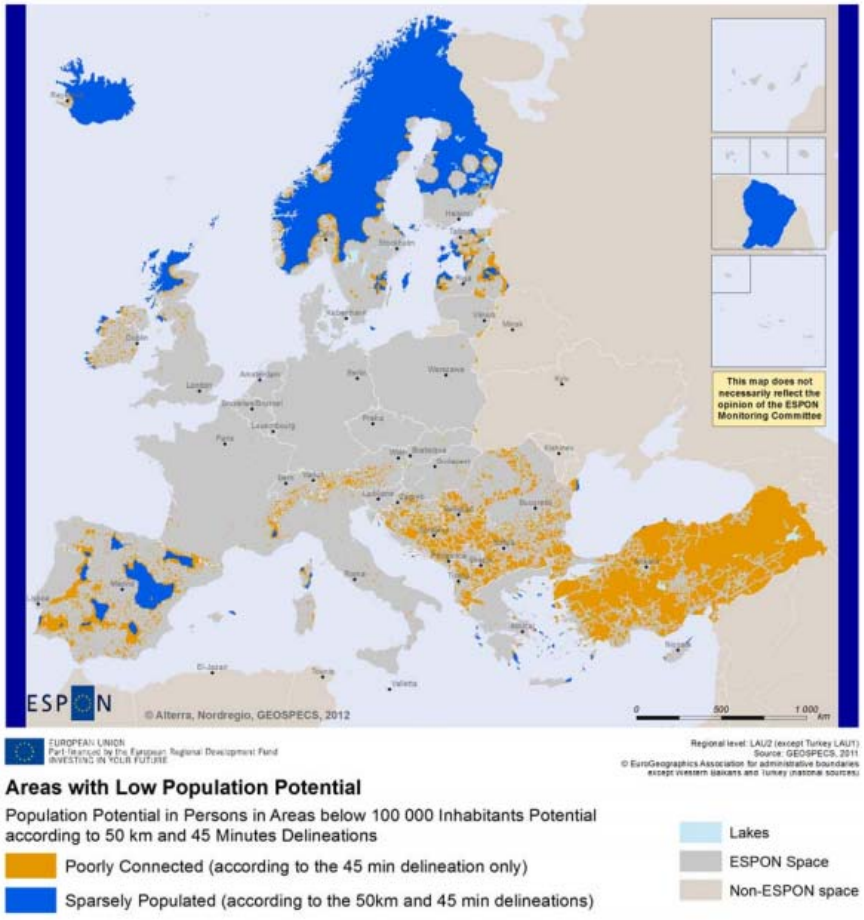
- Alps
- Apennines
- Atlantic Islands mountains
- Balkans/Southeast Europe
- Caribbean Island mountains
- Carpathians
- Central European Middle mountains
- Iberian mountains
- Icelandic mountains
- Indian Ocean Island mountains
- Massif central
- Mediterranean island mountains
- Mountains of the British Isles
- Pyrenees
- Scandinavian mountains
- Turkish mountains

- ESPON Space
- No data
- Non-ESPON space
- Lakes

Sparsely Populated areas in Europe as defined by the ESPON typology compilation (at NUTS3 level)

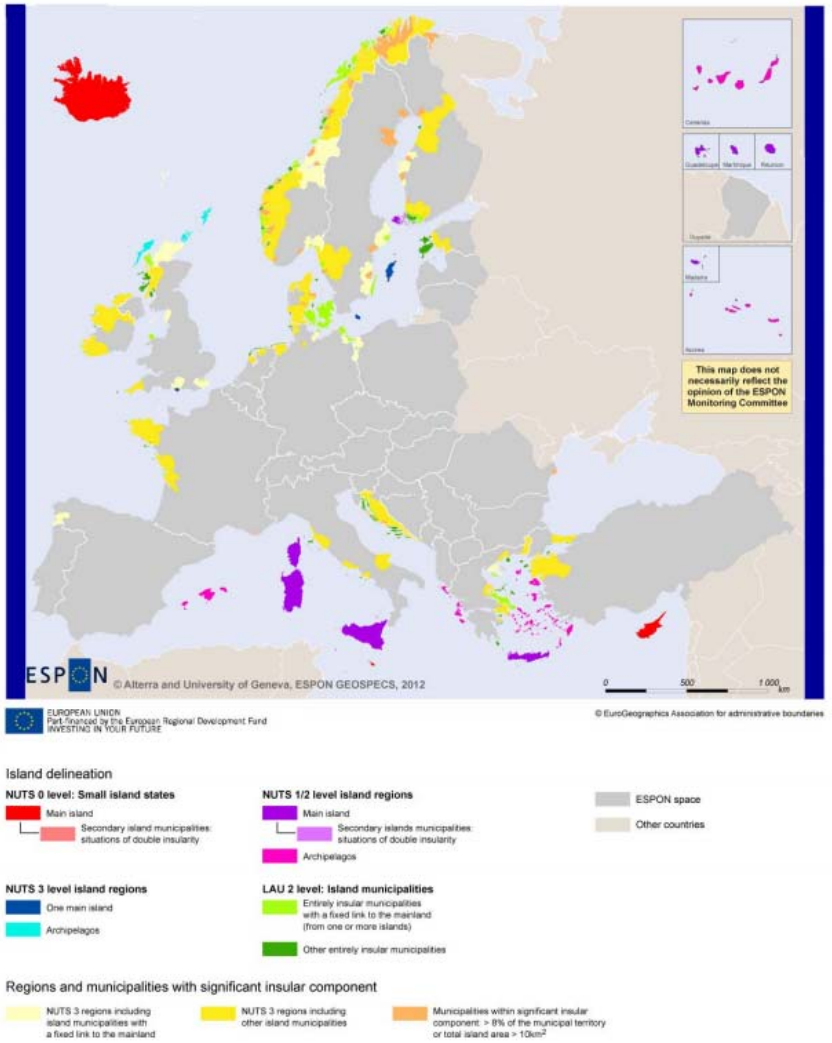


Sparsely Populated areas in Europe as defined by Geospecs (at LAU2 level)



Islands in Europe as defined by the ESPON typology compilation (at NUTS3 level)

Islands in Europe as defined by Geospecs (at LAU2 level)



2.3.2.7 Transnational Cooperation Areas

Typology entry point: Transnational cooperation areas

Typology name: Macro-regions

Author: DG-Regio

Defined at geographical level: NUTS2 and NUTS3

Adoption to other geographical levels: -

Typology types:

- North Sea, Northern Periphery and Arctic, Baltic Sea, North West Europe, Alpine Space, Danube, Atlantic Area, Central Europe, Adriatic-Ionian, South West Europe, Mediterranean, Balkan-Mediterranean, Caribbean Area, Amazonia, Indian Ocean Area

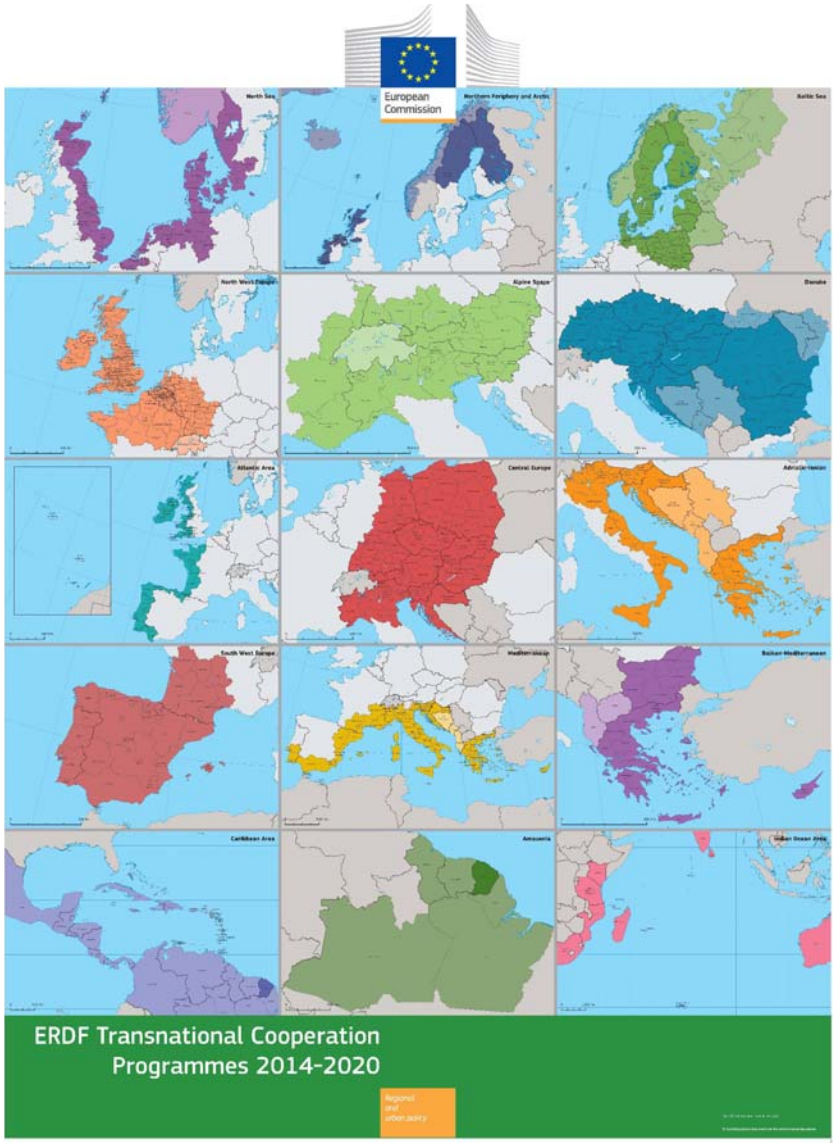
References:

- Baltic Sea Region
- Danube Basin
- Alpine Space Programme
- Adriatic Ionian Macroregion Area

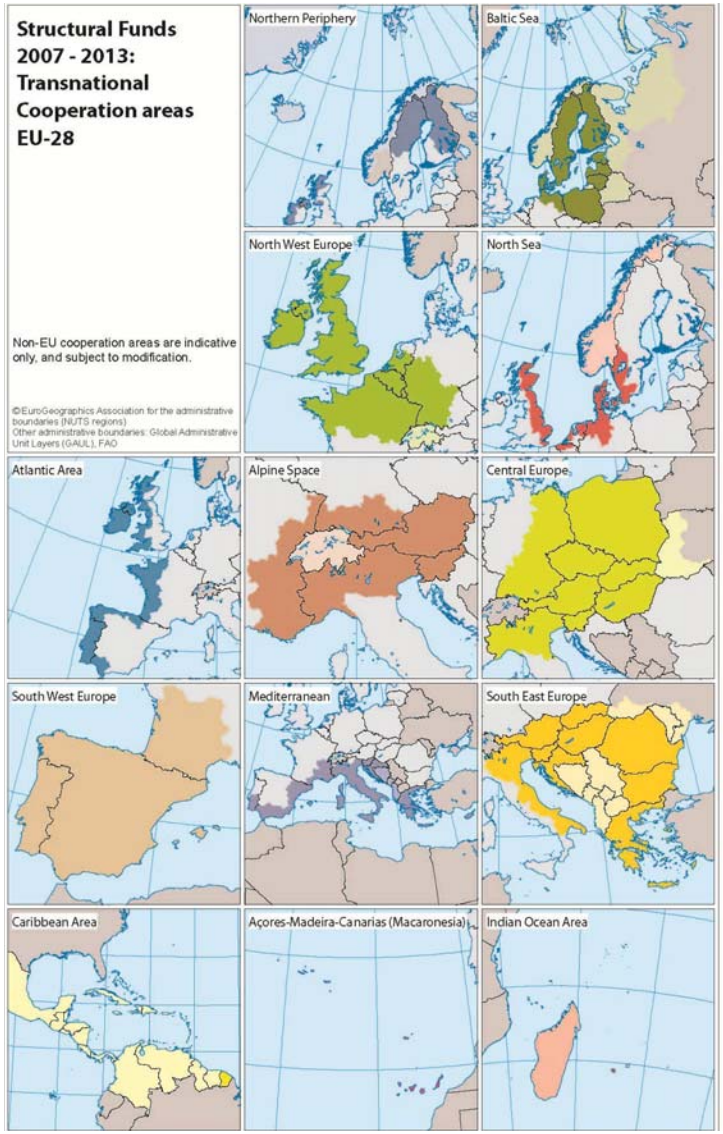
Comments: also included as a reference the eligibility typology of the budgetary period 2007-2013, including the following typology types:

- Northern Periphery, Baltic Sea, North West Europe, North Sea, Atlantic Area, Alpine Space, Central Europe, South West Europe, Mediterranean, South East Europe, Caribbean Area, Açores-Madeira-Canarias (Macaronesia) Indian Ocean Area

Transnational Cooperation Programmes 2014-2020



Transnational Cooperation Programmes 2007-2013



2.3.2.8 Cities (as in LUZ)

Typology entry point: Cities

Typology name: LUZ harmonized delineations

Author: ESPON Data Base

Defined at geographical level: aggregation of LAU2

Adoption to other geographical levels: -

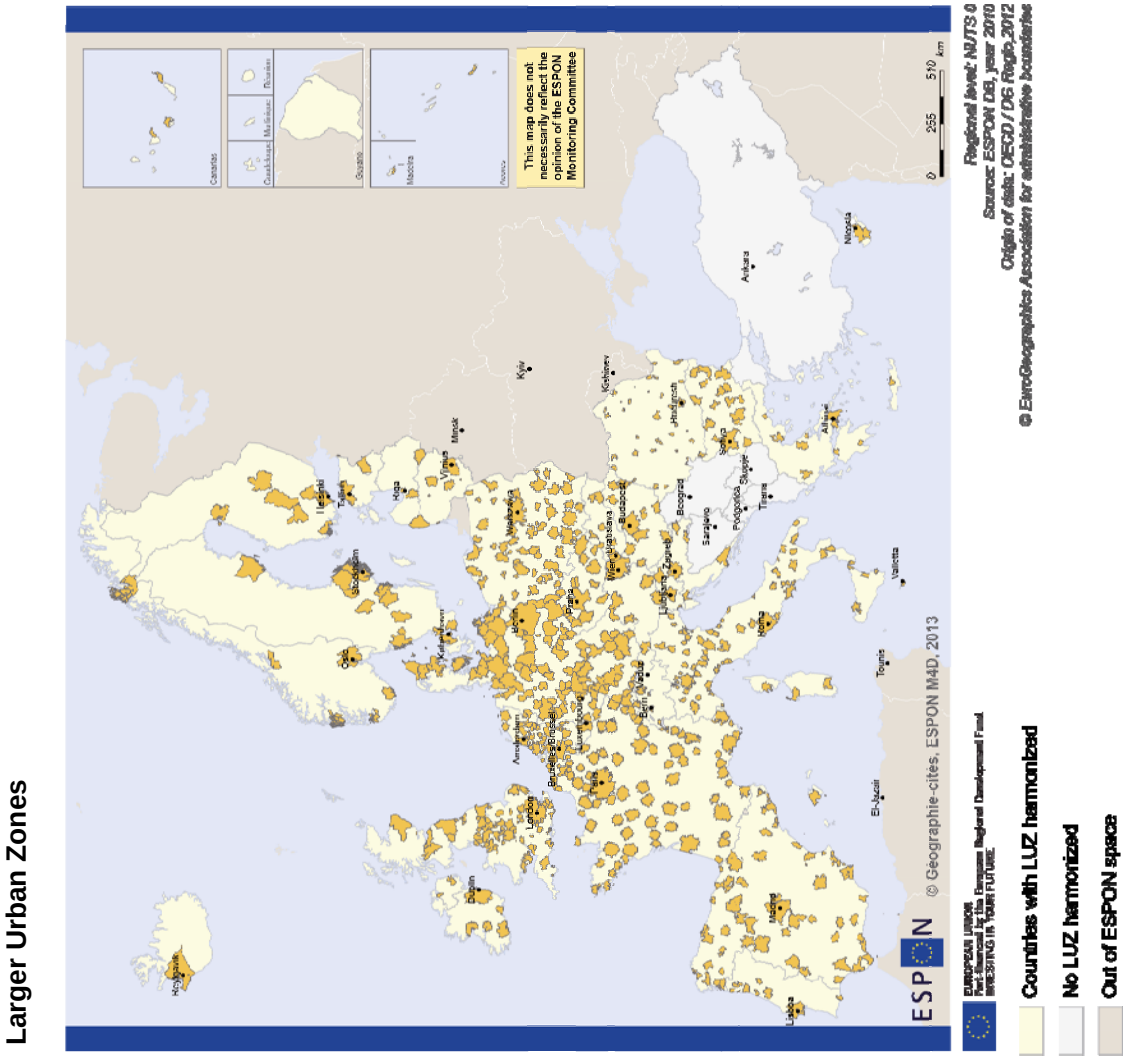
Typology types:

- Countries with LUZ harmonized
- No LUZ harmonized

References:

- ESPON

Comments: -



2.4 The Policy Dimension of Compass Indicators

The list of policy issues to be monitored for each type of regions, cities and territories emerges in ETMS from the review of key European policy documents, in line with the specific requirements made by the ESPON CU in the Inception Report (CSF, Territorial Agenda 2020, or the Green Paper on Cohesion, Cohesion reports, Europe 2020...). Other documents providing pertinent insights on territorial development issues, such as the Barca report or the Report for the Polish Presidency are used as complementary sources of information.

The next six tables provide the Policy Context under which each of the ETMS Compass Indicators is working on. They are organised under the 6 priorities of the Territorial Agenda 2020, and put into relation with the EU2020 Strategy and the Common Strategic Framework (CSF).

- Ensuring global competitiveness of the regions based on strong local economies
- Managing and connecting ecological, landscape and cultural values of regions
- Polycentric and balanced territorial development promotion
- Improving territorial connectivity for individuals, communities and enterprises
- Encouraging integrated development in cities, rural and specific regions
- Territorial integration in cross-border and transnational functional regions

2.4.1 Compass Indicators and TA2020 Global Competitiveness Priority

TA2020 Priority	**Ensuring global competitiveness of the regions based on strong local economies**
Rationale: **What territorial features should be improved?**	- Social capital, territorial assets, and the development of innovation and smart specialisation strategies in a place-based approach playing a key role in ensuring competitiveness, - Integration of local endowments, characteristics and traditions into the global economy, contributing to the reducing of vulnerability to external shocks.
"Storyline" for monitoring	Strong local economies are important from both a growth and resilience perspective. Each region can contribute to the competitiveness of Europe based on regional factors and endowments, and a balanced and territorially diverse growth structure is more resilience to external chocks to the economic as well as environmental systems. Evolving strong local economies are about many factors and the understanding (and measurement) of such a process has to pay attention to many dimensions: economy and businesses, innovation, resources, people and labour markets, interaction or regions, connectedness, and much more. To this end, this is perhaps the most multi-faceted priority of the TA2020 and it relates to many aspects of EU2020; and it is addressed by many objectives of the future cohesion policy. Some of the key identified questions considered relevant for territorial monitoring **of this dimension of policy** (competitiveness of the regions based on strong local economies) are as follows: • How efficiently do territories perform in economic terms? • Is economic convergence of regions progressing in Europe? • What is the knowledge capital of European territories? • How diversified are their territorial labour-markets? • Which territories are most dynamic in demographic terms? • How heavily will the territories be impacted by ageing of population? • What is the skill level of population?

	• What are the land resource potentials? • How accessible are the European territories? • What is the quality of digital infrastructure and services across Europe?
Specific spatial and geographical dimensions	All territories and regions are included in this dimension and are to be considered. Territorial factors are critical. Smart specialisation of regions is as important as the interaction of regions and connectedness both physically and digitally.
ETMS relevant Indicators	**Economic Competitiveness:** Total R&D expenditure as % of GDP; GDP-PPS per person employed **Human Capital:** Net migration rate; Share of Persons aged 30-34 with tertiary education attainment **Social Inclusion:** Employment rate 20-64 years; Total employment rate; Difference between female and male employment rates; Young unemployment rate; Elderly employment rate **Environmental Qualities:** Share of Renewable Energy in Final Energy Consumption; Land use pattern **Availability of Services and Functions:** Access to MUAs; Air connectivity (with 45 minutes drives); Connectivity ICON; Households with broadband access
Associated Europe 2020 targets	- Employment: 75% of the 20-64 year-olds to be employed. - R&D / innovation: 3% of the EU's GDP (public and private combined) to be invested in R&D/innovation. - Education: Reducing school drop-out rates below 10%, at least 40% of 30-34–year-olds completing third level education.
Linking issues between TA2020 and EU2020 relevant for this priority*	- Ensuring and improving global accessibility. - Ensuring and improving European accessibility. - Focus on territorially bound factors for regional development. - Building up and utilising further local innovation systems and networks. - Understanding and utilising territorial characteristics for energy production. - Revitalisation of cities as regional centres and interaction of medium sized cities in a polycentric regional system.
Thematic objective(s) of cohesion policy (according to CSF)	1. Research and innovation. 2. Information and communication technologies (ICT). 3. Competitiveness of Small and Medium-sized Enterprises (SMEs). (4. Shift towards a low-carbon economy.) (5. Climate change adaptation and risk prevention and management.) 6. Environmental protection and resource efficiency. 7. Sustainable transport and removing bottlenecks in the key network. 8. Employment and support to labour mobility. 10. Education, skills and lifelong learning. 11. Institutional capacity building & efficient public administration.

2.4.2 Compass Indicators and TA2020 Regional Ecological and Cultural Values Priority

TA2020 Priority	Managing and connecting ecological, landscape and cultural values of regions
Rationale: **What territorial features should be improved?**	- Well-functioning ecological systems and the protection and enhancement of cultural and natural heritage as important conditions for long-term sustainable development, - Integration of ecological systems and areas protected for their natural values into green infrastructure networks at all levels, - Development of joint risk management, - Special attention – if needed – paid to cultural landscapes in order to make best use of these assets (environment-friendly job creation and strengthening their recreational functions as a complement to conservation), - Improvement of regional and local identity by strengthening awareness and responsibility of local and regional communities towards their environments, landscapes, cultures and other unique values.
"Storyline" for monitoring	Ecosystems, landscapes and cultural values are important both for environmental, social and economic dimensions. Obviously the environment is the basis for all life, and it constitutes the backbone also for quality of life, attractiveness of places (for living and visiting), the wellbeing of humans, and the identity of regions. Also, ecosystems, landscapes (and to some extent culture) also determines much of the economic activities and provides raw materials, flowing resources and absorptive capacity for society. Hence the management of the environment and the integration of green economy in the creation of future growth and jobs is an important dimension, and a merit for monitoring. This amount to understanding both the state of productive resources, the emissions of harmful substances, the quality of nature and place in different regions, and the transition to a more integrated (cradle-to-cradle) production and consumption. Some of the key identified questions considered relevant for territorial monitoring **of this dimension of policy** (ecological, landscape and cultural values of regions)are as follows: • How environmentally-friendly are energy consumption patterns? • What is the quality of the living environment? • What are the land resource potentials?
Specific spatial and geographical dimensions	Both Urban and regional perspectives. Physical planning for adaptation and mitigation. Territorial endowments of resources and energy production. Impact for declining regions based on new green economy potentials.
ETMS relevant Indicators	**Environmental qualities:** - Share of Renewable Energy in Final Energy Consumption - Air pollution: PM10 - Degree of soil sealing - Land use pattern
Associated Europe 2020 targets	- Climate change / energy: greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990, 20% of energy from renewables, 20% increase in energy efficiency.
Linking issues between TA2020 and EU2020 relevant for this priority.*	- Wise management of cultural and natural assets
Thematic objective(s) of cohesion policy (according to CSF)	4. Shift towards a low-carbon economy. 5. Climate change adaptation and risk prevention and management. 6. Environmental protection and resource efficiency.

2.4.3 Compass Indicators and TA2020 Balanced Territorial Development Priority

TA2020 Priority	Polycentric and balanced territorial development promotion
Rationale: **What territorial features should be improved?**	- Polycentric and balanced territorial development of the EU as the key element of achieving territorial cohesion, - Cities as centres contributing to the development of their wider regions (the aspect of functional regions), - Polycentric territorial development fostering the territorial competitiveness of the EU territory also outside the core 'Pentagon area', - City networking improving performance in European and global competition, - Small and medium-sized towns playing a crucial role at the regional level so that polarization between capitals, metropolitan areas and medium-sized towns on the national scale should be avoided.
"Storyline" for monitoring	Some of the key identified questions considered relevant for territorial monitoring **of this dimension of policy** (Polycentric and balanced territorial development promotion) are as follows: • Which territories are most dynamic in demographic terms? • How accessible are the European territories? • What is the quality of digital infrastructure and services across Europe? • How intensively do territories cooperate?
Specific spatial and geographical dimensions	Urban Centres
ETMS relevant Indicators	**Human Capital:** Population potential within 45 min; Net migration rate; Total population change; Birth rate; Old age dependency ratio; Share of Persons aged 30-34 with tertiary education attainment **Availability of Services and Functions:** Access to MUAs; Air connectivity (with 45 minutes drives); Connectivity ICON; Households with broadband access; Cooperation intensity (ETC)
Associated Europe 2020 targets	- None to be directly related
Linking issues between TA2020 and EU2020 relevant for this priority.*	(- Investing in education) - Interaction between metropolises at the EU scale - Interaction between main national growth poles - Services of general economic interest (specifically in sparsely populated areas)
Thematic objective(s) of cohesion policy (according to CSF)	(2. Information and communication technologies (ICT).) 7. Sustainable transport and removing bottlenecks in the key network. 8. Employment and support to labour mobility.

2.4.4 Compass Indicators and TA2020 Connectivity Priority

TA2020 Priority	Improving territorial connectivity for individuals, communities and enterprises
Rationale: **What territorial features should be improved?**	Fair and affordable accessibility to services of general interests, information, knowledge and mobility are essential for territorial cohesion. Further development of TEN-T linking the main European centres. Development of secondary networks at regional and local scale. Encourage the accessibility of urban centres in peripheries to combat social exclusion. Breaking the territorial barriers for accessing geographically specific territories such as Islands or Outermost areas.
"Storyline" for monitoring	Cities are thought as the centres for the provision of services to persons and businesses. Aiming at improving territorial cohesion is thus related to the substantial improvement of the connectivity of remote places to such service centres. The improvement of connectivity is expected to enhance the capacity of individuals and businesses in those places to contribute to economic development and social progress. Attention should be particularly targeted to the most 'disconnected' of Europe's territories in terms of transport and communication infrastructure, i.e. islands and Outermost Areas.
Specific spatial and geographical dimensions	Urban Centres Islands and Outermost Areas
ETMS relevant Indicators	**Social Inclusion:** Disposable household income; At-risk-of-poverty rate **Availability of Services and Functions:** Access to MUAs; Air Connectivity; Connectivity ICON; Household with broadband access
Associated Europe 2020 Targets	*A target on educational attainment which tackles the problem of early school leavers by reducing the drop out rate to 10% from the current 15%, whilst increasing the share of the population aged 30-34 having completed tertiary education from 31% to at least 40% in 2020* *The number of Europeans living below the national poverty lines should be reduced by 25%, lifting over 20 million people out of poverty*.
Linking issues between TA2020 and EU2020 relevant for this priority *	National and daily accessibility between metropolises Accessibility to the main, and secondary, centres E-connectivity Access to energy networks Renewable and local energy production
Thematic objective(s) of cohesion policy (according to CSF)	2. Enhancing access to, use and quality of ICT 7. Promoting sustainable transport and removing bottlenecks in key network infrastructures 9. Promoting social inclusion and combating poverty 10. Investing in education, skills and lifelong learning

2.4.5 Compass Indicators and TA2020 Integrated Urban-Rural Development Priority

TA2020 Priority	Encouraging integrated development in cities, rural and specific regions
Rationale:	Making cities motors of (smart, sustainable and inclusive) development.
What territorial	Enhance the accessibility of rural, peripheral and sparsely populated territories.

features should be improved?	Safeguarding and sustainable utilization of environmental resources. Territories facing severe depopulation should have long-term solutions to maintain their economic activity by enhancing job creation, attractive living conditions and public services for inhabitants and businesses. Modernization of primary sector in rural areas through resource-efficient investments in new and alternative sectors. Urban-rural interdependence recognised through integrated governance. Accessibility of urban centres from rural territories to ensure the necessary availability of job opportunities and services of general interest. Geographically specific territories are often faced with long-standing demographic challenges.
"Storyline" for monitoring	A cohesion-friendly territorial development necessitates a better functional integration between urban centres and their direct surroundings, from a transport infrastructure, but also with regards to the complementarity of the local labour market. Especially the diversification of activities in Geospecs and rural areas that are traditionally dependent on the primary sector towards more manufacturing and services activities needs to be promoted and monitored. The monitoring of the demographic change in quantitative and qualitative terms is necessary in order to understand the labour market challenges of the future, for instance with regards to access to skilled individuals. The integration and complementarity of local labour markets should be promoted between cities and their surroundings, as well as among localities sharing similar territorial challenges and opportunities (e.g. integration between SPA localities, or between mountain municipalities).
Specific spatial and geographical dimensions	Urban Centres Rural regions and Geospecs areas (SPA, mountain, islands…)
ETMS relevant Indicators	**Economic Competitiveness:** Employment per sector **Human Capital:** Population potential within 45 minutes; Total Population Change; Net migration rate **Availability of Services and Functions:** Access to MUAs **Environmental Qualities:** Share of renewable energy in final consumption
Associated Europe 2020 Targets	*Removing bottlenecks in key network infrastructures, thereby boosting our industrial competitiveness* *Further progress with the integration of the European energy market can add an extra 0.6% to 0.8% GDP. Meeting the EU's objective of 20% of renewable sources of energy alone has the potential to create more than 600 000 jobs in the EU. Adding the 20% target on energy efficiency, it is well over 1 million new jobs that are at stake.*
Linking issues between TA2020 and EU2020 relevant for this priority *	Focus on territorially-bound factors Compact cities Enlargement of local labour markets
Thematic objective(s) of cohesion policy	3. Enhancing the competitiveness of SMEs, the agricultural sector and the fisheries and aquaculture sector 6. Protecting the environment and promoting resource efficiency 7. Promoting sustainable transport and removing bottlenecks in key network infrastructures 8. Promoting employment and supporting labour mobility

2.4.6 Compass Indicators and TA2020 Integrated Cross-Border Regions Priority

TA2020 Priority	Territorial integration in cross-border and transnational functional regions
Rationale: **What territorial features should be improved?**	Integration of territories through territorial cooperation foster global competitiveness. Create a critical mass for development, diminishing economic, social and ecological fragmentation.
"Storyline" for monitoring	The strong disparities that exist across Europe have been identified as a barrier for taking benefits from the economic potential of the continent. Hence, the increased competitiveness of the continent's economy is strongly related to the capacity to foster a larger degree of integration of territorial ensembles across the borders. This means that territorial development should be promoted through the reduction of economic, social and ecological fragmentation in cross-border regions as well as within macro-regions, such as the BSR, the Danube or the Adriatic one. This aim can be attained through a strong integration of cross-border labour markets, made possible by enhanced connectivity and cooperation.
Specific spatial and geographical dimensions	Cross-border regions Macro-regions
ETMS relevant Indicators	**Economic Competitiveness:** GDP per capita in PPS; GDP per person employed **Social Inclusion:** Employment rate 20-64 years; Total employment rate; Young unemployment rate; Disposable household income; At-risk-of-poverty rate **Availability of Services and Functions:** Access to MUAs; Cooperation Intensity (ETC) **Environmental Qualities:** Degree of soil sealing; Land use pattern
Associated Europe 2020 Targets	All three Objectives of Smart, Sustainable and Inclusive growth through cross-border and macro-regional integration.
Linking issues between TA2020 and EU2020 relevant for this priority *	Critical mass of means through territorial cooperation Trans-border accessibility
Thematic objective(s) of cohesion policy	7. Promoting sustainable transport and removing bottlenecks in key network infrastructures 11. Enhancing institutional capacity and ensuring an efficient public administration

* Based on the conclusions of the report for the Polish Presidency: Böhme et al. (2011) How to strengthen the territorial dimension of Europe 2020 and the EU Cohesion policy.

2.5 The EU2020S Dimension of Compass Indicators

The ESPON SIESTA project developed in 2012 a system of indicators to monitor the regional deployment of the EU2020 Strategy. Siesta indicators were based a screening of data availability at regional level, including as 'compulsory indicators' the headline targets set by the EU2020S.

The SIESTA Project suggested a particular understanding of 'Sustainable Growth' dimension by the EU2020S, basically meaning sustainable recovery of the path of economic growth through increasing levels of competitiveness. Although it would be true that the EU2020S conception of 'Sustainable Growth' embraces some of the typically associated notions to sustainable

development (resource efficiency, renewable sources of energy, etc.), in practice it primarily means building an economy which leaves the crisis behind. Thus, SIESTA considered competitiveness and economic growth in the years of the crisis under Sustainable Growth, along with green economies, and more classic environmental elements.

Sustainable Growth headline targets

- *The three targets known as "20/20/20": a 20% reduction (and even 30% if possible) in greenhouse gas emissions in relation to 1990 levels, 20% of energy from renewable sources and a 20% increase in energy efficiency*

For Smart Growth, the SIESTA project included research, innovation, education, development, digital society. It included the Youth on the Move, the Innovation Union and Digital Agenda flagship initiatives, and was linked to the following headline indicators with their corresponding targets.

Smart Growth headline targets

- *3% of the GDP to be invested in R&D*
- *Reducing early school leavers to below 10%*
- *At least 40% of 30-34 year-old population completing third level education*

For Inclusive Growth, Siesta focussed basically on employment, human capital on the one side (Agenda for New Skills and Jobs flagship initiative), and on social well-being and equality, and prevention of exclusion, and poverty (EU Platform Against Poverty flagship initiative), and was linked to the following headline indicators with their corresponding targets.

Inclusive Growth headline targets

- *75% of the 20-64 year-old population to be employed*
- *At least 20 million fewer people in or at-risk-of-poverty and social exclusion*

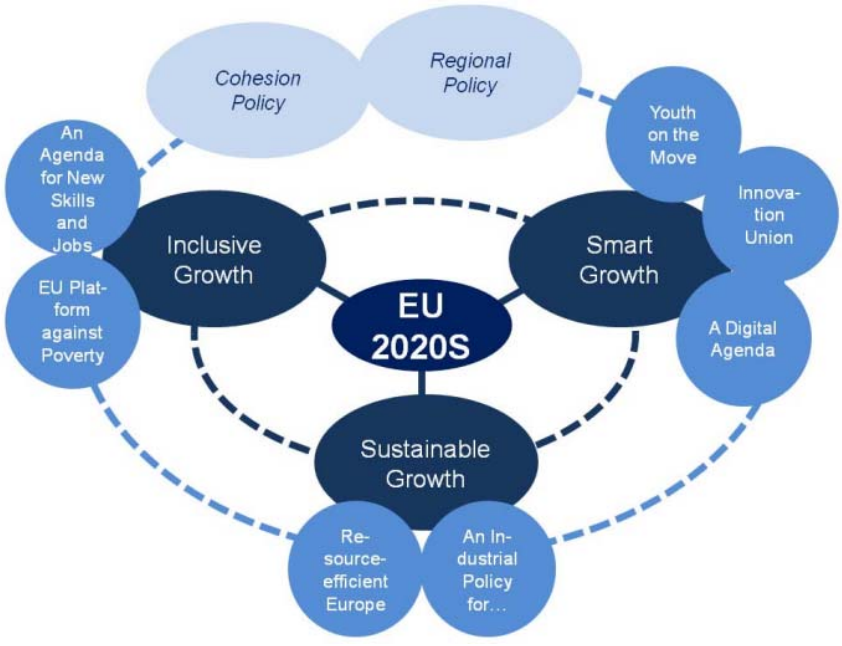


Figure 1. EU2020S Pillars and Flagship Initiatives from the perspective of ESPON SIESTA (2013)

The following table relates the ETMS Compass Indicators and Themes with the EU2020 Priorities, following the proposal by ESPON SIESTA Project. It also indicates (in blue) the incorporation of EU2020 Headline Indicators in the Compass Indicators.

It is currently being analysed the extent to which the 3 missing EU2020S Headline indicators (Energy Efficiency, CO2 Emissions and Early School Drop Offs) can or cannot be incorporated in the ETMS for regional monitoring.

Table 3. Compass Indicators and the EU2020 Strategy Priorities

EU2020 PRIORITIES	ETMS THEMES	ETMS Indicator
Sustainable Growth	Economic Competitiveness	Central Government Debt
		Public cash surplus/deficil
		Domestic credit to private sector
		Balance of Accounts
		Foreign Direct Investment
		Exports of Goods and Services
		Total R&D expenditure
		GDP per capita in PPS
		GDP per person employed in PPS
		Employment in primary sector
		Employment in secondary sector
		Employment in tertiary sector
	Environmental Qualities	Share of Renewable Energy in Final Energy Consumption
		Air pollution: PM10
		Degree of soil sealing
		Landscape fragmentation
		Protected natural areas
Smart Growth	Human Capital	Net migration rate
		Total population change
		Birth rate
		Old age dependency ratio (ODR)
		Persons aged 30-34 with tertiary education atteinment
Inclusive Growth	Social Inclusion	Total employment rate
		Employment rate 20-64 years
		Elderly employment rate (55-64 years)
		Differences between female to male employment rates
		Young unemployment rate (15-24 years)
		Disposable household income per capita
		At-risk-of-poverty rate
	Access to territory and services	Population potential within 45 minutes drives
		Air connectivity within 45 minutes drives
		Accessibility to airport hubs (availability of intercontinental flights)
		Accessibility to ports (availability of extra-EU container shipping services
		Air traffic at major airports
		Container traffic at major ports
		Households with broadband access
		Cooperation intensity (ETC)
		(*) EU2020 target

2.6 ETMS indicators compared to other ESPON monitoring projects

The Compass Indicators as well as the thematic categories in which they are distributed inherit the experience of previous ESPON research. The ESPON INTERCO project is at the basis of the indicator selection, and the BSR-TEMO has been closely considered as a pilot territorial monitoring tool (developed for the VASAB area), aiming at providing maximum compatibility.

The SIESTA project and the City Bench projects have also been considered in relation to their selection of indicators.

ETMS defines five thematic domains for grouping its indicators that, like INTERCO and BSR-TeMo, focus on aspects related to Territorial Cohesion and Territorial Capital. SIESTA Project chose a categorisation that was aligned with the headlines of EU2020 Strategy targets and flagship initiatives. The Citybench project has chosen an analytical categorisation of its indicators based on a sectoral approach (i.e. transport, economy…).

The thematic categories by these projects are presented in the next table. Correspondences between categories are displayed in colour codes.

Table 4. Thematic categories for ETMS Indicators and for other past and on-going ESPON research

ETMS	INTERCO	BSR-TEMO	SIESTA	CITYBENCH
Economic competitiveness	Strong local economies ensuring global competitiveness	Economic performance & competitiveness	Economic growth & competiveness	Economy & Population
Environmental Qualities	Innovative territories	Access to services, markets & jobs	Green economy, climate change and energy	Quality of life
Human capital	Fair access to Services, market and jobs	Innovative territories	Research, development and innovation	Demography
Social Inclusion	Inclusion and Quality of Life	Social inclusion & quality of life	Education	Connectivity
Access to territory and services	Attractive regions of high ecological values and strong territorial capital	Environmental qualities	Digital society	Smartness
	Integrated polycentric territorial development		Employment, skills and jobs	Environment
			Poverty, Exclusion and ageing	LUZ morphology

The next tables provide an image of which ETMS indicators are also part of the other analysed ESPON Monitoring Systems, with comments whenever relevant. A table with the complete lists of indicators considered by each of these monitoring systems can be found in the following page.

Table 5. ETMS Indicators contrasted to other past and on-going ESPON research

ETMS THEMES	ETMS Indicator	INTERCO	TEMO	SIESTA	CITYBENCH	COMMENTS
Economic Competitiveness	GDP per capita in PPS	x	x	x	x	CITYBENCH: at LUZ level
	GDP-PPS per person employed		x	x		INTERCO/SIESTA: used 'Regional labour productivity' inidcator instead
	Employment per sector*		x		x	TEMO: Focused only on technology and knowledge sectors; SIESTA: used 'Human resources in S&T'; CITYBENCH: at LUZ level
	Total R&D expenditure as % of GDP	x	x	x		Interco: indicator was labelled as 'intramural expenditures on R&D'; TEMO: Separate indicators for GD Expenditure on R&D for businesses AND in total
	Debt					
	Balance of Accounts					
Environmental Qualities	Share of Renewable Energy in Final Energy			x	x	SIESTA: used share of renewal energy at national level;
	Air pollution: PM10	x	x		x	CITYBENCH: residential CO2/PM10
	Degree of soil sealing	x	x			TEMO: used 'soil sealing per capita'
	Land use pattern*		x		x	TEMO: used a 'fragmentation index'; CITYBENCH: calculated green areas ratio at LUZ level
Human Capital	Population potential within 45 min	x	x			Interco/TEMO: used pop. pot within 50km, instead of 45mn
	Net migration rate	x	x			
	Total population change		x			
	Birth rate					INTERCO/TEMO/CITYBENCH: used 'life expectancy at birth rate' indicator
	Old age dependency ratio	x		x		TEMO: Economic ratio i.e. number of persons supported by the nr of persons employed
	Share of Persons aged 30-34 with tertiary education	x	x	x	x	Interco/TEMO: used pop aged 25-64 instead of 30-34; CITYBENCH: residents
Social Inclusion	Employment rate 20-64 years	x	x	x		
	Total employment rate		x		x	CITYBENCH: at LUZ level
	Difference between female and male employment rates	x	x	x		TEMO: used the 'gender imbalances' indicator
	Young unemployment rate		x	x		SIESTA: used as well 'long term unemployment'
	Elderly employment rate					
	Disposable household income	x				
	At-risk-of-poverty rate		x	x	x	SIESTA: used different indicators of 'drop out rate' at urban and regional levels
Availability of services & functions	Access to MUAs		x			TEMO: used Functional areas - Access to cities; CITYBENCH: used road/rail connections and journey to work instead
	Air connectivity (with 45 minutes drives)	x				Interco: used accessibility potential by air ; CITYBENCH: used inbound/outbound flights number instead
	Connectivity ICON					TEMO & CITYBENCH: Used multimodal accessibility instead
	Households with broadband access		x	x	x	TEMO: 'internet access' instead of 'broadband access'
	Cooperation intensity (ETC)	x				Interco: used as well Cooperation degree

Table 6. Indicators by INTERCO, BSR-TEMO, ESPON SIESTA, CITYBENCH and ETMS

INTERCO

• *Strong local economies ensuring global (5 ind)*	• *Inclusion and quality of life (6 ind)*

o GDP per capita in PPS NUTS3 o Unemployment rate NUTS 3 o Old age dependency ratio NUTS 3 o Labour productivity in industry and services (NUTS2) o Labour productivity per person employed (NUTS0)	o Disposable household income (NUTS 2) o Life expectancy at birth NUTS 2 o Proportion of early school leavers (NUTS1) o Gender imbalances NUTS3 o Difference in female-male unemployment rates (NUTS2) o Ageing index NUTS 3
• *Fair access to services, markets, jobs (7 ind)* o Access to compulsory school (NUTS0) o Access to hospitals NUTS0 o Accessibility of grocery services o Access to university (SILC data) o Accessibility potential by road (NUTS 3) o Accessibility potential by rail (NUTS 3) o Accessibility potential by air (NUTS 3)	• *Attractive regions of high ecological values(7 ind)* o Potential vulnerability to climate change (NUTS3) o Air pollution: PM10 NUTS3 o Air pollution: Ozone concentrations NUTS3 o Soil sealing per capita NUTS3 o Mortality, hazards and risks n.a. n.a. o Biodiversity n.a. n.a. o Renewable energy potential
• *Innovative territories (3 ind)* o Population aged 25-64 with tertiary education NUTS 2 o Intramural expenditures on R&D (NUTS 2) o Employment rate 20-64 (NUTS 2)	• *Integrated polycentric territorial (5 ind)* o Population potential within 50km (NUTS3) o Net migration rate NUTS3 o Cooperation intensity NUTS2 o Cooperation degree NUTS 2 o Polycentricity index (NA)

Baltic Sea Region Territorial Monitoring System -TEMO

• *Economic performance and competitiveness* o Macroeconomic development (2 ind.) ▪ GDP per capita ▪ GDP per person employed o Labour market (2 ind.) ▪ Unemployment rate, total ▪ Employment rate (20-64 years) o Demography (3 ind.) ▪ Net migration rate ▪ Total population change ▪ Economic dependency ratio	• *Access to services, markets and jobs* o Potential accessibility (4 ind.) ▪ Accessibility potential by road ▪ Accessibility potential by rail ▪ Accessibility potential by air ▪ Multimodal accessibility potential o Spatial structure *(3 ind.)* ▪ Functional areas: access to cities ▪ Population potential within 50 km ▪ Border crossings o Internet *(1 ind.)* ▪ Households with internet access at home
• *Innovative territories* o Human capital (2 ind.) ▪ Population with tertiary education (25-64 years) ▪ Employment in technology & knowledge-intensive o Financing and institutions (2 ind.) ▪ Gross-domestic expenditures on R&D, business ▪ Gross-domestic expenditures on R&D, total	• *Social inclusion and quality of life* o Social inclusion (4 ind.) ▪ At-risk-of-poverty rate ▪ Severe material deprivation rate ▪ Youth unemployment rate (15-24 years) ▪ Gender imbalances o Health (2 ind.) ▪ Life expectancy at birth (in years) ▪ Self-assessed general health status
• *Environmental qualities* o Consumption and production (3 ind.) ▪ New soil sealing per capita ▪ Air pollution (PM10) ▪ Eutrophication o Natural resources (1 ind.) ▪ Fragmentation index	

ESPON SIESTA

SMART GROWTH
• *Research, Development and Innovation (5 ind)* o R&D expenditure o Distance to the EU2020 targets on R&D expenditure o R&D expenditure change 2003-2009 o Human resources in science and technology o Private expenditure on R&D, 2007 to 2009
• *The Territorial Dimension of Education (7 ind)* o Potential Early school leavers (drop-out rate) o Distance to the EU2020 targets of regional drop-out rate o Change in regional drop-out rate, 2000-2010 o Drop-out rate in Larger Urban Zones (LUZ), 2004 to 2008 o Population aged 30-34 with tertiary education, 2010 o Distance to EU2020 targets of population 30-34 with tertiary education o Evolution of high qualified population (30-34 years), 2000-2010
• *Persisting Territorial Divide of the Digital Society (4 ind)* o People working in the ICT sector, 2011 o Broadband penetration rate, 2006 to 2009 o Individuals aged 16-74 ordering goods or services over the internet for private use, 2010 o Individuals who have never used a computer, 2011
SUSTAINABLE GROWTH
• *Regional Disparities in Growth and Competitiveness (4 ind)* o GDP per capita (PPS) in relation to the EU average (EU=100), 2010 o Change in GDP per capita (PPS) in relation to the EU average (EU=100), 2000-2010 o Change in national GDP per capita (PPS), 2007-2011 o Labour productivity (in relation to the EU27 average), 2010
• *Territorial Differences in Energy and Climate Change (9 ind)* o National share of renewable energy in gross final energy consumption, 2010 o Distance to EU2020 targets on share of renewable energy sources, 2010 o Potential for electricity production from wind power stations, 2005 o Potential for electricity production from photovoltaic panels in kWh, 2005 o Gross inland consumption of energy in relation to GDP, 2010 o Distance to EU2020 targets of national energy intensity, 2010 o Change in energy intensity of the national economy, 2000-2010 o National GHG emissions in 2010 compared to 1990 o Change of national GHG emissions as distance to EU2020 targets, 2005-2009
INCLUSIVE GROWTH
• *Territorial Patterns of Employment and Lifelong learning (8 ind)* o Employment rate as percentage of active population aged 20-64, 2010 o Distance to Europe 2020 targets on employment rate, 2010 o Trends in employment rate, 2000-2010 o Gender balance of employed people, 2010 o Unemployment rate (percentage of active population aged 15-74), 2010 o Youth unemployment rate, 2009 o Participation of adults (aged 25-64) in education and training, 2010 o Population (aged 25-64) with low educational attainment, 2010
• *Territorial Variations in Poverty and Social Exclusion (6 ind)* o Distance to EU2020 targets of population at-risk-of-poverty, 2010 o People at-risk-of-poverty after social transfers, 2010 o Evolution of people at-risk-of-poverty after social transfers, 2005-2010 o Material deprivation rate as percentage of total population, 2010 o People living in households with very low work intensity, 2010 o Long-term unemployment (as percentage of unemployed population), 2010

ESPON CITYBENCH

• *Economy and Population (4 ind)* o GDP per head in PPS o % of persons unemployed	• *Social media (1 ind)* o Crisis awareness

o Population density o Population, total	
• *Connectivity (4 ind)* o Potential accessibility by air o Potential accessibility by rail o Potential accessibility by road o Total "Satisfied" with "Public Transport"	• *Investment climate (3 ind)* o Ease of doing business o Electr. prices for industrial consumers o Gas prices for industrial consumers o Total "Agree" with "It is easy to find a job"
• *Demography (2 ind)* o Ageing index o Old age dependency ratio	• *Environment (6 ind)* o Combined adaptive capacity to climate change o Maximum CO2 concentration o Maximum PM10 concentration o % of renewable energy in energy consumption o Total % of green urban areas o Total "Satisfied" with "Green spaces"
• *Smartness (2 ind)* o High tech patent applications to the EPO o Number of IP Addresses	• *Quality of life (4 ind)* o Total "Agree" with "I am satisfied to live in..." o Total "Agree" with "It is easy to find a house" o Total "Satisfied" with "Cleanliness" o Total "Satisfied" with "Cultural facilities"

3 Data Management

3.1 Conceptual Approach

3.1.1 Data and Data-sets

> *Related items of (chiefly numerical) information considered collectively, typically obtained by scientific work and used for reference, analysis, or calculation*.
>
> Source: Oxford English Dictionary

Statistical data constitute the main “raw material” on the basis of which an ETMS is built. They are the results of measures, which may have been processed by the providers, by other researchers or directly by the ETMS-team so as to improve their coherence.

All types of measurement are based on hypotheses on the objects of study. They presuppose a conceptualisation of what it measures, and methods defining how it is approached quantitatively. A simple measure such as “total population” can for example be built on a number of different definitions of “population”, e.g. persons with their effective main place of abode in a given area, persons with their legal address in a given area or persons that happen to be in an area at the time of the census. These types of issues concern all measurement in social sciences.

Secondly, the way in which the value is computed introduces a bias that may need to be taken into account. Registers will yield different results from censuses; many ”data” are calculated on the basis of surveys by using models to generalise results from a sample to the population as whole.

These issues are particular important in the context of territorial monitoring, as estimates that are scientifically valid for a large population may not be scientifically valid when considering a small local area.

In addition, an ETMS is directly or indirectly based on data compiled by different organisations, using different methods and instruments for the production of statistical data. This is particularly obvious when collecting data from national statistical institutes. Data from European bodies such as Eurostat and the European Environmental Agency (EEA) are normally processed so as to be comparable across the European territory. However, they are in many cases accompanied by information on the more limited reliability of data for some parts of Europe. In all cases, data can only be used by the ETMS if they are accompanied by precise metadata (see below).

Data mostly correspond to stocks, e.g. of population, area, quantities of goods produces, incomes, value of goods produced. A ratio is a combination of at least two datasets calculated for a specific heuristic purpose. It is therefore to be considered as an “indicator” (see below). In some cases, however, an ETMS dataset will be the result of complex calculations. This typically concerns measures of accessibility and population potential that are based on time-distances calculated with the help of a transportation network model. Even if these types of measures may be considered as indicators in their own right, connecting them to stock data would introduce an unreasonable level of complexity in the ETMS. From an organisational point of view, it therefore seems preferable to consider them as “data”.

All ETMS data are “geo-data”. The “geo” implies that the dataset has a spatial component that makes it possible associate the data with a geographical object, i.e. to georeference it. This geographical object can be an area (e.g. population in a region, local unit or grid cell), but also a

line (e.g. goods crossing a border, air passengers between two cities) or a point (e.g. number of beds in a hospital, number of students in a University).

3.1.2 Indicators

That which serves to indicate or give a suggestion of something; an indication of

Source: Oxford English Dictionary

Distinguishing between indicators and data is important for the ETMS because the issues related to each category are quite different:

- Data are measures, and raise issues related to the method of measurement and to its processing;
- Indicators are heuristic devices, constructed to provide a picture of a pattern or trend in relation to a policy issue or debate.

Indicators are therefore combinations of data for individual geographical objects (population density, percentage of built-up area), for interconnected geographical objects (e.g. difference in income between two neighbouring regions, between an urban core area and its rural surroundings). They may also compare situations at two points in time (e.g. growth rates). Other indicators test the validity of a model, e.g. residuals of a regression analysis between two variables.

Mapping data can in some cases provide information on the organisation of a territory. Mapping the total population of regions for example shows where the greatest concentrations are located. However, the link to policy issues (e.g. exploring whether large agglomerations have better economic performances than other areas) necessarily presuppose a combination of data.

Indicators calculated at different geographic scales reflect different types of processes. Multiscalar analysis has been the specific focus of the ESPON HyperAtlas[3] and could be a source of inspiration if for the ETMS in view of combining results obtained at different scales.

3.1.3 Metadata

a set of data that describes and gives information about other data

Source: Oxford English Dictionary

As shown above, data can only be used by the ETMS insofar as they are accompanied by precise metadata. Elements of particular importance are the source, year/date of reference, methods of data collection and processing. Given the diversity of data sources, metadata will in many cases be associated with individual values or with groups of values rather than with a whole dataset. The data and metadata template developed by the ESPON Database project makes it possible to manage such data. This template, and the corresponding structure of metadata in the ESPON Database would therefore need to be applied to the ETMS.

Metadata associated with indicators is produced by the ETMS team itself, insofar as the indicators themselves are produced on the basis of data. However, the extent and scope of

[3] http://www.espon.eu/main/Menu_ToolsandMaps/ESPONHyperAtlas/

interpretations that can be made on the basis of an indicator (its "exploitability") will depend on the quality of the data on the basis of which it has been calculated. The question of the link between "indicator metadata" and "data metadata" therefore needs to be addressed. In any case, indicator metadata needs to incorporate an overall assessment of background data used.

Mapping files will also be associated with metadata. The INPIRE Directive (Infrastructure for Spatial Information in the European Community)[4] contains detailed metadata regulations[5], which are based on ISO norms. From the perspective of the ETMS, apart from information on the source and genealogy of each mapping file making it possible to track how it has been constructed, data on its precision may be useful. The ETMS should in these respects follow the same approach as the ESPON Database.

Overall, metadata constitute the centrepiece in the setup of the ETMS, as they make it possible to construct coherent and comparable results over time. A starting point of the ETMS is therefore the assessment of the metadata compiled in the ESPON Database, in view of identifying datasets that may be directly transferred into it. For other datasets, one may either consider compiling missing pieces of information, or collecting the data directly from primary sources.

3.1.4 Statistical geographic levels

The «Spatial Levels» are defined in relation to the agreed subdivisions of the European Territory in different systems of geographic units, i.e.:

- LAU2 (about 118 000 in the EU and 121 000 in ESPON Space (EU27+4))
- LAU1 (not defined in all EU27+4 countries)
- NUTS3 (1294 units in the EU, 1353 units in the ESPON Space)
- NUTS2 (270 units in the EU, 286 units in the ESPON Space)
- NUTS1 (97 units in the EU, 101 units in the ESPON Space)
- NUTS0 (27 units in the EU, 31 units in the ESPON Space)

The different NUTS levels were initially defined in the following ways by the 1961 Brussels Conference on Regional Economies, organised by the European Commission:

- NUTS2 are "basic regions", i.e. the framework generally used by Member States to apply their regional policies. They are therefore supposed to be "the appropriate level for analysing regional/national problems".
- NUTS1 are "socio-economic regions grouping together basic regions". They are meant to be used for "analysing regional problems within the EU, such as 'the effect of the customs union and economic integration on areas at the next level down from national areas".
- NUTS3 are "regions which are too small for complex economic analyses" and may be used for "specific analysis or to pinpoint where regional measures need to be taken".

[4] http://inspire.jrc.ec.europa.eu/

[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:326:0012:0030:EN:PDF

These considerations are still referred to by Eurostat in their publication presenting the NUTS2010 Nomenclature[6]. However, it needs to be kept in mind that they were elaborated prior to debates on territorial cohesion, at a time when metropolisation and other economic and demographic polarisation processes were much less advanced. Many of Europe's largest urban functional spaces extend beyond and across NUTS2 boundaries, making the assessment of economic and social processes associated with these specific and important areas difficult within this framework. Inversely, many processes of polarisation and segregation occur at a much finer scale than NUTS3.

From a more theoretical perspective, the idea according to which the level at which regional policies are applied (NUTS2) would necessarily also be the appropriate one for the analysis of issues can and should be challenged. Insofar as the objective of regional policies is not merely to organise a convergence of regional and national "performance levels" in view of facilitating further integration in the single market, but the promotion of a more cohesive, sustainable and economically and socially prosperous Europe, regional average values at NUTS1, 2 or 3 level will often provide an unsatisfactory evidence base on the challenges to be addressed.

3.1.5 Spatial nomenclatures

Each spatial level is associated with a set of nomenclatures, for different years. There are three "official" European nomenclatures of NUTS (2003, 2006 and 2010). Before 2003, regional delineations were made on the basis of "gentlemen's agreement" between the countries, which implies that tracking detailed changed in boundaries may be complex. The Eurostat website tracks changes from 1995[7].

NUTS delineations are only revised every three years at most, except in the case of a complete administrative reorganisation in a Member State, or in the case of very small changes leading to a change of less than 1% in the smallest region involved. All proposals for changes are formally notified the Commission by the Member States. The previous revisions have occurred in 2006 and 2010; the 2010 revision entered into force on January 1st, 2012.

By comparison, LAU units are defined nationally and are revised continuously, on the basis of national regulations. This difference between "NUTS" and "LAU" is the reason for which the spatial levels that were previously designated as "NUTS 5" and "NUTS 4" are now called "LAU-2" and "LAU1". This also implies that yearly updates of LAU boundaries are needed to map socio-economic data. The Euroboundary map of Eurogeographics has been produced between 1991 and 2012[8].

3.2 Challenges for an harmonised database constitution along time

Compared to other forms of territorial observation and spatial analysis, monitoring puts a particular emphasis on tracking evolution over longer or shorter time period, both by comparing current situation to past ones and by identifying the different ways in which recent trends and patterns can be drawn upon to foresee future developments. By way of consequence, dealing

[6] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-11-011/EN/KS-RA-11-011-EN.PDF

[7] http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/history_nuts

[8] The first five of these (1991, 1995, 1997, 2001 and 2004) were produced under the acronym SABE. Since 2006, yearly updates have been produced). http://www.eurogeographics.org/content/euroboundarymap

with challenges linked to the production of comparable and policy relevant analyses over time will be a core challenge for the ETMS.

This challenge has multiple dimensions:

- Keeping the ETMS **updated**, basing analyses on data that are recent enough to be perceived as relevant for policy stakeholders;
- Producing indicators that provide an evidence-base for current policy debates, while preserving the **coherence** of the monitoring system over time;
- Compiling data from different years that are **comparable**;
- Overcoming the challenge of **changing boundaries** of statistical units, but also of functioning urban regions and of policy-making areas;
- Using methods that can be **reproduced** by different research teams.

Producing updated data implies that the ETMS should mainly gather data directly from National Statistical Institutes and, in some cases, from Eurostat. Data compiled by other ESPON projects will generally only be available once they have been integrated in the ESPON database. Up to now, this process has taken multiple years for all projects. The ETMS would therefore need to function on the basis of direct contacts with data providers.

The frequency of data updates is quite different from country to country. Some countries may for example have yearly updates of local data based on registers, while others will only have one census per decade and produce interim estimates based on surveys and regional figures. Decisions therefore need to be made on the extent to which the ETMS should produce updated results for countries that have published new data even if this implies covering only parts of the ESPON Space.

Estimated figures between census dates or as a preliminary result of surveys furthermore tend to be adjusted at a later stage. This implies that results published on the basis of these data may later need to be revised. The ETMS therefore needs to consider to what extent the most recent data may function as a basis for its analyses.

Secondly, European policy debates are influenced by fashions and “buzz-words”, on the one hand, and by events such as the on-going financial crisis, on the other. While the ETMS should be policy-driven and seek to produce evidence that could feed into these debates, it also needs to preserve its coherence over time. This implies that the investigation of issues that may only be relevant for a limited time should not be done at the expenses of longer-term monitoring.

The compilation of comparable data is third challenge. Statistical methods evolve continuously, e.g. the way in which population is counted, the definition of Statistical economic activities are classified. Trend data will therefore in many cases be derived from estimates, based on hypotheses on how data compiled using different method can be combined.

Changes in the boundaries of administrative and statistical units further complicate the compilation of comparable data over time. This is a part of the so-called Modifiable Area Unit Problem (“MAUP”) which is further discussed below.

Finally, reproducing analyses in view of comparing results produced at different times and potentially by different researchers requires that the methods are well documented, and that the background material used remains accessible to the ESPON community.

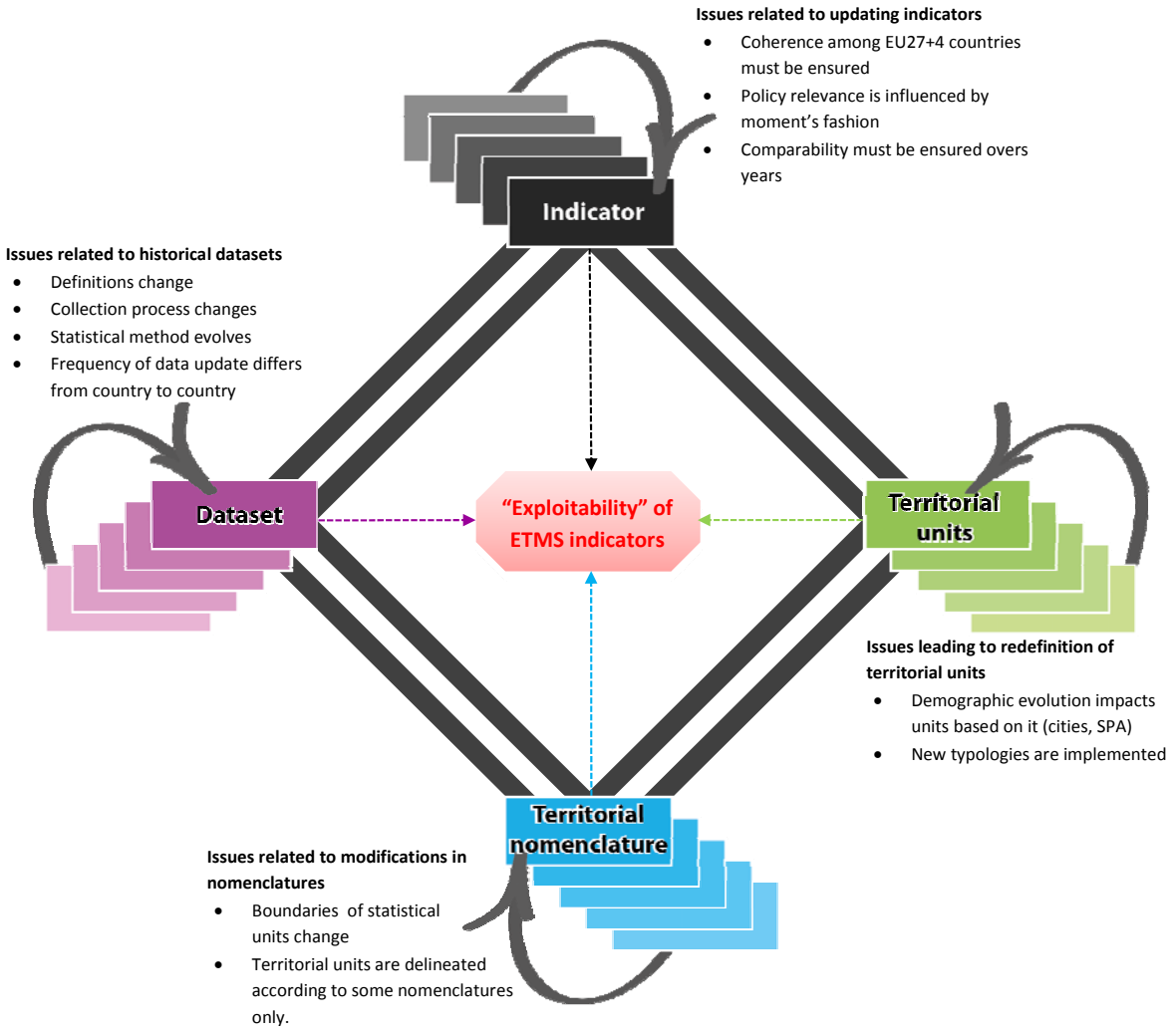


Figure 2. The time-related challenges of the ETMS

Figure above brings together these different time-related challenges of the ETMS, grouping them according to four main components of the ETMS:

- datasets
- territorial units
- territorial nomenclatures
- indicators

The figure shows how the extent of these time-related challenges and the ways in which they overcome largely determine whether indicators can be useful in the context of an ETMS (i.e. its "exploitability").

As part of the M4D project, there are attempts at constructing coherent time series for population figures on the basis of a semi-automatic procedure using the "R" programme. Members of the M4D project team also consider developing a dedicated programme that would combine figures associated with different geographic delineations in a fully automated way. This initiative is still at a preliminary stage, and would be implemented independently of the ESPON programme. A more

detailed technical report on these issues will be submitted by the M4D TPG at the end of June. These considerations will then be incorporated in the ETMS.

Generally, the objective is to produce trend data for current NUTS or LAU nomenclature (that are a priori of the greatest interest for policy-makers) combining data associated with this nomenclature and with previous NUTS or LAU nomenclatures. This first implies that ETMS calculations need to be continuously updated not only for current figures but also for past ones: recalculation of historical data at a given moment in time will be outdated when new boundary changes occur. Admittedly, to limit the number of boundary changes that need to be considered, one could consider an iterative system in which recalculations of e.g. 1990 data to the 2013 nomenclature would be made on the basis of previous estimates calculated for the 2010 nomenclature. However, the bias induced by such a method would need to be carefully considered. This presupposes that very detailed information on the estimation methods used at each stage are available.

Generally, recalculations between territorial nomenclatures are based on transfer "keys" (or "ratios"). These keys are only applied to stock data, i.e. quantities, and not to ratios. This is one of the reasons for which it is essential that the ETMS is built on stock data. The keys reflect different types of changes:

(1) Mergers: 100% of the stock is transferred to the new geographic units

(2) Split of a region in two or more units: attribution of the stock proportionally to e.g. the number of inhabitants, economically active persons and area of each of the new regions.

(3) Transfer of areas from one region to another region: reallocation of stocks between these two regions proportionally to e.g. the number of inhabitants, economically active persons and area in the areas that are transferred.

This implies that in situations (2) and (3), data at a lower level than the one considered are needed to carry out the recalculation, e.g. using LAU2 data to assess the number of persons that has been transferred between two NUTS3 regions. Furthermore, a number of different recalculations methods can be envisaged:

- one can based the transfer "key" on current figures, or on figures at the time of the split or transfer;
- one can use different types of figures for the same data. Some may be clearly preferable to others (e.g. population compared to area for most socio-economic data), but may not be available for all parts of Europe. Therefore, one needs to consider whether one should apply different methodologies in different parts of Europe to maximise the quality of the estimates, or apply different methods to increase the coherence of the dataset.

The calculation of "potentials" as an alternative to recalculations between nomenclatures of statistical units is presented in section "*Using potentials to facilitate comparisons over time*" below.

3.3 Compiling and processing data for an ETMS

Establishing an ETMS first implies that coherent and comparable indicators can be calculated for different years, which presupposes that detailed metadata are available for each dataset (see next section a) "*Compiling and managing metadata on datasets*"). Secondly, a "toolbox" of methods to deal with missing and heterogeneous data with insufficiently frequent data updates is needed (see section b) "*Dealing with missing and heterogeneous data and insufficiently frequent*

data updates"). Finally, given the difficulty and resource-intensive of transfers of data between territorial nomenclatures, the calculation of potentials on the basis of stock data can be considered as an option (see section c) "*Using potentials to facilitate comparisons*").

3.3.1 Compiling and managing metadata on datasets

In the case of datasets, comprehensive metadata procedures have been developed under the ESPON M4D project (along with related DBMS) and should be used as a starting point in designing ETMS metadata for datasets. The objective is to ensure the best possible interoperability between ESPON DB and ETMS.

As demonstrated in the previous section, the time dimension is particularly important in the context of an ETMS. The special attention that needs to be given to data updates, methodological coherence of time series and changes in the boundaries of statistical units implies that some further development of metadata tools are needed.

Some main challenges can be listed:

- Compiling the most recent data, i.e. as soon as they are published by national statistical institutes and other primary data sources;
- Gathering data at LAU2-level, which have not up to now been redisseminated by Eurostat or by any other European bodies;
- Gathering the information needed to convert data between different territorial nomenclatures;

Addressing these three challenges requires the following improvements in the handling of metadata, building on the metadata infrastructure already established by the ESPON Metadata and Data Navigator projects:

1. Dataset sources

   In addition to existing fields in ESPON metadata templates, ETMS needs more precise information on data origin such as census name, contact details of the responsible section or person at each national statistical institute, details on methodologies applied, available years, update periodicity (with information on the foreseen date for the next publication of data) and geographical levels at which data are available.

   The database model of the ESPON Database model foresees that each datasets can be linked to a nomenclature. The details of how this connection is organised will need to be checked, so that it can function in the context of the ETMS. Ideally, the each nomenclature should also be linked to one or more mapping files.

2. Managing multiple versions of datasets

   The ETMS will not only store original data, but also data recalculated according to other nomenclatures and data that have been updated or homogenised on the basis of data at other geographical levels.

   Therefore, the ETMS metadata system must make it possible to establish links between these different versions of the same datasets, describing how the original data has been converted to an another nomenclature, updated or homogenised.

3. Making updates possible through detailed methodological descriptions

The long term perspective to be developed within the ETMS presupposes that results can be reproduced irrespective of changes in group of researchers and organisations involved in the process.

This constrain is akin to the principle of "reproducibility", which is one of the main criteria for the validation of scientific results in so-called "hard sciences". The complexity of measures in social sciences makes often strict "reproduction" in different contexts and with different reference periods impossible. Access to detailed metadata is all the more important, so as to be able to produce as comparable results as possible.

Next table provides an overview on the compulsory metadata fields related to data collection in ETMS.

(*) Green text corresponds to standard metadata in ESPON database

Field	Information	Details
Background information on data compilation process	Who compiled the data? When was it done?	• Date of compilation • Responsible party
Sources	URL, when available Procedure to obtain data Data from census, register, remote sensing, other sources.	• Provider • Census name • Contact details of responsible NSI section / person in charge of dataset • Details on defini-tions/methodologies • Costs
Characterisation of data	What is measured?	• Data type • Units of measure
Availability (years)	For which years are data available?	
Frequency of updates	Frequency of updates Foreseen next delivery	
Statistical geographical level	From LAU2 to NUTS0 / grid	• Which levels available?
Restriction of use	Licensing conditions	• Rights of redissemination • Confidentiality
Associated mapping files	URL when available	• Provider • Map name • Contact details • Costs
Data harmonisation	Provide full methodology, when relevant Link to original dataset	• Source • Method • Scripts/tables
Spatial transformation (conversion between nomenclatures)	Provide full methodology, if any Link to original dataset	• Source • Method • GIS command used • Scripts/tables • Etc.

Table 7. Metadata requirements for the ETMS

3.3.2 Dealing with missing and heterogeneous data and insufficiently frequent data updates

A European monitoring system will be confronted to missing data, disparate data update frequencies, especially at the lower geographical levels (NUTS3, LAU2), and to data that have been compiled using different methodologies. Therefore, it will be necessary to set up rules and methods on how to deal with these types of challenges.

The ESPON 3.2 project has proposed different methods for the estimation of missing data, based on their temporal dimension, spatial dimension or on a combination of these two dimensions. These methods can be applied to the ETMS.

Different approaches can be considered for the homogenisation of data. For many datasets, Eurostat provides harmonised datasets for the EU27, and in some cases also for the entire ESPON Space. However, the geographic resolution of these data is generally limited, as a limited number of data are available at for NUTS3 regions, while most are only provided at the NUTS2 or NUTS0 levels.

When seeking to produce homogenous data at lower geographic levels, the TPG therefore needs to combine Eurostat data higher geographic levels with methodologically heterogeneous data collected from national sources for smaller regions and local areas. Concretely, lower level data are used as a key to distribute upper level harmonised data, as illustrated in the right part of next figure “Data estimation methods”. As a result, comparable estimates at lower geographic levels are produced, making it possible to characterise territorial units delineated at these scales. It is worth noting that the degree of reliability these estimate depend on the quality of homogenisation process made by the provider of higher level data (i.e. Eurostat, in most cases). These methods should therefore be identified and assessed when implementing the ETMS.

A third type of challenge for the ETMS concerns insufficiently frequent data updates. For example, in countries where local data is compiled through censuses and not registers, local datasets are only updated for one year per decade. In addition to providing an unsatisfactory basis for yearly monitoring report, these census data may correspond to different years depending on the country that is considered. On therefore needs to estimate data for inter-census years, using a similar method as the one describe above for the harmonisation of data. As described in the left part of the figure, higher levels data that are updated on a more regular basis can be used to calculate estimated values for lower administrative levels. The quality of these estimates will depend on the extent of changes in territorial patterns between the census year and the year for which estimates are calculated. One may assess the extent of these changes by consulting experts of the different considered areas.

In many cases, a given dataset can both be adjusted between years and in view of compensating for heterogeneous methods.

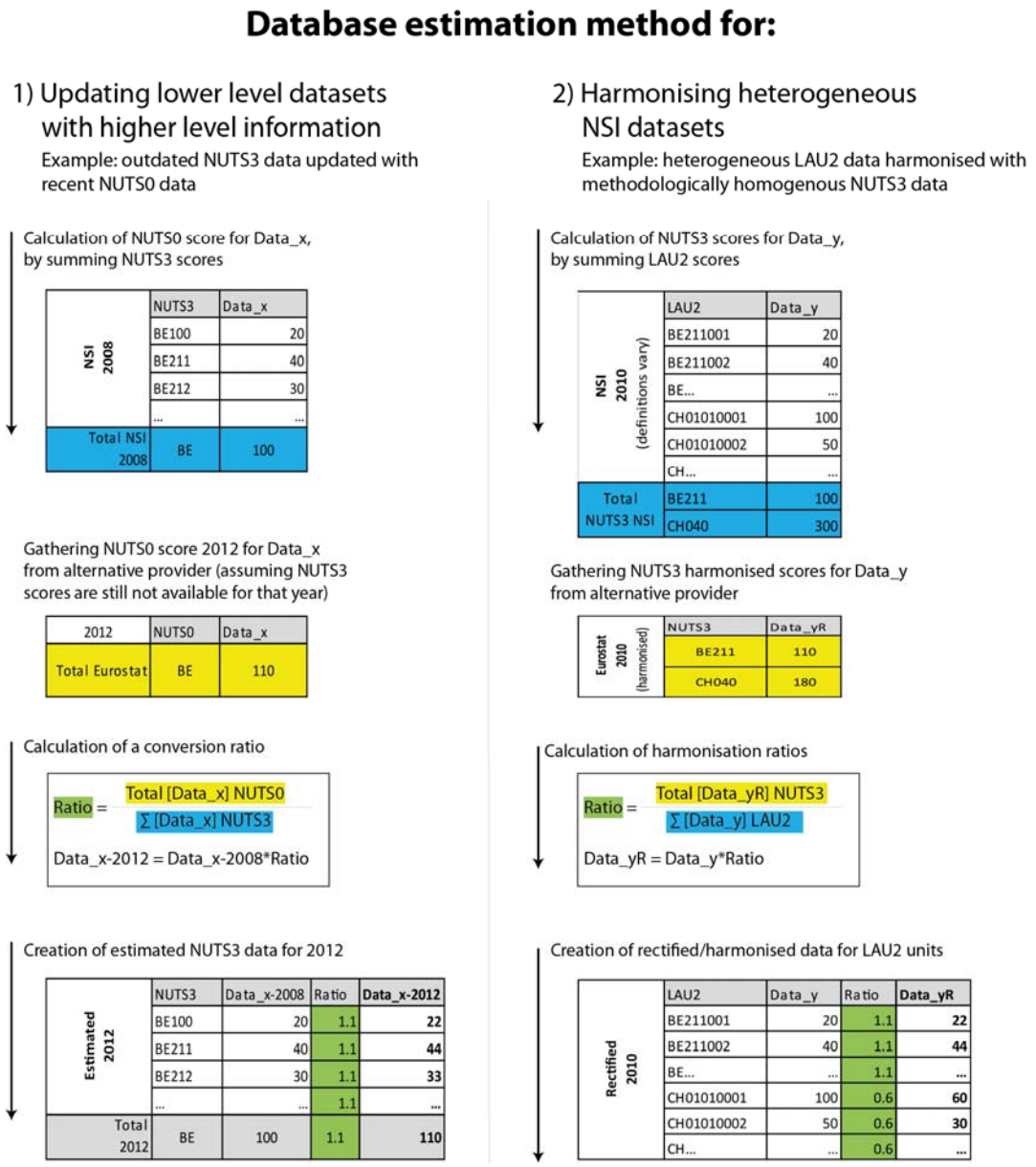


Figure 3. Data estimation methods. The time-related challenges of the ETMS

3.3.3 Using potentials to facilitate comparisons over time

Converting data between spatial nomenclatures can be extremely resource-demanding. It therefore may be justified to search for methods that would make it possible to circumvent this issue.

Calculating a “potential” implies summing up stocks (e.g. of population, wealth or area with a certain type of land use) within a distance within which spatial interaction can be presumed to be occurring (empirical approach) or be considered desirable (normative approach). The distance can be Euclidian or based on time-distances; it can be calculated taking into account obstacles such as national borders, language borders or a constraining topography when relevant. Typically, daily mobility ranges can be used as a starting point when identifying the distance to be considered. The method for the calculation of potential is illustrated in next figure.

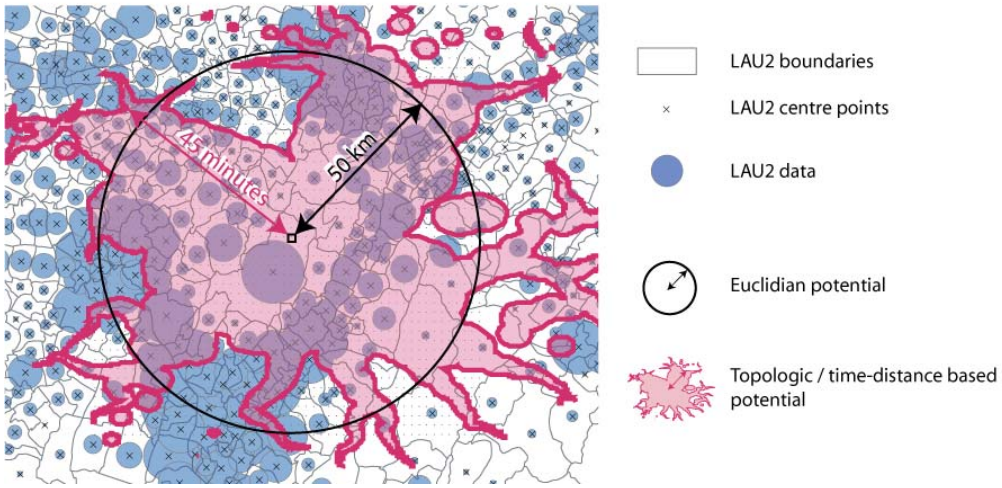


Figure 4. Calculation of potentials based on LAU2 data

Data associated with all LAU2 of which the centre point falls within the 50 km circle or area accessible within 45 minutes are summarised; this sum is the "potential". This means that the same data are taken into account as many times as they are associated to LAU2 units that are part of the potential functional neighbourhoods of the points of measurement.

One can also calculate potentials by using a negative function of distance. The hypothesis is then that the relevance of stocks for an area decreases with the distance to that area. A number of different decreasing functions of distance can be envisaged (see Grasland, 1991[9]).

The primary purpose of potentials is not to avoid MAUP-related challenge. The underlying idea is rather that individual regions and local areas should not be considered in isolation from each other when considering development opportunities and challenges. It is more relevant to consider areas of potential interaction around each point. Potentials can be calculated for each point in space, making it possible to identify disparities within each region or local area. An additional advantage is that bias resulting from differences of size between statistical units is much reduced when calculating potentials, as compared to analyses focusing on individual units.

This also implies that potentials calculated for two different years can be comparable, even if the background data are linked to different nomenclatures of statistical units. This greatly facilitates comparisons over time. Potentials can therefore be a relevant method for the ETMS.

Admittedly, the process of producing population potentials is relatively complex, as illustrated by next figure. For regions composed of multiple parts (e.g. coastal regions with islands and region with enclaves in other regions), it is first necessary to estimate the population in each of their components. These populations per part of region or local unit are then transferred to a grid. In this example, time-distances are calculated on the basis of an "impedance grid". This implies that the time needed to travel through each grid cell is estimated on the basis on number and quality of the roads crossing it, of its land cover and topography (terrain roughness). Obstacle such as rivers and railroads are also taken into account.

[9] Grasland, Claude (1990) « Potentiel de population, interaction spatiale et frontières : des deux Allemagnes à l'unification » in *Espace géographique*, Vol.19-20 n°3, 1990. pp. 243-254. http://www.persee.fr/web/revues/home/prescript/article/spgeo_0046-2497_1990_num_19_3_2992

Population values can be combined to calculate indicators. E.g. a population potential could be combined by an income potential, to calculate an average income per. inhabitant within daily mobility distance. Similarly, employment rates could be calculated on the basis of total employment and total working age population potentials.

A limitation of the method lies in the communication of results. These results would not be in the format most stakeholders are used to insofar as each region or local unit is considered in relation to its surroundings, rather approached taken in isolation. However, one may calculate averages of potential values within each regions, or the proportion of regional population or areas that meet target values. One may furthermore expect stakeholders to become more accustomed to the "smoothed" representations based on potentials if the ETMS helps popularising this type of approach.

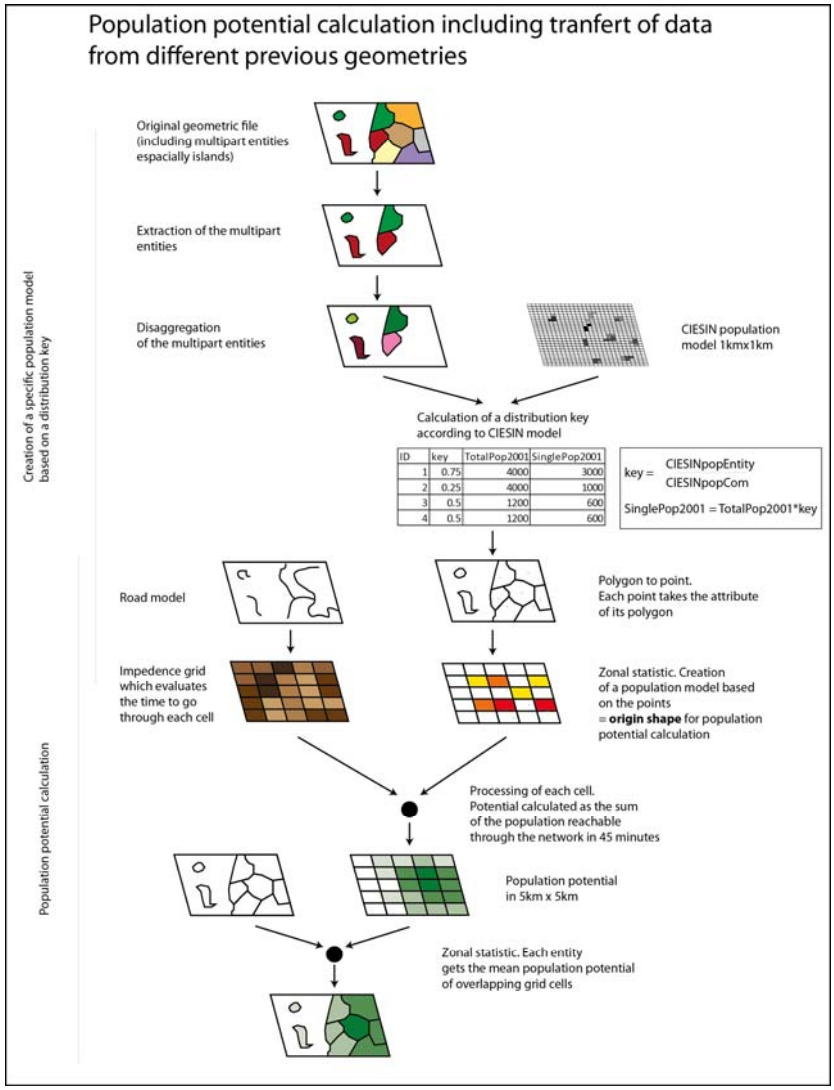


Figure 5. Method for the calculation of potentials. Source: ESPON GEOSPECS

3.4 The operation of the ETMS: inputs, process and outputs

Based on the considerations above, a proposal for the operation of the ETMS can be formulated. This proposal is illustrated in 0next figure below.

As a policy-driven instrument, the ETMS primarily receives inputs in terms of "thematic entry points" and "territorial entry points" defined by policy documents. As mentioned above, a balance needs to be struck between immediate policy demands and the long-term coherence of the ETMS. For example, including "Macro-Regions" as one of the territorial entry-points implies that macro-regional strategies are expected to become more established component of European territorial governance over coming years.

Indicators are designed in relation to both these entry points, as some issues are primarily connected to certain types of territories. However, the constrain of data availability is an obvious limitation in this process. Furthermore, for the operation of the ETMS, data only become useable ("exploitable") insofar as there is metadata of sufficient quality associated with it. Indicators can then be constructed by combining different datasets, as described above.

The operationalization of the territorial entry points presupposes the identification of territorial units. Each of the ETMS's four territorial entry points (Regions, Cities, Territories and Macro-regions) can be associated with a different analytical units:

- Regions are primarily associated with NUTS2 and NUTS3 units. However, for some analytical purposes, these levels can be mixed so as to obtain more homogenous regions either in terms of extent or total population. This is for example the case of the so-called "NUTS2/3" used by a number of ESPON project, and for the "Territorial Levels" used by the OECD[10].

- Cities have been delineated in different ways by the Urban Audit, which refers to the notions of "City level", corresponding to what is generally perceived as the "urban core" and "Larger Urban Zones" (LUZ) that reflect the extent of the "Functional Urban Region". In ESPON, the corresponding notions are "Morphological Urban Area" (MUA) and "Functional Urban Area" (FUA). In addition, in many respects, the monitoring of cities and urban regions is primarily meaning ful in relation to their respective territorial context. The more prospective notion of "Potential Urban Strategic Horizon" (PUSH), corresponding to the areas accessible within 45 minutes by road from MUAs, reflects these types of concerns

- The entry point "Territories" encompasses a wide variety of categories, e.g. Mountains, Islands, Sparsely populated areas (SPA), Coastal zones, Ultra-peripheral regions and border regions. Except for Ultra-peripheral regions, these categories have been delineated in a number of different ways, e.g. in the Green Paper on Territorial Cohesion, the Fifth cohesion report and in ESPON GEOSPECS. This diversity of methodologies also imply that different geographical scales are considered.

- Macro-regions are defined at different geographic levels, from NUTS0 to NUTS2. The Baltic Sea Region also includes regions in Russia. However, in view of gaining an understanding of territorial trends and challenges in macro-regions, one would generally need to go to lower geographic levels such as NUTS3 regions and urban areas.

[10] "For European countries, [the OECD classification of regions" is largely consistent with the Eurostat classification - facilitates greater comparability of regions at the same territorial level. The differences with the Eurostat NUTS classification concern Belgium, Greece and the Netherlands where NUTS2 level correspond to the OECD TL3 and Germany where the NUTS1 corresponds to the OECD TL2 and the OECD TL3 corresponds to 97 spatial planning regions (Groups of Kreise). For the United Kingdom the Eurostat NUTS1 corresponds to the OECD TL2. http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=REG_LAB_TL3

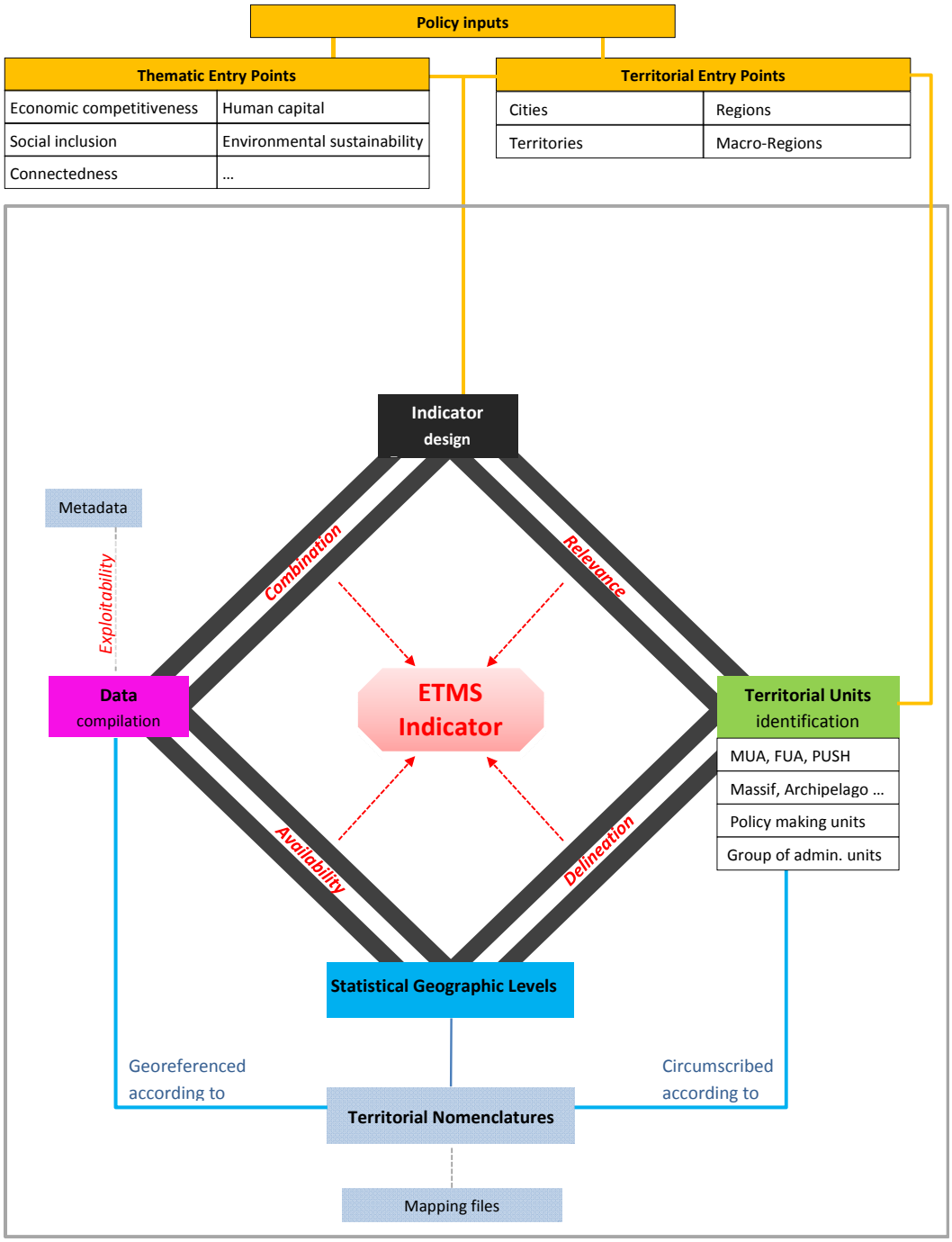


Figure 6. The ETMS process: overcoming a number of interlinked limitations and challenges

This implies that there are multiple connections between territorial entry points and analytical units. Some analytical units can be relevant for different territorial entry points and each territorial entry point requires different analytical units.

The relevance of each indicator for each territorial unit can be assessed by taking into account the policy questions that initially led to the design of the indicator. However, the feasibility of the application of an indicator to a territorial unit will depend on the geographical level at which data are available. Furthermore, indicators are not meaningful at all scales: Gross Domestic Product is not meaningful below NUTS3 level, and the analytical value of measures below NUTS0 level is

limited. Inversely, measures of demographic polarisation at NUTS3 level or at a higher scale do not reflect the most processes of rural-urban migration.

Each statistical geographical level is defined with reference to a territorial nomenclature. These nomenclatures, which vary depending on the year considered, are in turn used to georeference datasets and to delineate territorial units. Whenever there is a mismatch between nomenclatures of delineation and of georeferencing, the ETMS will have to apply conversion methods such as those described above (see section "*The time-dimension in ETMS*" earlier in this chapter).

Overall, the calculation of ETMS indicator therefore needs to overcome combined constrains related to the possibility of:

- combining datasets corresponding to the indicator designed;
- calculating the indicator for territorial units that are relevant, in view of producing a meaningful indicator and of answering policy demand;
- delineating the territorial units at the appropriate geographic level;
- having access to data at the appropriate geographic level.

As result of above mentioned challenges that ETMS is facing - i.e. ensuring its capacity to periodically and consistently update indicators - collection of datasets and related materials must follow a strict validation process. Particular attention must hence be given to elements that ensure reproducibility of the system over time. These elements can mainly be related to three categories of materials (data, metadata and mapping files) and one condition: the ability to implement time series. Figure below "Data Validation Process" summarises this process of collection/validation.

Once the ETMS project has defined suitable indicators, related dataset and the scale(s) at which they should be calculated, the first step consists in identifying potential providers. Have these data already being collected in ESPON DB? If not, are they available by alternative providers (EU agencies, NSI, others…)? Who can provide the latest release?

As a next step, the capacity of collecting comprehensive metadata detailed in the above section on compiling metadata (see section "*Compiling and managing metadata on datasets*" earlier in this chapter). The collection of metadata will in most cases require personal contacts with the organisation providing the data, as complete metadata for the purpose of the ETMS (see "**¡Error! No se encuentra el origen de la referencia.**") are seldom provided with the datasets.

In the perspective of future updates - i.e. recalculation needed as result of MAUP - it is essential that datasets can be linked with the appropriate mapping file for geo-referencing. These mapping files are therefore to be collected and stored as a component of the ETMS, even when they are not used for producing ETMS maps as such. When data for previous years cannot be georeferenced using standard ESPON or Eurogeographics digital maps, one can use mapping files from national sources.

Lastly, one needs to consider whether the dataset can become part of a time series composed of coherent data. For this purpose, the comparability of the datasets for the different years needs to be assessed, as well as the quality of their respective metadata and mapping files. In other words, the following questions should addressed:

- Are metadata comprehensive enough to allow duplication by a third party?
- Is it possible to geo-reference data using standard European maps? If not, are other digital maps available?
- Is the data updated on a regular basis?

Dataset that satisfy these different criteria can be considered suitable for ETMS database. Dataset, mapping files and metadata can be collected, processed and stored in ETMS format.

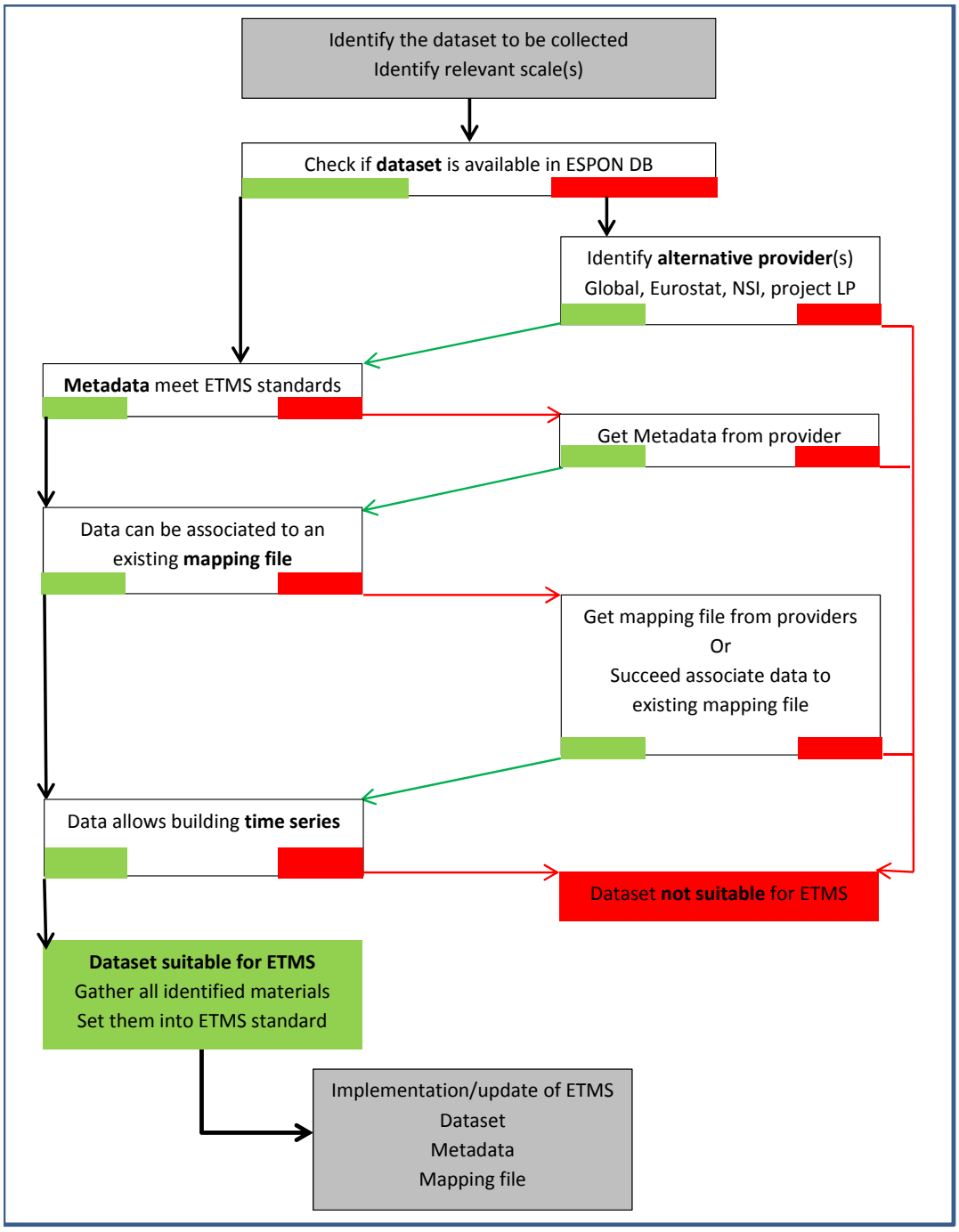


Figure 7. Data validation process

3.5 Concluding remarks

The review of perspectives, constrains and challenges for the ETMS shows a number of common points with the so-called ESPON "Long Term Database" that was introduced by the ESPON 3.2 project and that the ESPON M4D project has started to implement by compiling coherent time-series for a limited number of indicators. Many of the recommendations of the ETMS are akin to "10 commandments for data collection" proposed by the ESPON 3.2 project[11].

The challenge for the ETMS lies in combining a long term perspective with frequent updates based on the most recent data available data, so as to be able to provide policy-relevant results. This implies that ETMS data will necessarily evolve, as estimated recent data at lower geographical levels will progressively be replaced or corrected as data become available from national and European sources. This is a challenge in terms of communication of results, as they may change over time.

One can also not the high degree of complexity of the ETMS, due to the large number of constrains. For this reason, it is important that the instrument remains focused on addressing these challenges linked to the constitution of coherent time-series for territorial data. Data at national (NUTS0) level may be useful for analyses derived from the ETMS, but they are already compiled and managed by other online databases, e.g. those provided by the World Bank and by the OECD. It therefore seems unnecessary to incorporate these data directly in the ETMS. Similarly, an incorporation of the neighbourhood of the ESPON space in the ETMS would be premature.

The frequency of updates of ETMS indicators is most likely to be dictated by data availability rather than chosen. An ETMS that would compile regional data independently of their publication by Eurostat would require large and stable human resources and a well-established network of national contact points. Regular, direct personal contacts with national statistical institutes would be needed, as well as extensive efforts to estimate figures for countries delivering less-frequent updates of data. It is therefore doubtful that a perennial ETMS could be run in the context of an ESPON-project as they are currently administrated and organised.

[11] http://www.espon.eu/export/sites/default/Documents/Projects/ESPON2006Projects/CoordinatingCrossThematicProjects/Scenarios/fr-3.2-DN2_Final_Jan2007.pdf

4 ETMS Web Portal

ETMS is designed as a highly practical and user-friendly tool customised to the needs of different policy-makers and stakeholders groups. The design is based on a modular approach, integrating decentralised and interconnected modules easy to be maintained and updated.

The main components for the ETMS are the following:

- Data Analysis on Maps Tool. Made available in the central area of the ETMS Portal front page. It is provided as a link which opens an independent Data Analysis module on a separate window. It allows for searching and displaying indicators for different themes and territorial entry-points. It allows downloading the database behind displayed indicators. The Data Analysis on Maps tool is described in-depth in the next section of this Draft Final Report.

- Data analysis on Timelines Tool. Made available in the central area of the EMTS Portal front page. It provides a direct link which opens the Timelines Module on a separate window. It allows displaying territorial indicators over time for different themes and regional typologies. The Data Analysis on Timelines tool is described in-depth in the next section of this Draft Final Report.

- Publications. This section is available on the right side of the front page. It leads to the latest editions of the two written publications periodically produced by the ETMS: the Facts & Figures Leaflet, and the State of the Territory Report (*Monitoring Report*).

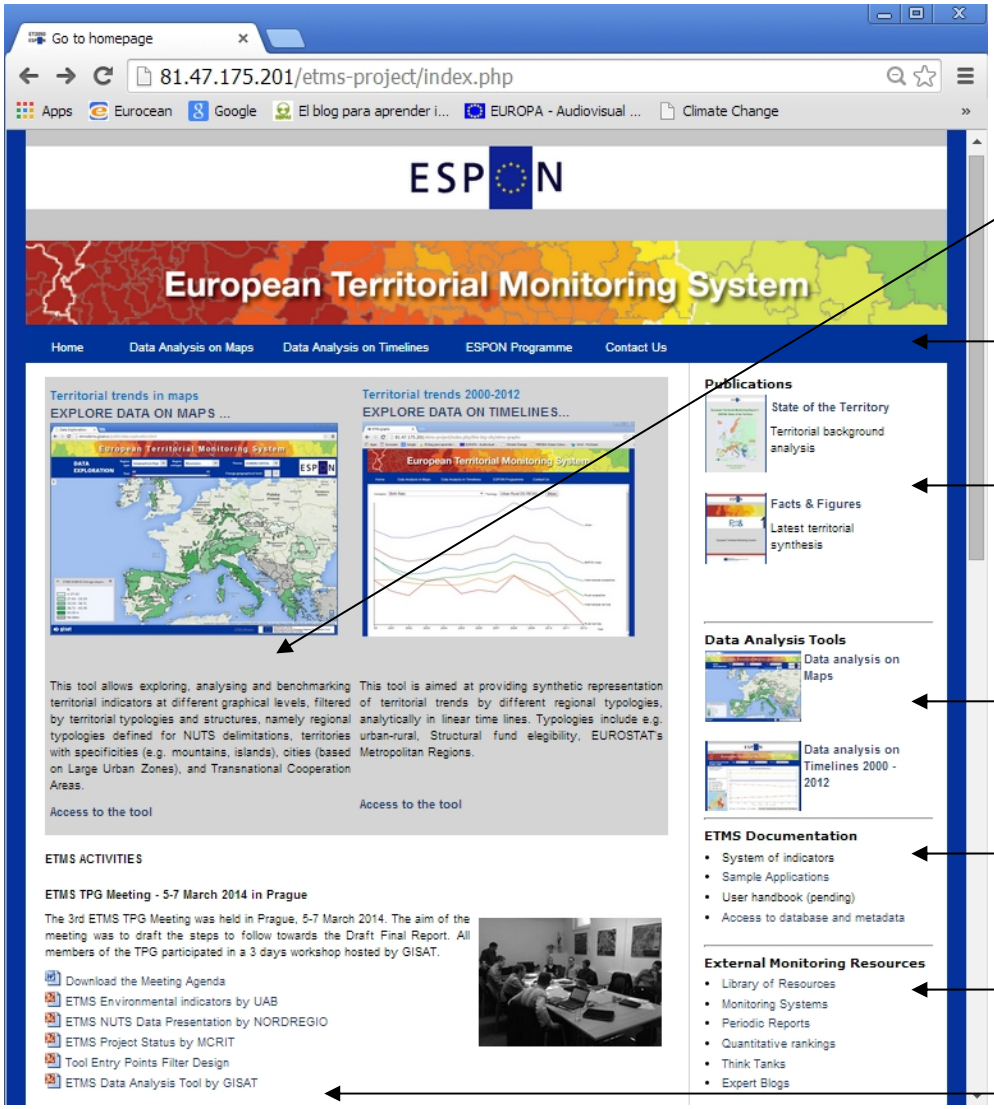
- ETMS Documentation. This section is available on the right side of the homepage. It provides direct links to ETMS system of indicators documentation, ETMS Tools User handbook (pending), ETMS Tools sample applications and ETMS indicators data and metadata.

- External Monitoring Resources. This section, developed add-hoc by the ETMS, contains a database of most relevant monitoring resources. Up to now, the Virtual Library contains more than 350 references, from around 100 global, European and regional institutions. The tool allows browsing resources by monitoring products or by provider institutions. For each resource, basic information and link to the original document is provided.

The ETMS Portal Website stores ETMS project documentation. ETMS Project activities can be viewed on the main page of the website. The aim of the project, the approach, the consortium information, and the main the tasks developed during the project and the reports produced can be downloaded from the right menu,

A quick access to ETMS Tools is provided by a navigation top bar.

All these elements are displayed in the ETMS Portal website layout as proposed in ETMS Portal website under development, available online at http://81.47.175.201/etms-project. This website is the embryo of the future ETMS Portal, and will be constantly updated throughout the development of the project until its final delivery to the ESPON CU towards the end of 2014.



Main access to ETMS Tools

Quick access to tools from all areas of the ETMS platform

Access to ETMS Publications

Access to ETMS Tools

Access to ETMS Documentation

Library of Monitoring Resources

ETMS Project Activities

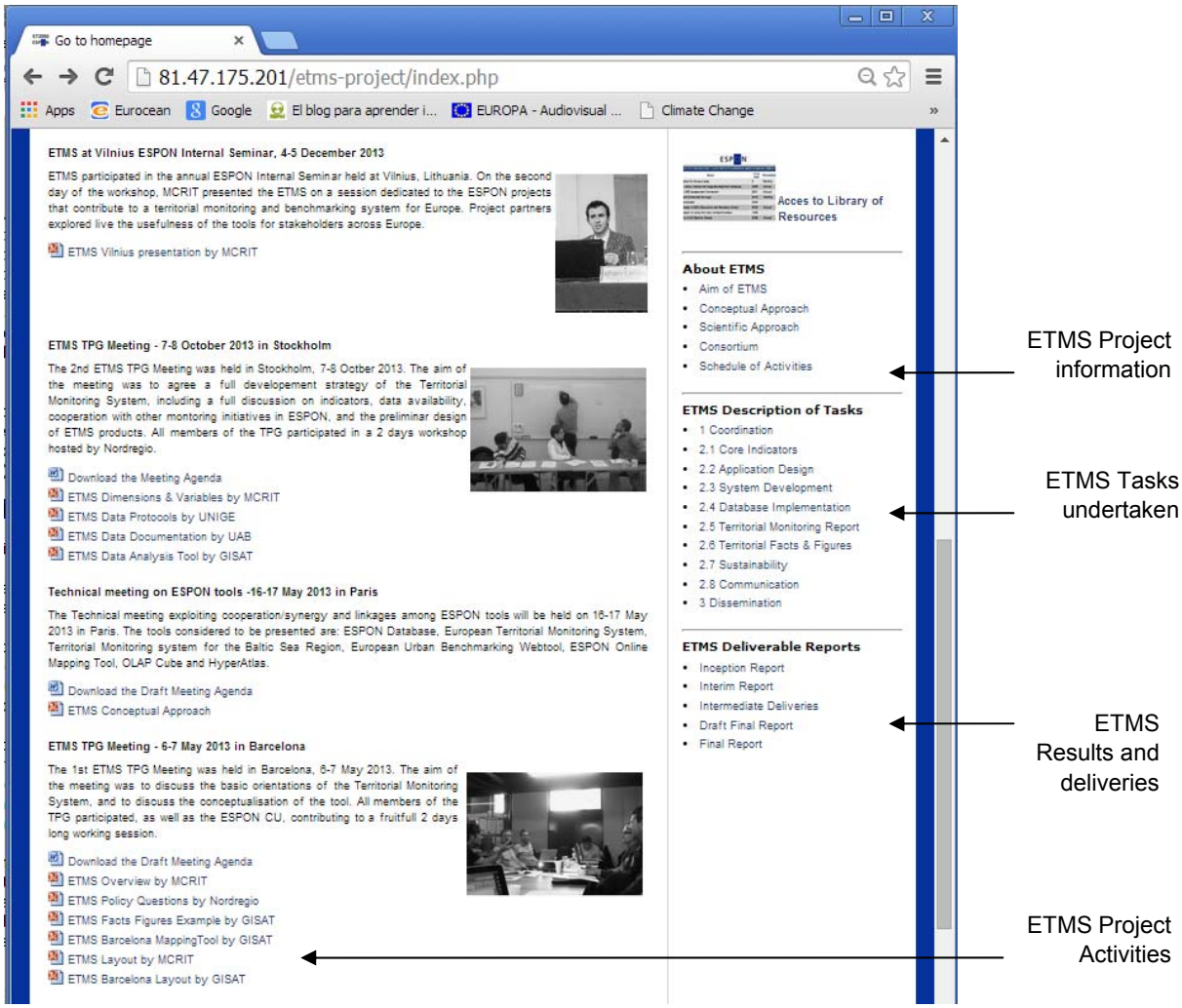


Figure 8. ETMS website

Online available at **http://81.47.175.201/etms-project**

5 Data analysis on Maps

5.1.1 Design and Orientation

The Data Analysis Tool prepared by GISAT is accessible via the ETMS website (http://81.47.175.201/etms-project/). The tool includes all crucial analytical functionalities developed in accordance with TPG and ESPON CU requirements. Values of the ETMS indictors for different types of regions defined in the frame of the ETMS project are incorporated and can be displayed and analyzed, including their comparison in different years (limited by the source data availability).

The main purpose of the interface is to present the geo-based informational content of the ETMS to its users, especially policy makers, in a simple, easy understandable, but also in interesting and attractive way. Based on experiences derived from previous work on other projects that deal with the geo-based information, the way of presentation of the project results is one of the crucial factors which influence the evaluation of the whole work. Compared to static outputs of the project work, presented in Facts and Figures Booklet or State of the Territory Report, the tool provides the user with added value represented by the possibility to explore the data interactively and also to focus on regions and analysis of interest, which can be specific for each particular user.

The tool visualizes values of the ETMS indicators, including their spatial distribution in the frame of pre-defined regional typologies and their development in time, in order to describe structures and dynamics related to Europe, its cities and other types of regions.

The platform also serves for the user analysis of indicator values, including comparison of different regions or comparison with datasets averages etc. The platform displays the information using interactive map supplemented by interactive charts or tables.

The technical solution for the platform is based on the open source software and programmed using royalties-free online knowledge. Displaying of both indicator values and vectors of analytical units in the interface is based on communication with the ETMS database and it is possible to add additional analytical units or indicators. Data queries are optimized to allow users efficient interaction. Displaying of additional geo-data layers in the map is realized through OGC standard web services (e.g. WMS).

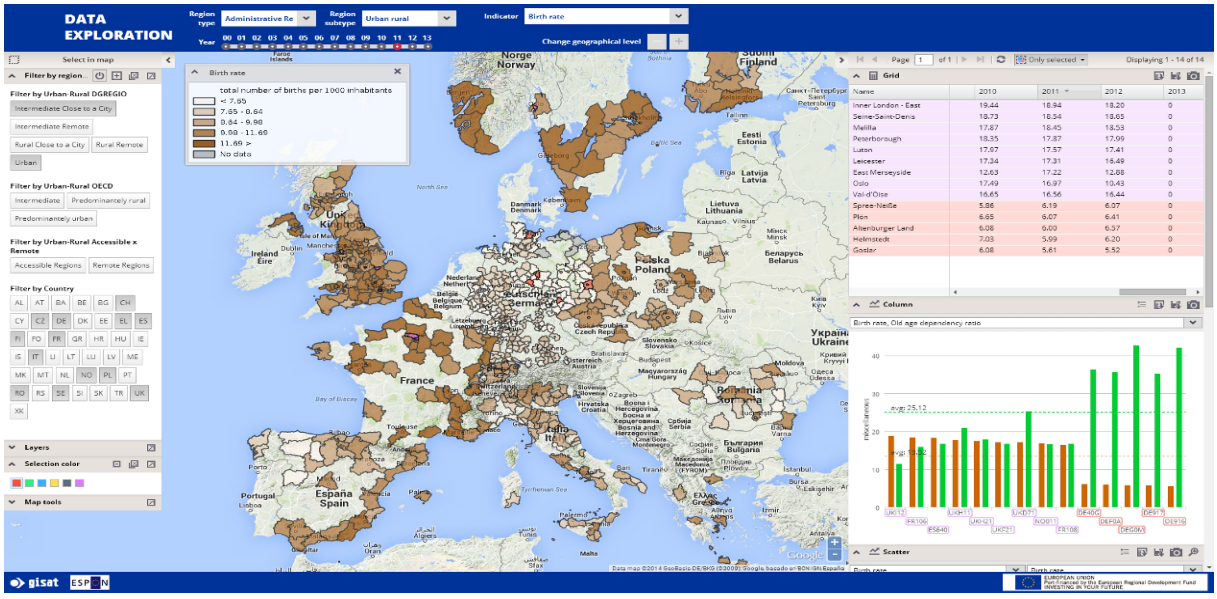


Figure 9. Overview of the Data Analysis Tool

5.1.2 Specifications

Incorporated components and functionalities provide the user with following possibilities:

- access to indicators sets via territorial entry-points, representing different regional typologies
- possibility to switch between displayed indicators interactively
- possibility to filter analytical units according to different regional typologies
- interactive switching between different levels and types of analytical units (e.g. different NUTS levels, different types of territories – e.g. mountain regions, national parts of mountain regions etc.)
- interactive switching between different years of interest
- interactive selection of analytical units of users interest in all map, table or charts
- possibility to compare selected units:
    - between each other
    - with averages of complete datasets or with averages of the set of selected units

Components of application are interconnected and selection in one of them influences the appearance of other components, in sense of units or time specification.

5.1.3 Functionalities of the Data Analysis Tool

Access via territorial entry-points

A solution for access to the information is based on **territorial entry-points** approach. These entry-points are representing different regional typologies, defined in the frame of the ETMS project. The index site of the application enables the user to select a regional type and subtype of his interest. This selection defines both analytical units to be displayed in the tool as well as a list of available indicators, which is specific for each regional subtype.

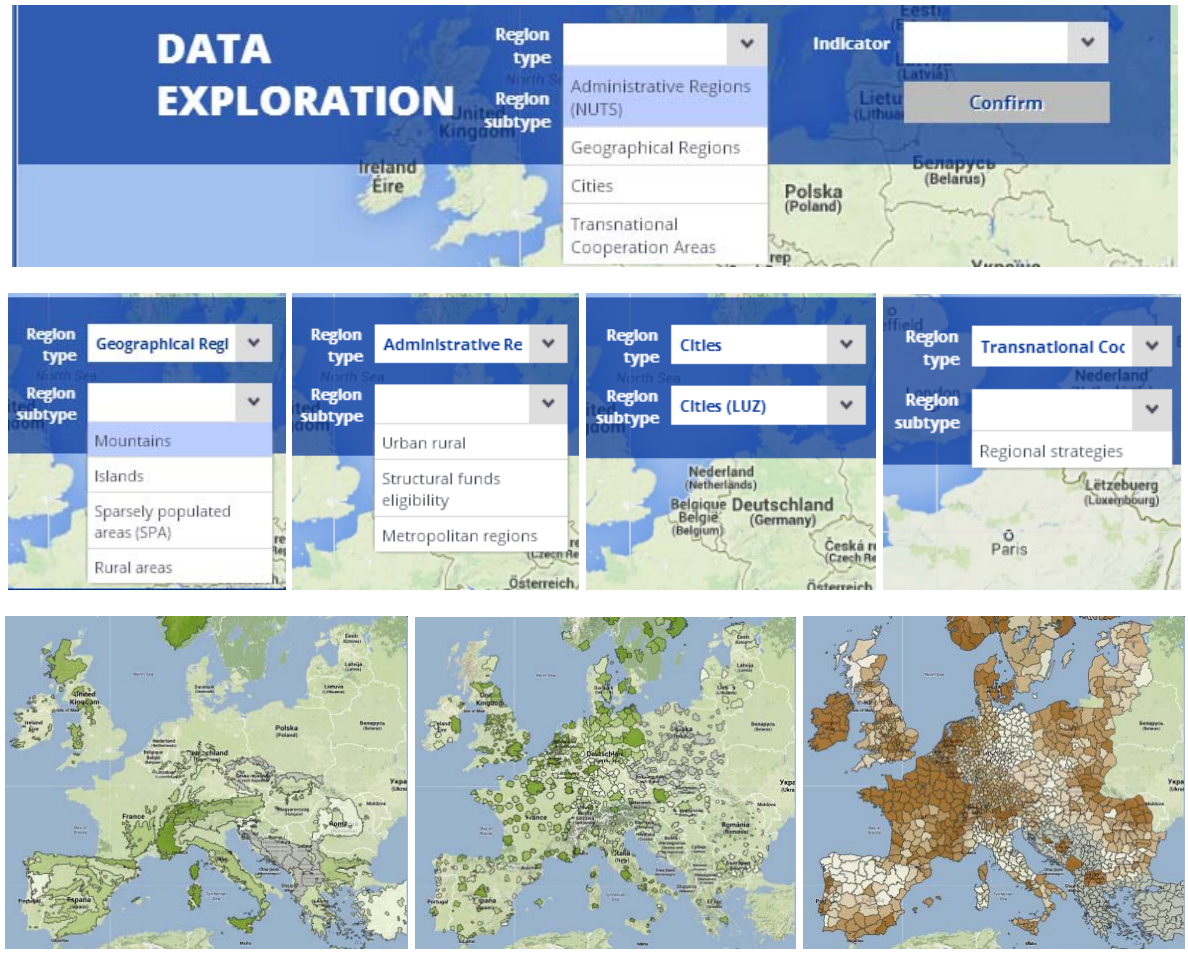


Figure 10. Access to information via territorial entry points

Switching between hierarchical regional levels

In the frame of the most of the territorial entry-points, more than one hierarchical level of regions is available. For the “Administrative Regions” and “Transnational Cooperation Areas” entry-points, a standard NUTS hierarchy is used (NUTS0, NUTS2, NUTS3). For the “Geographical regions” entry-point, Mountains and Islands have two hierarchical levels. For switching between these different hierarchical levels of regional units, a switcher is prepared in the application header panel, which enables the user to go to lower or higher hierarchical level of units using +/- buttons.

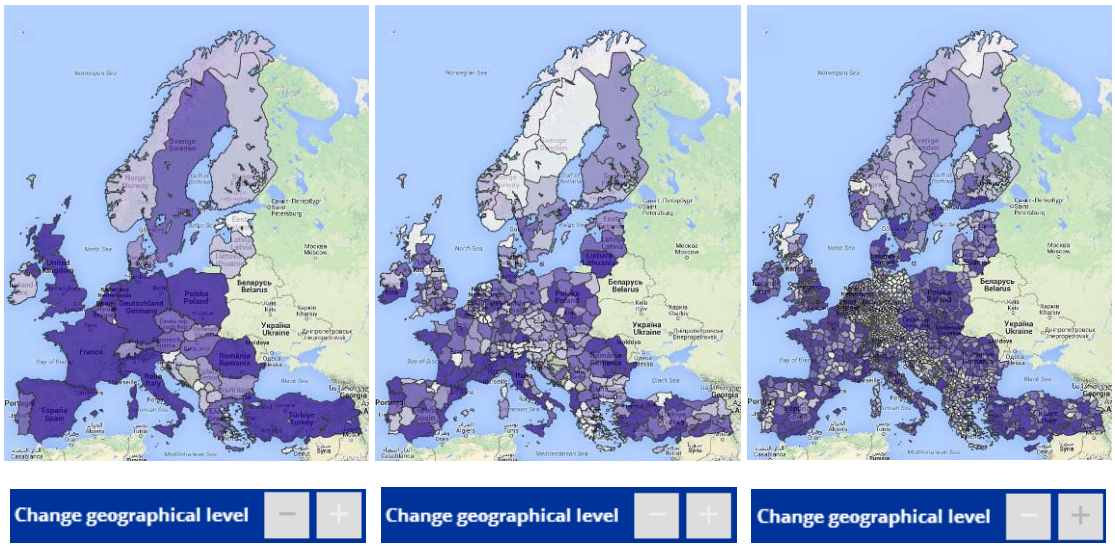


Figure 11. Switching between different hierarchical levels of the analytical units (in this case NUTS)

Selecting indicators of interest

The switcher located in the head panel of the application enables the user to switch between indicators in frame of indicators set specific for particular regional sub-type. Values of selected indicator occur in the map and in the charts panel. Both the column and the scatter charts provide additional functionality of the interactive switching between all indicators in the frame of actual indicators set.

Two different types of cartographical visualization are available in the tool. Indicator's values can be visualized either as a choropleth or via proportional circles in map. For each indicator, the type of cartographical visualization is pred-defined separately, based on its character (rate/stock).

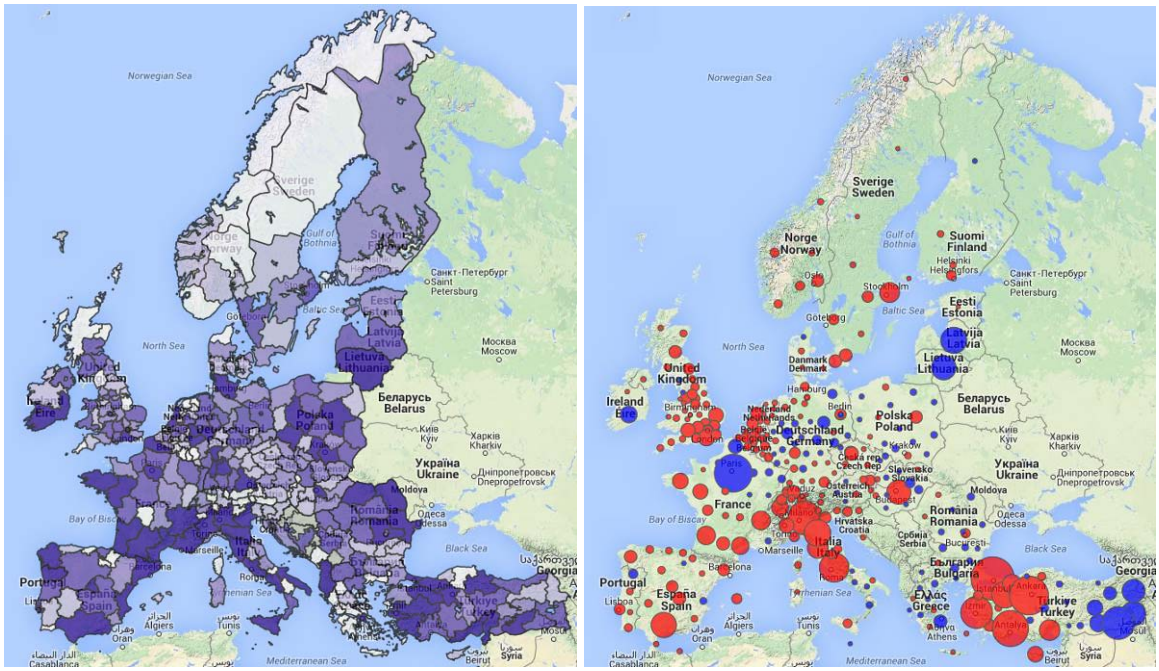


Figure 12. Two types of cartographical visualization available in the tool: choropleths and proportional circles

A visualization of each indicator in the map is accompanied by a corresponding legend generated for particular indicator, regional level or even a set of currently selected regions. In some cases, for several regions or even whole hierarchical regional levels, indicator's values are not available – such cases are indicated by the "no data" item on the legend and such regions are coloured grey on the map.

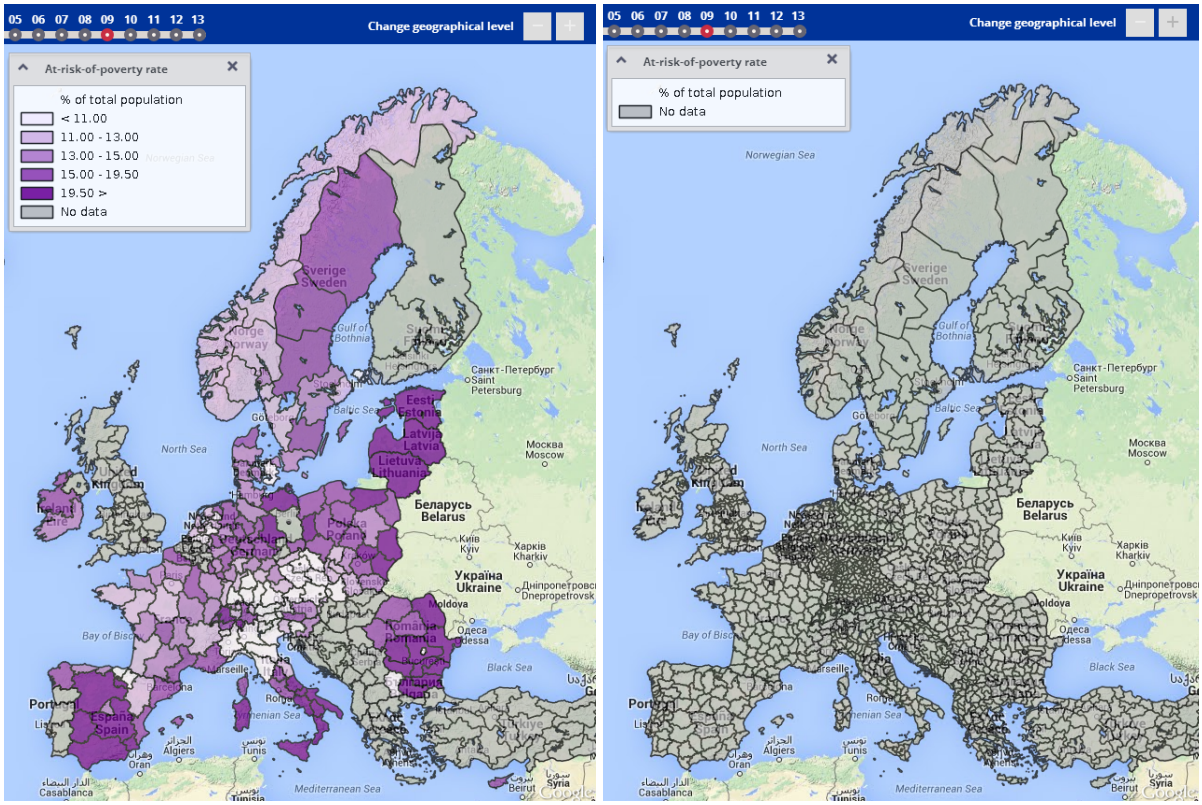
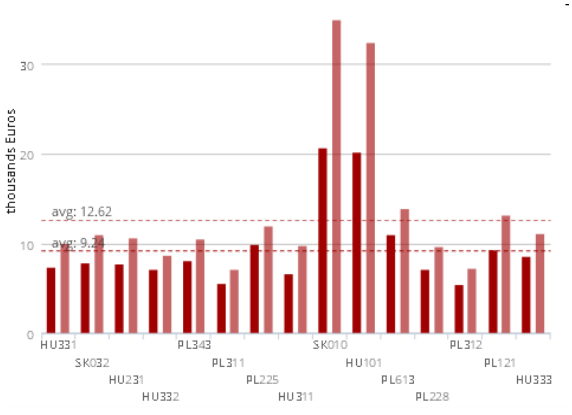


Figure 13. Indication of the "no data" for several regions/regional levels

Multi-temporal analysis

The application provides a possibility to display values for two different years in the map and for two or more different years in the column charts. The time series for selected indicator are available in the table, which is a part of the analytical panel.

Name	2003	2004	2005	2006
AL00			4.99	5.49
AT11	18.17	19.33	19.11	19.86
AT12	21.49	22.90	22.85	24.29
AT13	36.10	36.97	37.48	39.41
AT21	22.10	23.31	23.76	25.17
AT22	22.70	24.12	24.70	25.90
AT31	25.75	26.93	27.74	29.33
AT32	29.76	31.37	31.76	33.87
AT33	27.70	28.71	29.64	31.31
AT34	27.69	29.08	29.57	31.23
BA01				
BA02				
BA03				
BE10	51.50	52.12	53.58	54.13
BE21	29.62	30.71	31.93	32.79



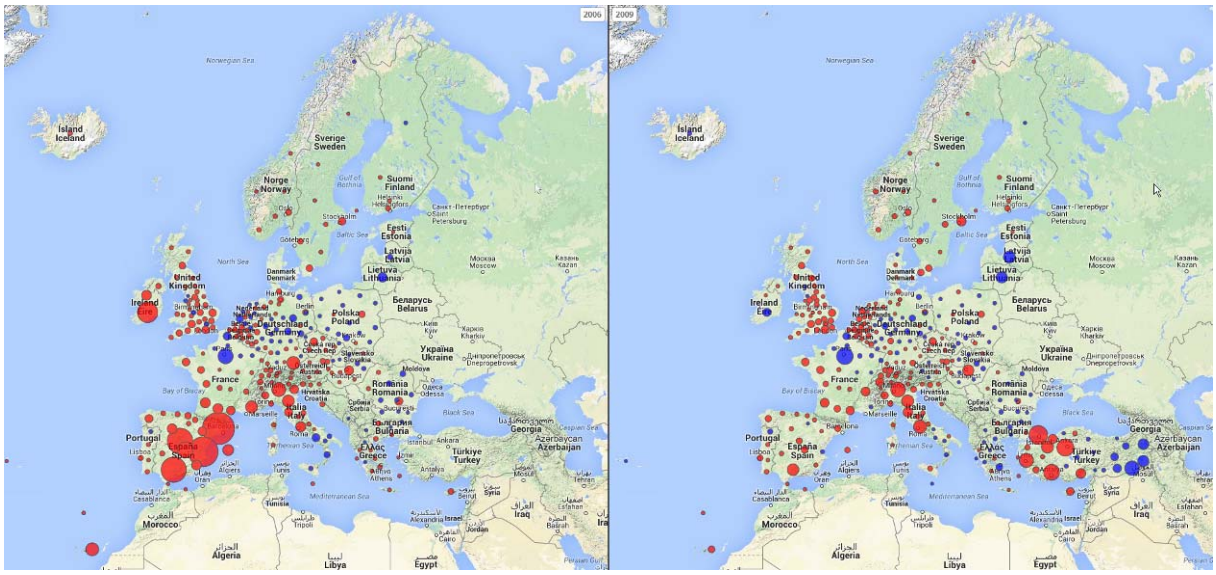


Figure 14. Displaying values for different years in the chart, map or as a time series in the table

Regional filters

A possibility to filter analytical units based on different regional typologies, as well as for example by countries, is incorporated. The user can set multiple filtering conditions, which influence selection of regions displayed in both map and charts.

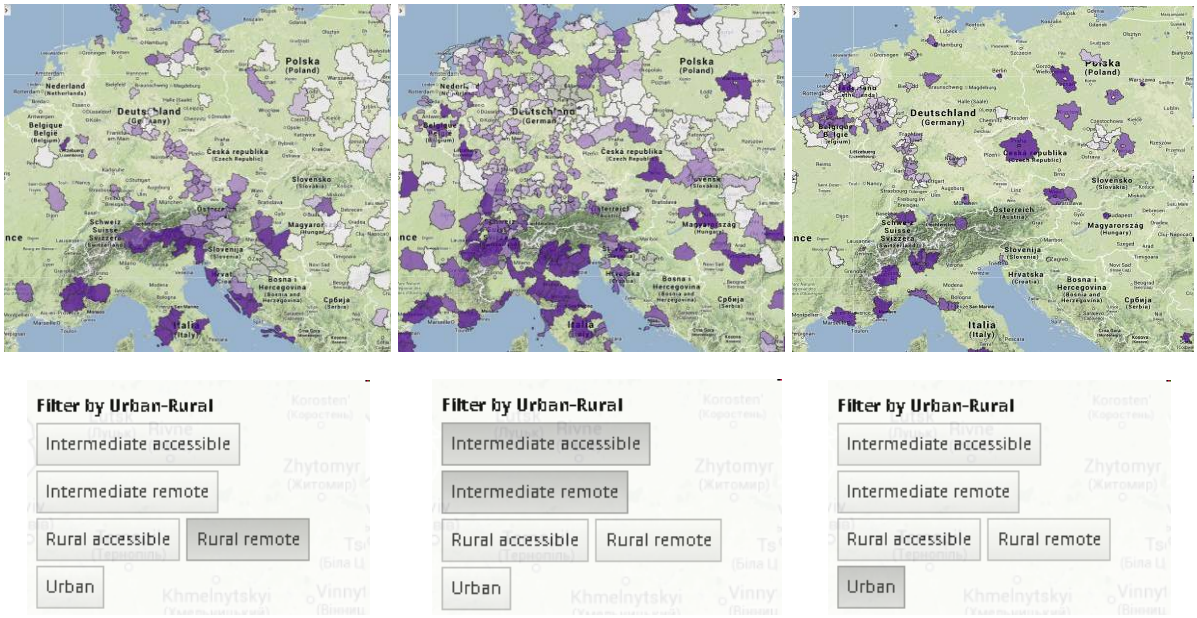


Figure 15. Filtering regions by different regional typologies

Different filters can be combined, which enables advance filtering, e.g. selection of all urban or intermediate accessible regions it several selected countries.

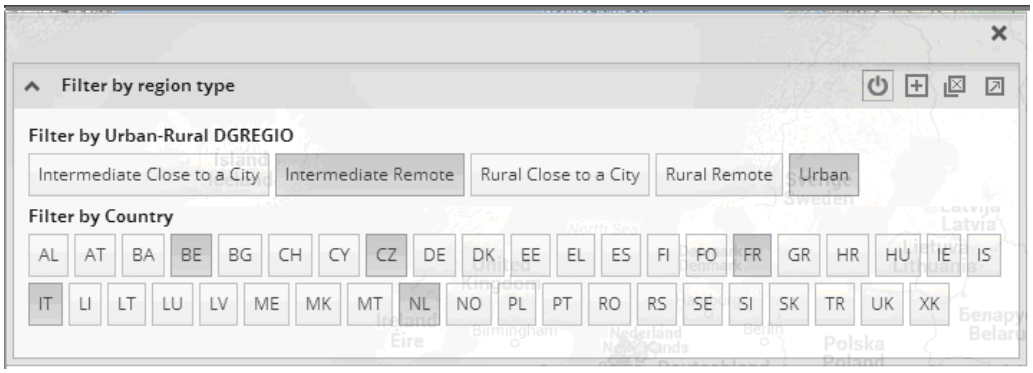


Figure 16. Example of a combined regional filter

Multiple units' selection

The application enables the user to define a user selection of analytical units of his interest. He can also define more different selections of analytical units - each of them is than highlighted by corresponding colour in map, charts and tables. These units can be zoomed into and compared with each other, as well as with any other unit defined in frame of particular territorial entry point.

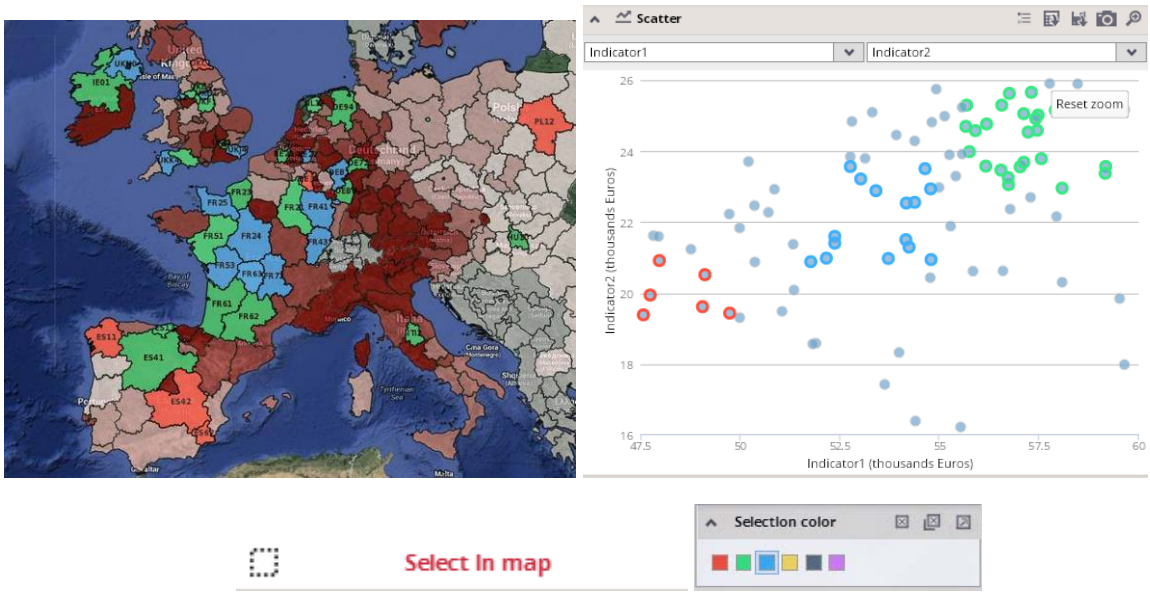


Figure 17. Multiple user's selection of the analytical units of interest; tools for multiple selections

The Analytical panel

The right panel of the application is dedicated to the statistical analysis based on analytical units, which are realized via interactive table, column and scatter charts. The panel can be expanded or collapsed using the arrow in the upper right corner of the map window.

Table and column chart serves for displaying indicators values for different (or multiple years). Units which are displayed here can be defined by the current units' selection (through the activation of the "selected only" button at the top of the panel). The selection itself can be done in all components of this analytical panel by clicking on the units which should be selected. A multiple selection can be done by holding the CTRL button while selecting more units.

The **table** also enables to sort the analytical units according to their indicators' values, in ascending or descending way, by clicking on the header of the column which should be sorted. Indicators to be currently displayed in the **column chart** can be modified by the user, through the menu at the top of the chart. Again, multiple indicators can be selected by holding the CTRL button while clicking on indicators. A line representing **average** of indicators' values of the current set of the analytical units (defined by the hierarchical level selected of current units' selection) appears in the column chart.

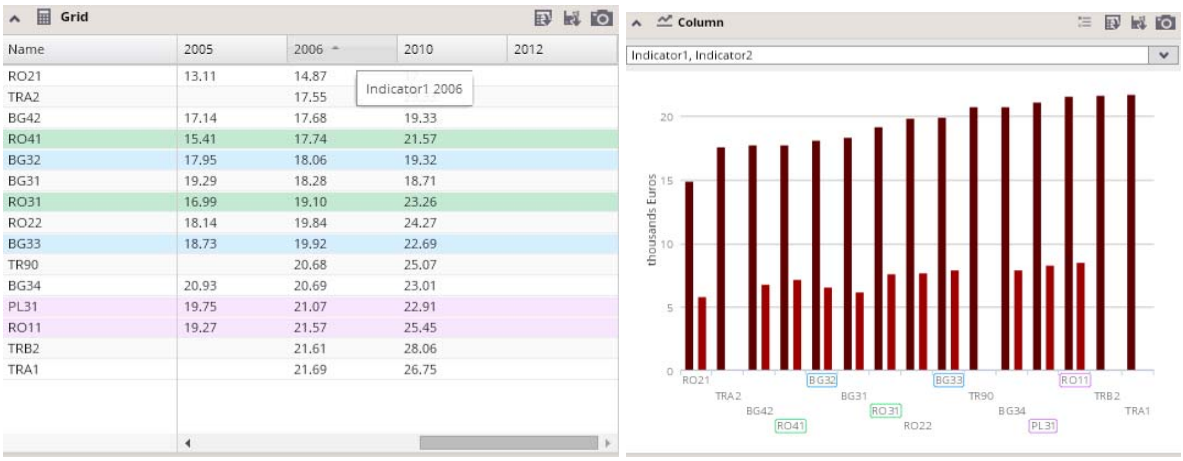


Figure 18. Interactive table and column chart

The **scatter chart** located in analytical panel serves to a 2D analysis of two different indicators, which enables the user to observe their eventual correlation. Also the scatter chart offers a two years mode. Units can be selected directly in this chart, via clicking on them or drawing a rectangle over the 2D interval which should be selected.

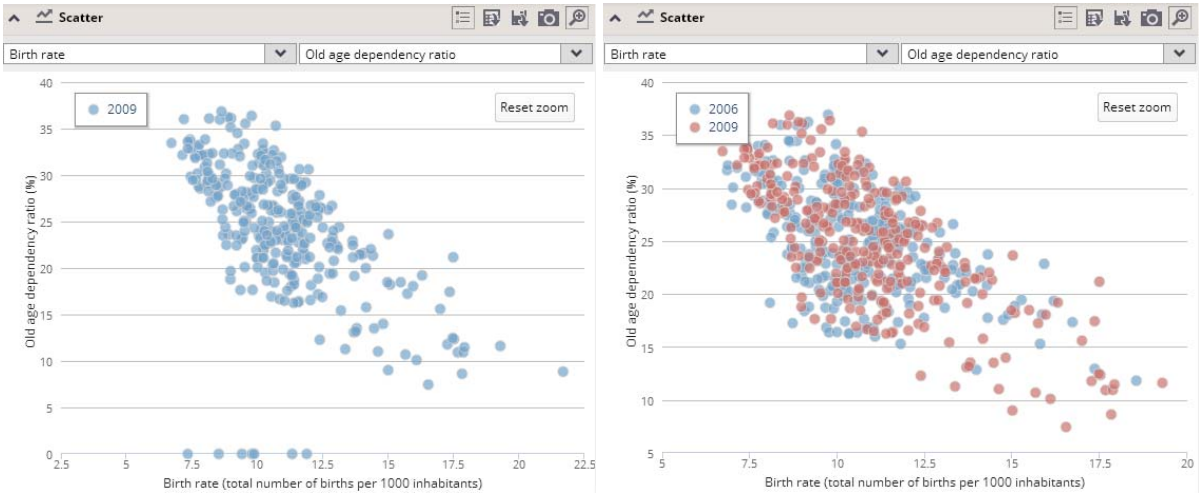


Figure 19. Scatter chart – observing a correlation between values of two different indicators

The analytical panel also displays a map of **furthermost regions** which belong to the ESPON space. This map is available at the bottom of the panel.

The Tools panel

The left panel of the application incorporates different tools for navigation in the map as well as for units' selection. Also regional filters and tools for modification of the map window in sense of

displaying different layers are incorporated in this panel. The panel can be expanded or collapsed using the arrow in the upper left corner of the map window.

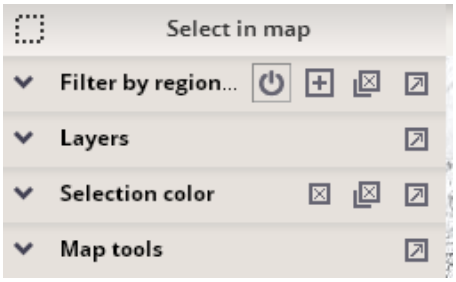


Figure 20. The Tools panel

A multiple selection of units can be done via defining the different selection colours and selecting units of interest directly in the map or in charts or table in the analytical panel. The selection by "mouse hover" over the unit of interest in the map can also be activated in this panel.

Figure 21. Tools for multiple units' selections

Modification of the map layout is possible through the "Layers" panel. This panel provides a user with a possibility to display different background layers – Google ones or Open Street Map, as well as to set opacity or display a legend for displayed layers.

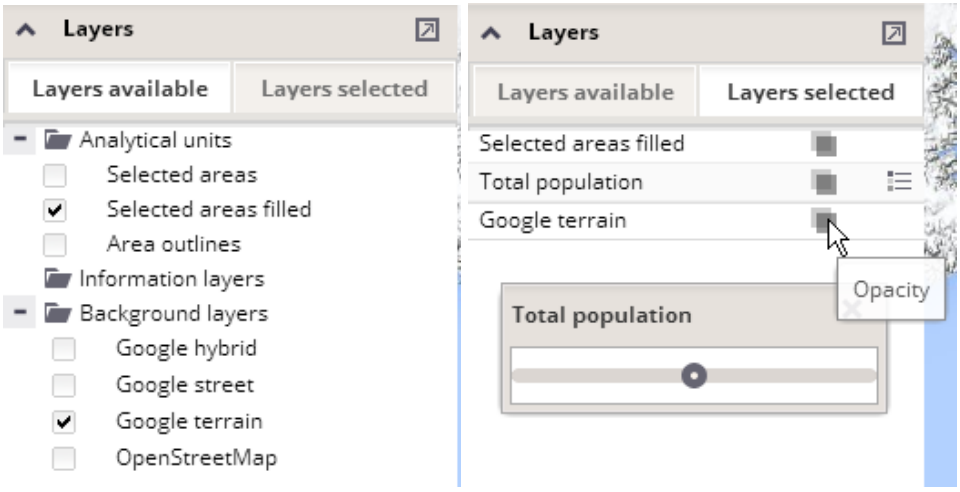


Figure 22. Tools for modification of the map layout

Exporting a content of the Data Analysis Tool

Most of elements which can be displayed in the Data Analysis Tool can be exported either as graphics or in a tabular form. Buttons which serve for exporting of the content of different charts (or table) are available in the panel on the top of each chart or table. For these components, exporting options involves export as a CSV or PNG. Current map layout can be exported using the “Save as image” button in the Map tools panel.

Figure 23. Buttons for export of the DAT elements – charts or tables (left) and map (right)

6 Data analysis on Timelines

6.1 Conceptual Design

Data Analysis on Timelines Tool is available at the ETMS website (http://81.47.175.201/etms-project/).

The main propose of the tool is representing analytically over time, and at an aggregated level:

- Territorial trends within Europe by different regional typologies (based on averages)
- European trends compared with the rest of the World (selected groups)
- Forecast indicators 2030 by different regional typologies (based on averages)

This tool displays ETMS indicators over time comparing the evolution of such trends based on different typologies of regions (e.g. urban-rural, structural funds allocation), or for different regional aggregations (e.g. Eastern or Mediterranean Europe).

Data Analysis Timelines also displays ETMS indicators at an aggregated level for the ESPON area compared to other world regions (e.g. BRIC countries, or non-European advanced economies).

Based on the results of the ESPON ET2050 project, indicators that were projected at regional level between 2010 and 2030 (economic, demographic, transport and land-use) are displayed in the ETMS with the same regional typologies used for the monitoring of current trends in Europe at regional level.

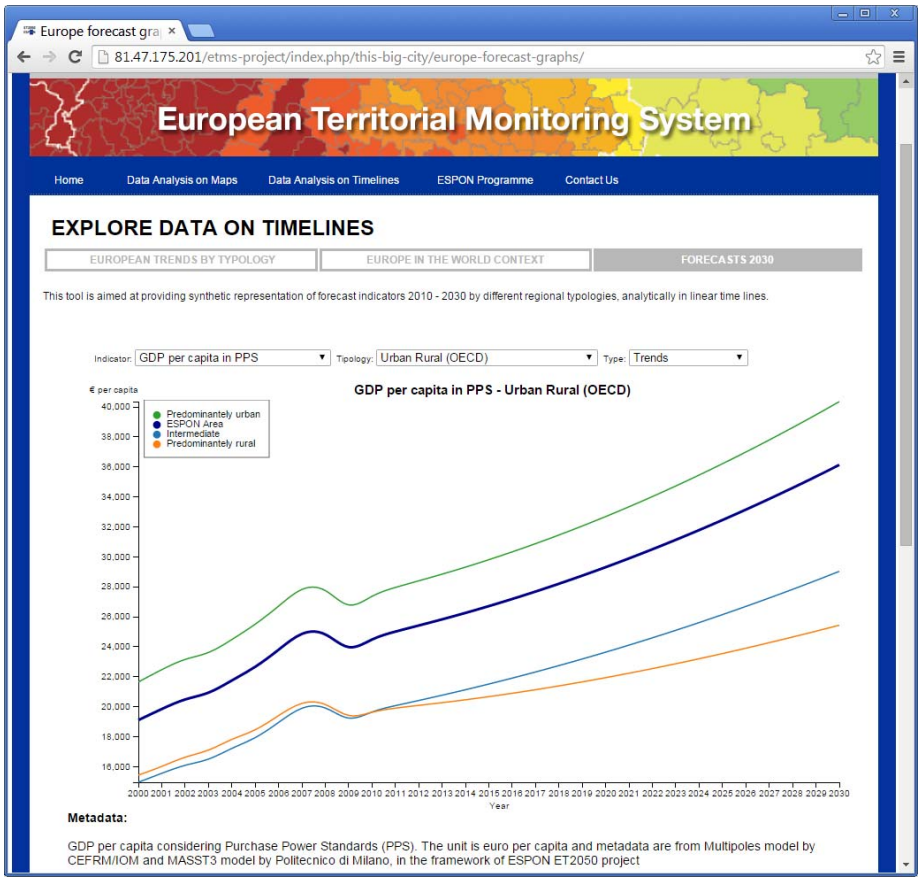


Figure 24. Data in Timelines module. ET2050 GDP per capita Forecast 2000-2030 in urban & rural regions

In brief, the ETMS Data Analysis on Timelines Tool provides the user following possibilities:

- Display ETMS indicators over time at regional level by different regional typologies and regional aggregates (within the ESPON area).
- Display ET2050 forecasts by 2030 at regional level by different regional typologies and regional aggregates (within the ESPON area).
- Contextualise the ESPON area in the world level by comparing it to other world macroregions, for a number of macroeconomic indicators.
- Interactive switching between indicators and different typologies
- Interactive switching between different data type: absolute data and relative data
- Compare ETMS indicators values within regional typologies and with ESPON average value

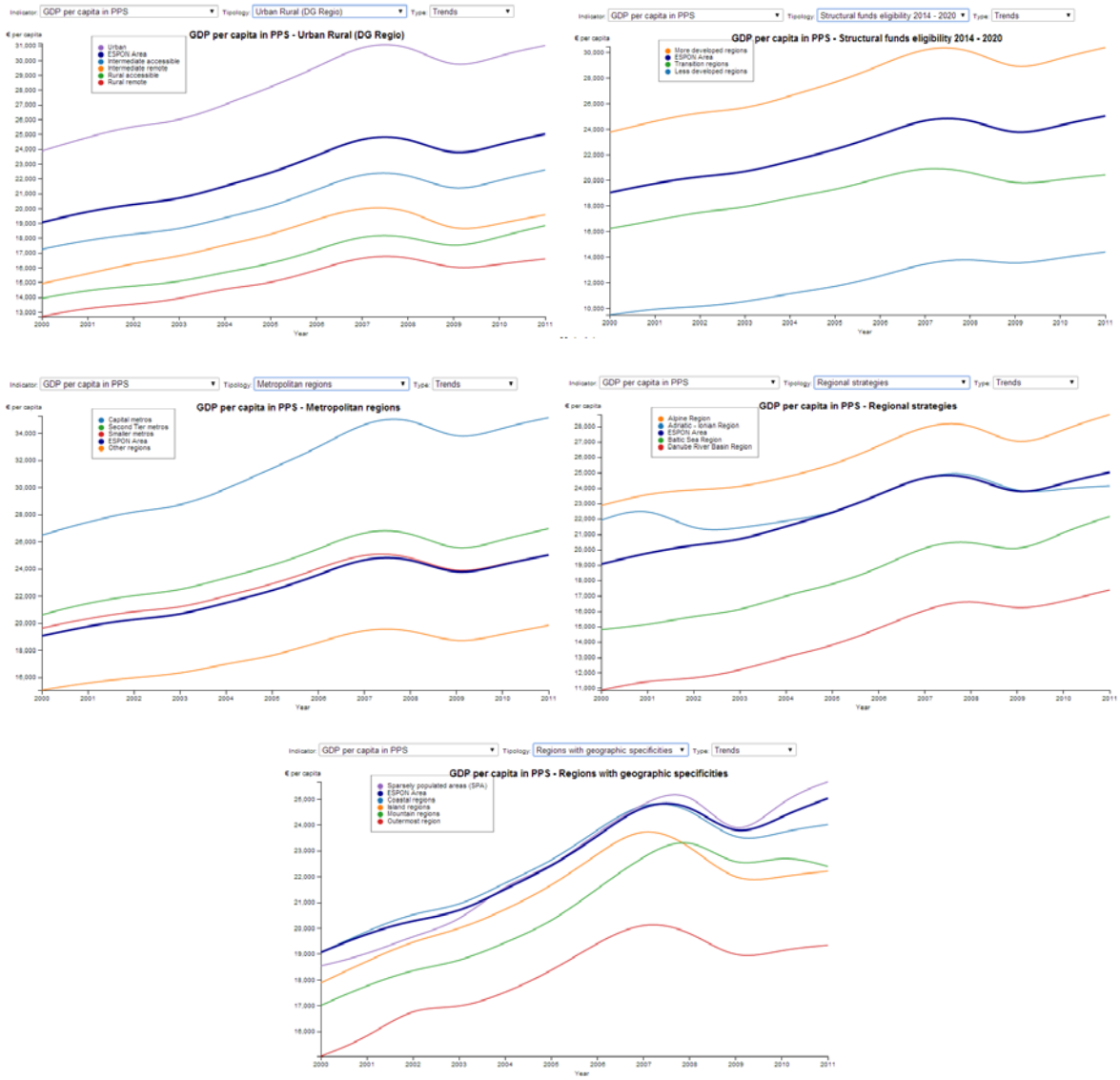


Figure 25. Example of current Territorial Trends analysis: GDP per capita evolution 2000-2012 by urban-rural typology, structural funds eligibility, metropolitan regions, transnational cooperation areas, and regions with geographical specificities

6.2 How to Use

6.2.1 Where to access the tool from

The user can access to Data Analysis on Timelines from ETMS website project homepage:

- Through tool bar at the bottom of website
- Through main menu at the centre of website
- Through Data Analysis Tools, at the right side of the website

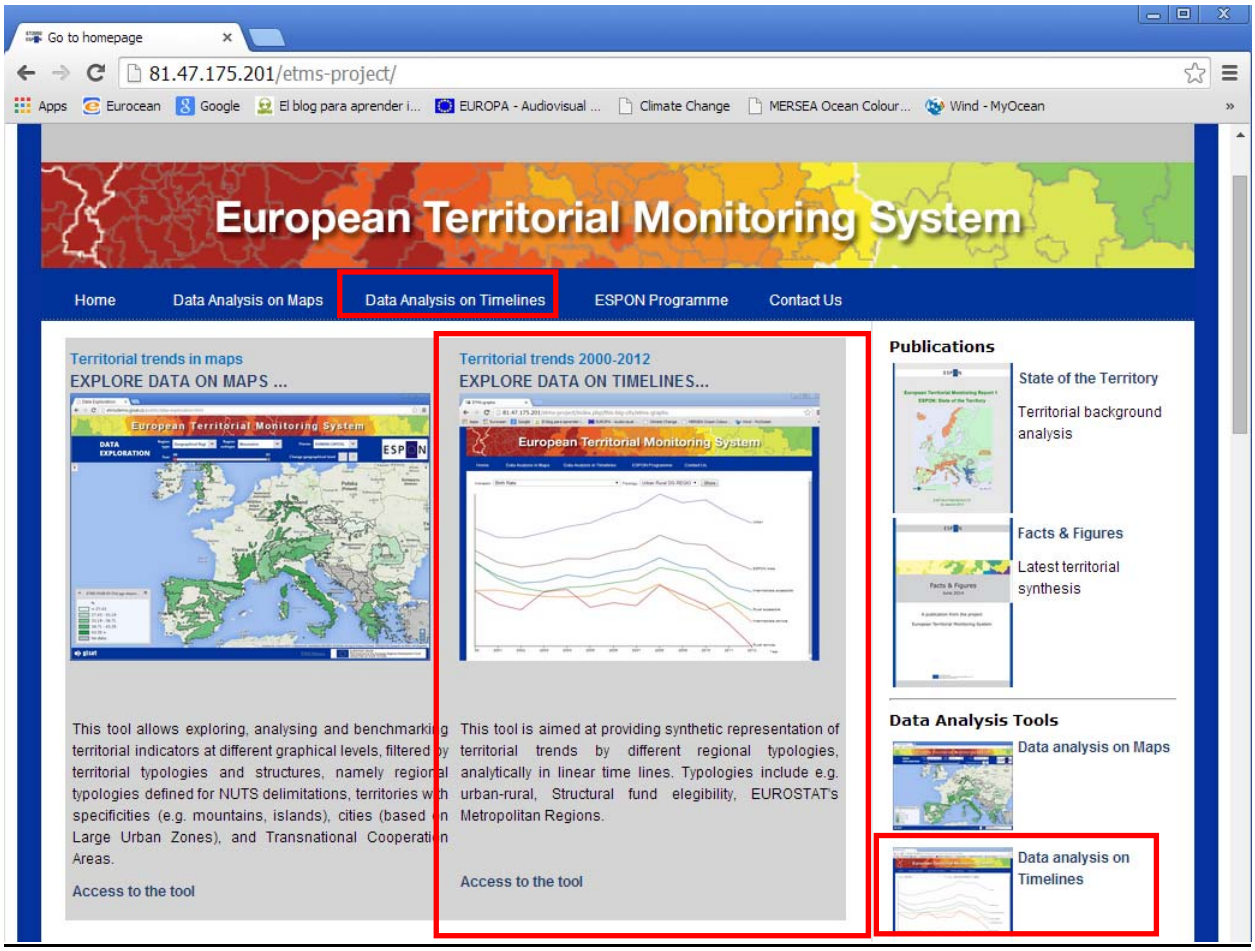


Figure 26. Access to ETMS Data Analysis on Timelines Tool from ETMS project home page

6.2.2 How to navigate the tool

The user can select which component of the module to activate using the top 3 options on the tool screen:

- ESPON Territorial trends. Final results are displayed with a line graph that shows data available over time for each region within typology selected, usually from 2000 to 2012. The ESPON average is always displayed. A legend is also shown.
- Europe in the World. Final results are displayed with a line graph that shows worldwide indicators over time, grouping countries as follows: ESPON area, neighbourhood, BRIC countries, advanced economies and the rest of the world.

- Forecast 2030: Final results are displayed with a line graph that shows data available over the time for each reagion within typology selected, usually from 2000 to 2030. The ESPON average is always displayed. A legend is also shown.

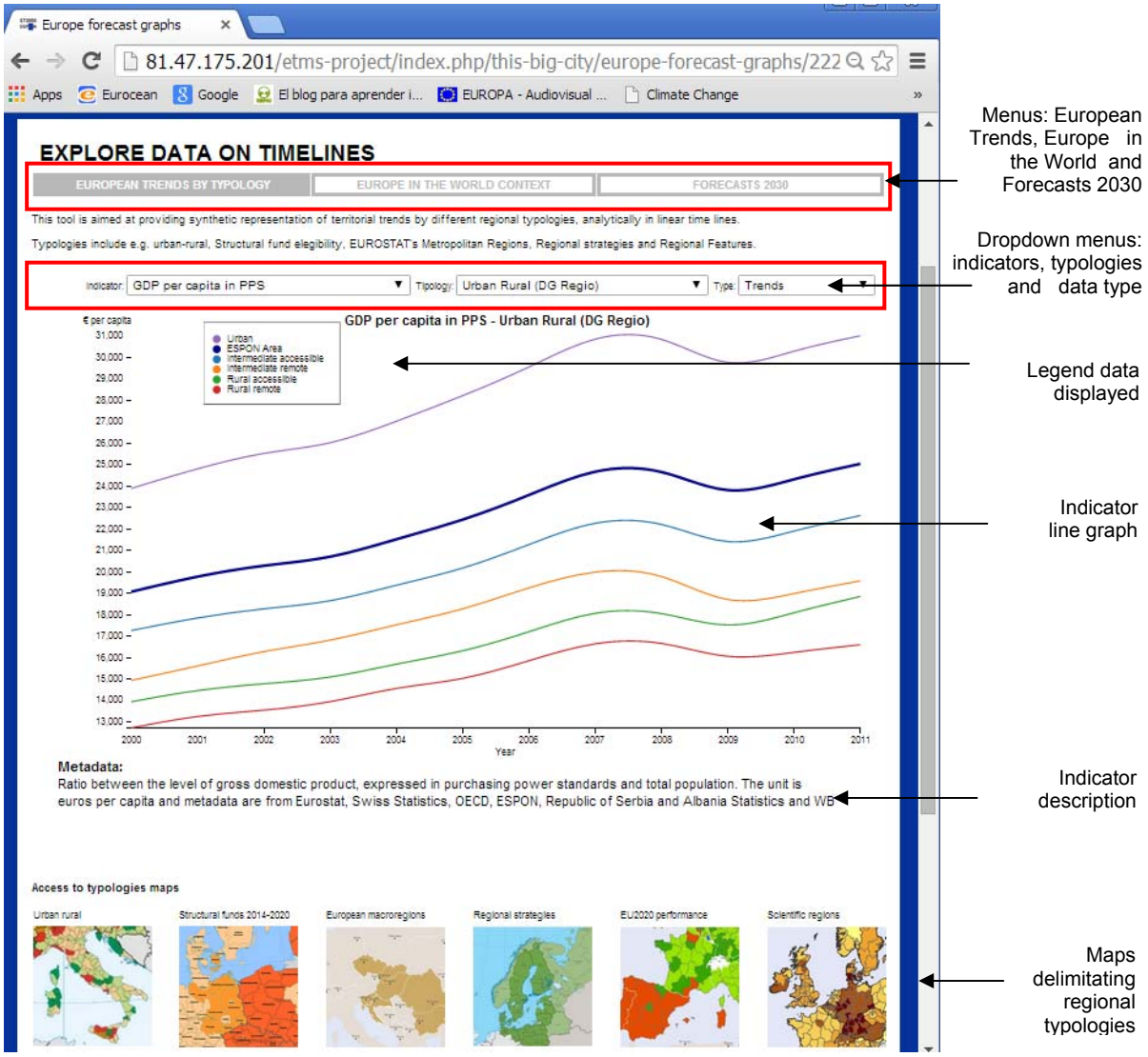


Figure 27. ETMS Data Analysis on Timelines Tool

The user can interact with the tool through three drop-down menus:

- Indicator dropdown menu: with this menu user can select among ETMS indicators available. In case of ESPON territorial trends, nineteen (19) indicators are stored; in case of Europe in the World, nine (9) indicators are stored; in case of forecast indicators 2030, ten (10) indicators are stored.

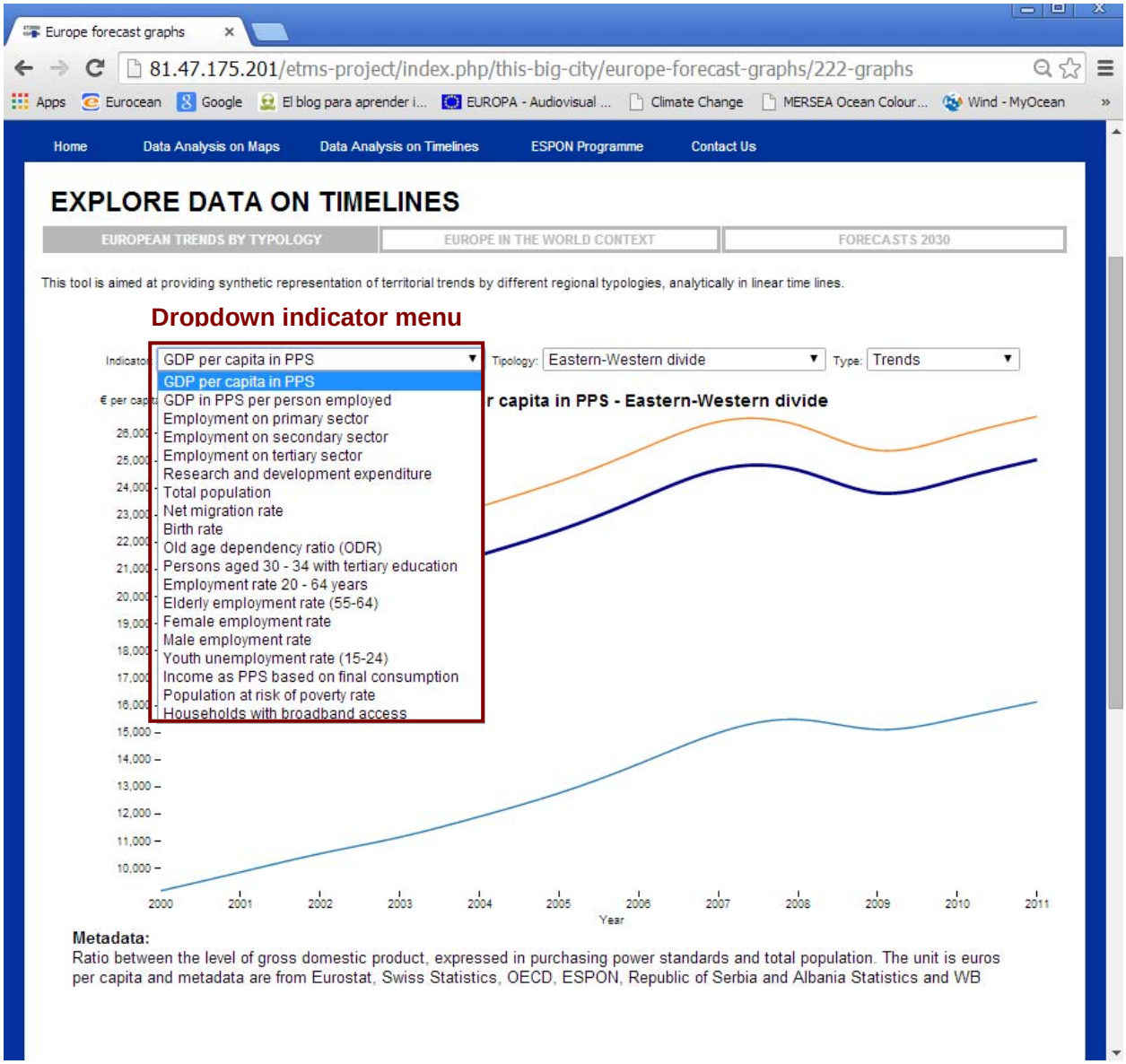


Figure 28. Dropdown ETMS indicator selection menu

- Typology dropdown menu (only available in ESPON territorial trends and Forecast 2030): with this menu users can select the regional typology. Thirteen typologies can be selected: Easter and Western divide, urban rural typology (booth DG Regio and OECD are available), Metropolitan Regions, Structural Funds eligibility, EU2020 Performance, Scientific Regions, Southern countries, Eastern countries, Northern countries and Western countires, geographical regions (costal, mountain, islands, outermost and sparsely populated areas) and main cooperation regions (Danube River Basin, Baltic Sea, Alpine Region and Adriatic-Ionic.

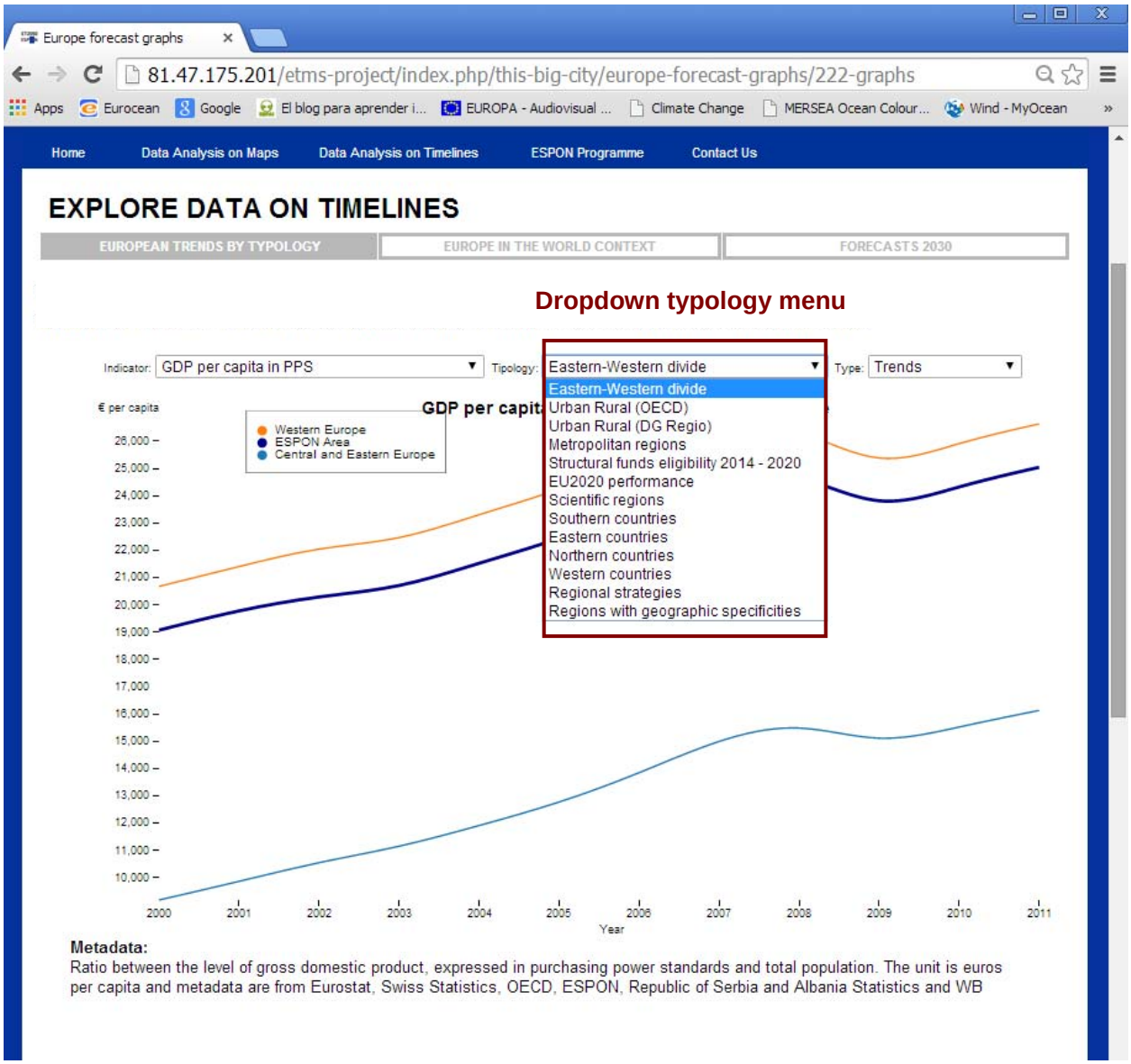


Figure 29. Typology Dropdown Menu

- Data type dropdown menu: with this menu users can select type of data displayed. Data can be displayed by trends, annual growth rate, growth compared with ESPON average and growth compare with initial data.

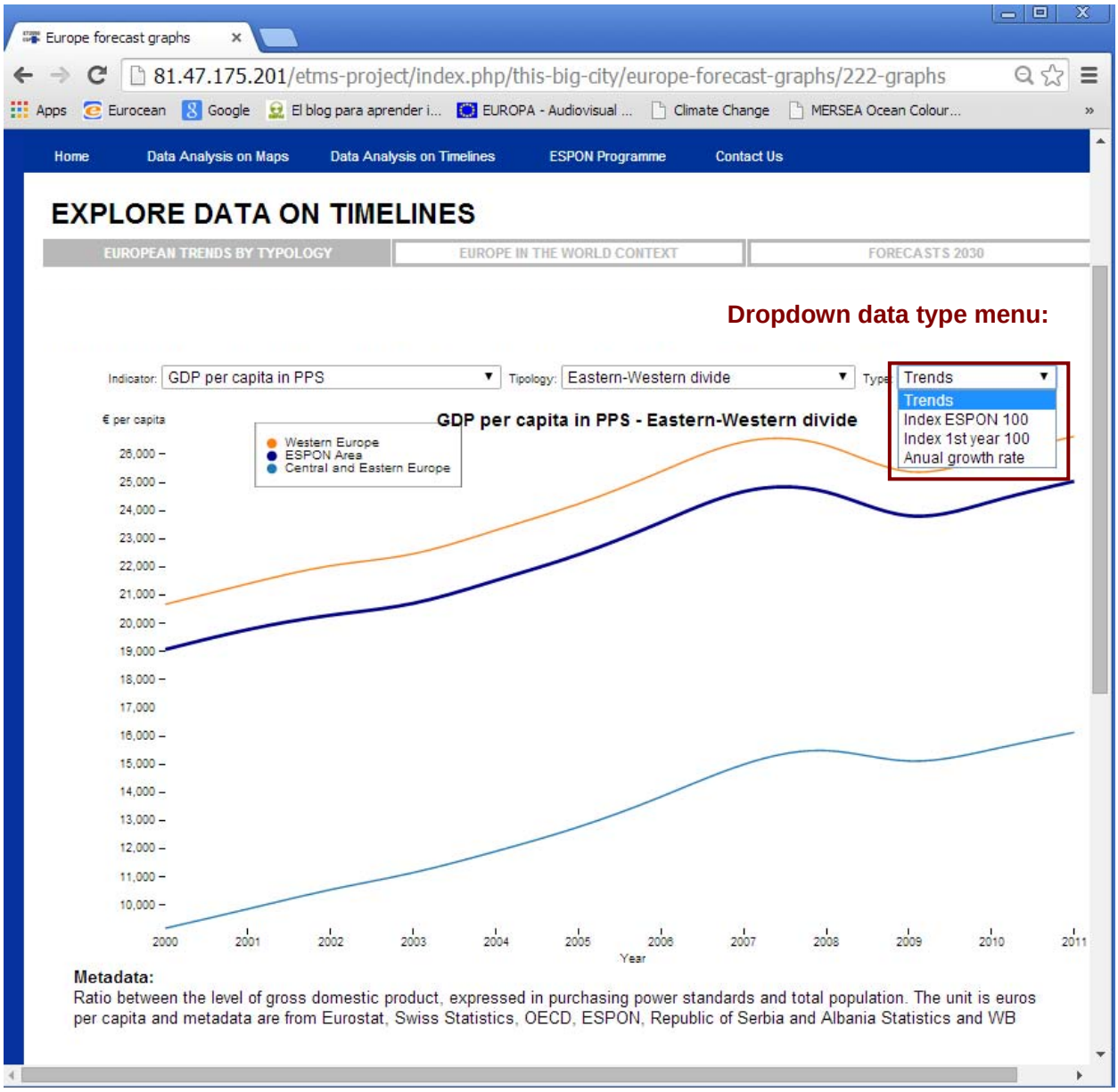


Figure 30. Data Type Dropdown Menu

For any indicator, Data on Timelines allows displaying ETMS allows using any of the following units:

- Indicators by absolute terms
- Indicator annual growth rate (%)
- Indicator growth over the time in relation to ESPON average (index ESPON = 100)
- Indicator cummulated growth over the time in relation to first year (index InitialYear = 100)

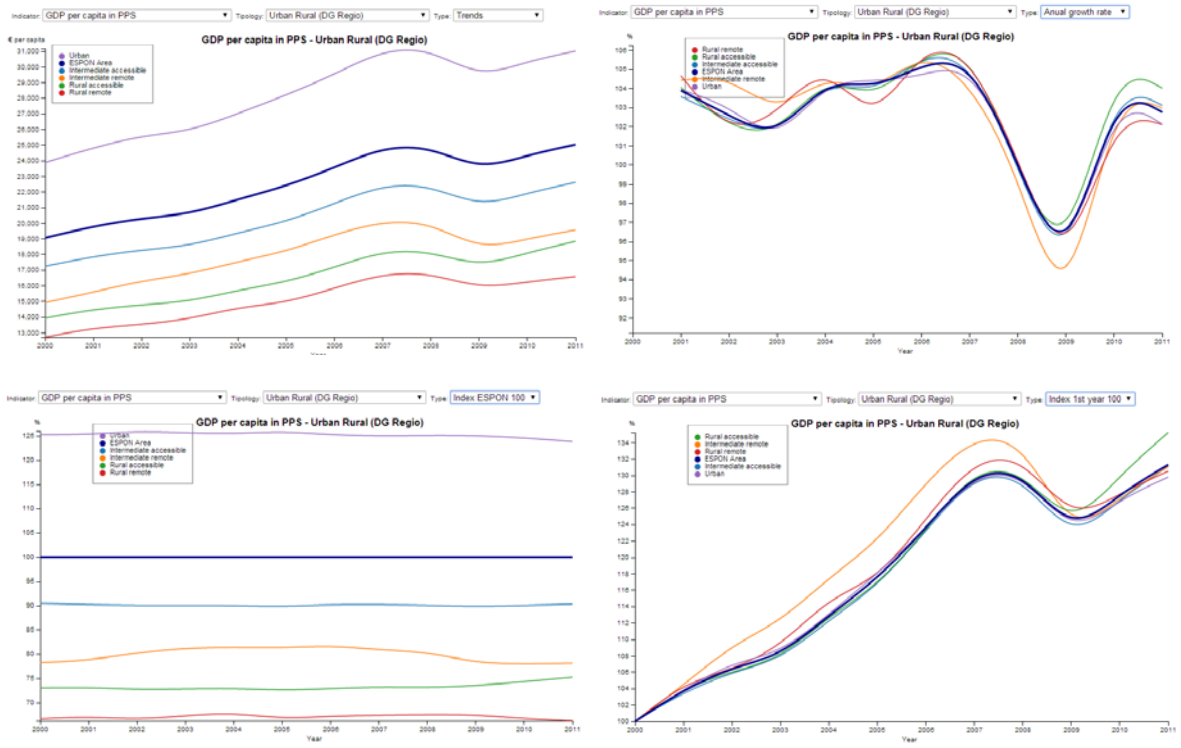


Figure 31. Example of data displayed in different units: GDP per Capita evolutions 2000-2012 in absolute terms (top left), annual growth rate (top right), index ESPON = 100 (bottom left) and index 2000=100 (bottom right).

7 ETMS Facts and Figures Booklet (F&F)

The aim of the F&F (Facts and Figures) booklet is to provide a periodic and simple synthesis of the evolution of the Compass Indicators.

The F&F issues will mainly consist of maps and charts. To a lesser extent tables will be included in the F&F Booklet.

The F&F releases are designed to be easily and quickly comprehensible, as they are directed towards policy makers that are looking for information provided at a glance.

Based on previous discussion between the TPG and the ESPON CU, it was conjectured that the F&F Booklet should emphasize visual material illustrating key development trends across Europe, whereas the Monitoring Report would be more focused on the interplay between policy narratives and territoriality of these trends.

In concrete terms, this means that the text included in the F&F booklet should be held to the minimum necessary for explaining to the reader the key findings that are displayed in each visual material chosen and how it may provide relevant input to the policy debate. However, some entry-points to the policy debate are desirable, in order to explain the policy relevance of the statistical evidence presented, e.g. how it may provide new insights on the extent to which European territories are able to 'deliver' on the policy orientations identified in the Europe 2020 Strategy and the Territorial Agenda.

The overarching aim of the booklet is not to highlight territorial structures as such, but rather to show how past and current development trends may impact the evolutions of these territorial structures over time.

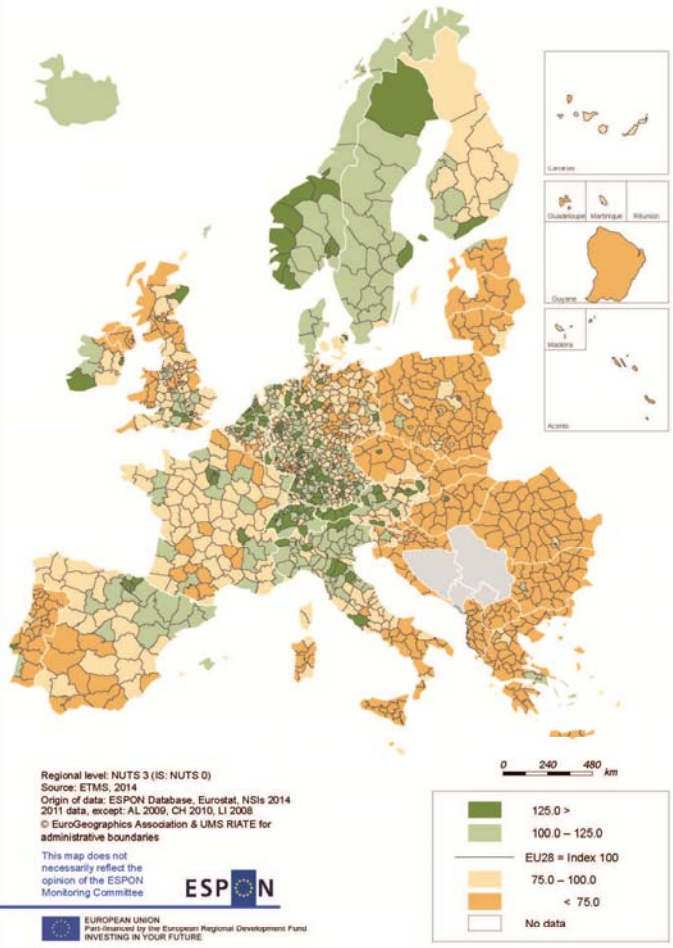
For in-depth analysis, the more extensive State of the Territory reports will be published every 2 years.

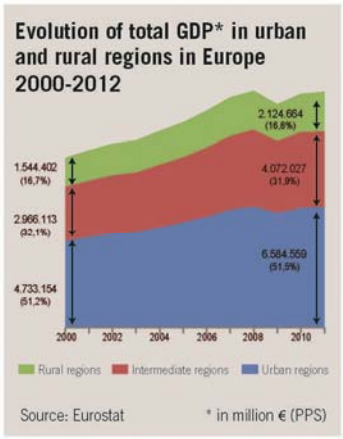
7.1.1 Layout and structure

The layout of the booklet is based on previous ESPON publications and thus it follows the general rules of ESPON communication material. The size of the publication chosen was A4.

The content of the booklet follows a simple structure:

- Table of contents introducing the chapter structure of the publication, as well as some information about the ETMS project rationale.
- Five double-page (i.e. facing each other) chapters, following the five domains chosen by the project team to compile the ETMS database: Economic Competitiveness, Environmental Qualities, Social Inclusion, Human Capital and Access to Territory and Services.
- Each page contains at least one European map that gives the reader a quick insight on the key territorial dynamic for this topic. Further graphic material has been developed in order to give a sharper territorial focus on the issue (especially focusing on urban-rural differences, or a specific outlook at one macro-region) and also to give some insights on differences among European countries.





Economic growth across Europe

Urban regions in Europe contribute with 51.5% of total GDP, even though they only concentrate 22% of the European population. Together with intermediate regions, they make up for 83.4% of European GDP. This share is growing as a result of increased urbanisation.

One objective of the Territorial Agenda 2020 is to ensure competitiveness of all regions based on strong local economies, rural regions included. If the largest urban areas tend to grow faster than rural or intermediate regions, this results in polarisation of economic activities and growing national imbalances.

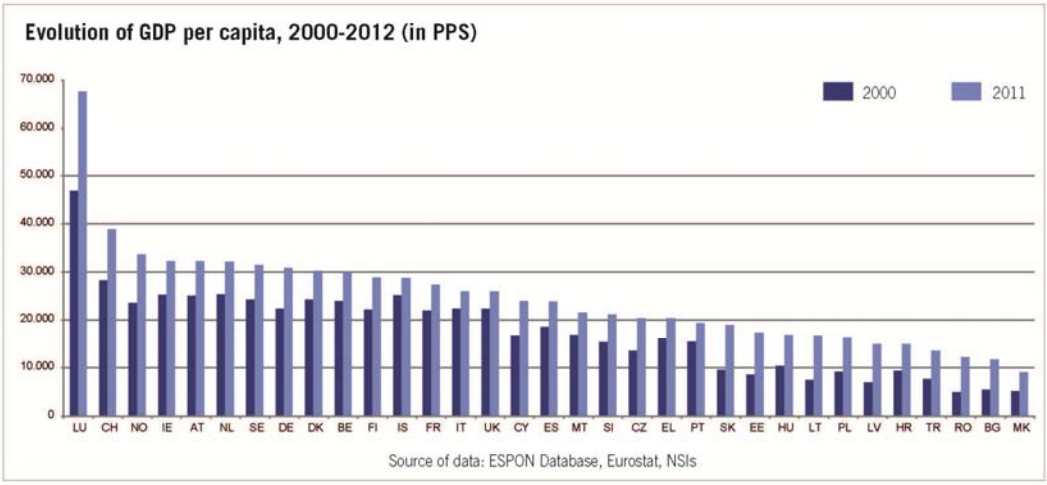


Figure 32. Example of a Facts and Figures Leaflet page

8 State of the Territory Report

8.1 Approach

The ESPON ETMS State of the Territory report has been produced, based on the review of reference Monitoring Reports (see the Interim Report of June 2013) and interviews carried out with Stakeholders thereafter. The principles of the State of the Territory report are the following:

A. **Outspoken Policy Links.** The narrative of the report has a clear link to the policies monitored in ETMS, in a language that is appealing both to specialised readers and to people from other policy fields.

B. **Targeted groups.** A clear definition of a target group is important in order to be able to focus the themes, language and level of detail to the end user of the Monitoring report. In the ESPON ETMS State of the Territory the main target group is national and European policy makers. Regional and local authorities as well as scientists, which could also make use of the State of the Territory report, are seen as secondary target groups.

C. **Scope.** The scope of the State of the Territory report highly depends on the plans ESPON has for the future maintenance of the system in terms of human resources and budget. The volume and type of data that will be collected on a continuous basis are also decisive for the scope of the State of the Territory report.

D. **Stand alone sections.** The State of the Territory report is available as a full monitoring report but can also be downloaded as a collection of freestanding sections or chapters.

E. **Website publication**. The State of the territory can be presented both as a paper report and a webpage presentation.

F. **Technical approach.** A focus on technical information including methodologies, data sources and perhaps even the inclusion of entire data sets if necessary.

G. **Graphic language.** Maps and Figures used are consistent and easy to understand.

H. **Maps, graphs & tables.** The report will include qualitative policy discussions along with maps, graphics and tables. Maps, graphics and tables will be produced with the ETMS Data Analysis tool.

I. **Reader friendly format.** This includes layout issues (e.g. pages not heavily loaded with text), language (e.g. easy communication language) and structure (e.g. easy to navigate).

8.2 Publication cycle

The aim is to publish a new State of the Territory issue every 2 years. The magnitude of the report is envisioned on around 50 pages.

8.3 Layout and Structure

A draft of the State of the Territory publication is attached and fully documented to this report as a separate document "***State of the Territory Report - Draft_141022***".

The basic idea is to give the report a fixed structure of six chapters linked by a logical narrative path, but than can be dealt with as stand-alone documents. In doing so, the report becomes both a comprehensive linear review on the State of the Territory, and a reference consultation tool for analysis of particular policy issues.

- **Chapter 1: Introduction and policy context.** The introduction chapter introduces the aim and specific topic of the report, but also ESPON, and the general policy context. ***(4 pages)***

- **Chapter 2: Highlights/Summary.** The summary chapter presents the main highlights of the report, rather than providing a full summary. ***(4 pages)***

- **Chapters 3 to 8: Policy Development.** The six following chapters present the main evidence of the ETMS. There is one chapter for of each of the six priorities of the Territorial Agenda 2020.

  Each of the chapters starts with a short section on the understanding of the policy priority.

  Following this understanding latest territorial information is presented to discuss to what degree Europe moves towards achieving the objective. A range of maps and graphics accompanies the text. In many cases developments are discussed in different time perspectives, e.g. until the financial crisis and since the entrance of the crisis.

  The final section of each chapter sums up the territorial observations both in light of the policy objectives of the Territorial Agenda 2020 and the Europe 2020 Strategy. . ***(44 pages)***

8.4 Synthesis of the Report

This first ESPON Monitoring Report shows what progress Europe has made on its way towards achieving the objectives set out in the Territorial Agenda 2020. It furthermore reflects on what that progress means in relation to achieving the objectives of the Europe 2020 Strategy.

Overall, Europe has made some progress in relation to the various objectives of the Territorial Agenda 2020. However, the economic crisis brought an increasing focus on economic growth building on the strengths of the strongest poses some challenges to cohesion-oriented objectives.

8.4.1 Promote polycentric and balanced territorial development

Polycentric and balanced development has many facets. Recent European demographic trends point towards polarising trends between metropolitan and non-metropolitan area, rather than reflecting a core-periphery pattern opposing the “Pentagon” and the rest of Europe.

Recent European economic development trends show that in general terms European cities and regions were moving towards more cohesion until the beginning of the crisis. The economic crisis brought this convergence process to a halt.

Considering the limited perspectives of getting back to the high pre-crisis economic growth levels during coming years, the pursuit of polycentric and balanced development as promoted by the Territorial Agenda 2020 will need to be based on other levers. A better functional division of labour between regions and smart specialisation could be a way forward.

8.4.2 Encouraging integrated development in cities, rural and specific regions

Integrated development in cities, rural areas and areas with geographical specificities is important for a balanced territorial development.

Looking at the increasing population disparities between urban and rural areas, it appears that large parts of Europe are currently moving in the opposite direction of this target.

For more than one decade, major metropolitan areas and larger cities concentrate an increasing share of population in many countries, but there are also significant exceptions. The biggest differences in growth rates between urban and rural areas can be found in the Nordic countries, Estonia and Bulgaria. At the other end of the scale, Italy, France, Luxembourg, Poland, Switzerland and the United Kingdom experience no significant urban-rural polarisation, while Cyprus and Latvia have higher demographic growth in rural areas.

Focusing on mountain regions as one example for areas with geographical specificities, in many mountain areas there is a rapid polarisation between urban and rural areas. More concretely, e.g. in the Alps and the Pyrenees, rural areas taken as a whole have a growing population. However, growth in urban parts is considerably higher, particularly in the Pyrenees. The Carpathians and Balkans experience limited population growth in urban areas, and a significant to strong population decline in rural areas.

Overall, this argues for a more place-based approach of a policy mix bringing together regional development policies and relevant sector policies.

8.4.3 Territorial integration in cross-border and transnational functional regions

The development of cross-border and transnational functional regions aims at helping overcoming negative border effects and make better use of potential synergies and joint solutions across national borders.

The evolution of economic border discontinuities within and outside the EU is characterised by the existence of distinct patterns that relate to economic wealth and performance. Within Europe, the main economic cross-border discontinuities between countries have been increasing over the past decade. At the same time disparities between Italy in Mediterranean non-EU Member Stats have been declining.

Major and increasing disparities exist between Luxembourg and it neighbours, between Switzerland and France, and Switzerland and Italy, as well as between East and West Europe.

Despite that, countries in the East have had higher growth between 2000 and 2012, the border differential has increased when measured in absolute figures. In other words, the slower growth in the West has on average generated more additional wealth per capita compared to neighbouring countries in Eastern Europe.

The only exception in this respect is the Adriatic Sea, where Italy's economic decline has contributed to reduce the discontinuity between the Eastern and Western shores. Also the disparities between Italy and Malta have been reduced.

Overall, the observed development does run contrary to the overall cross-border integration objective of the Territorial Agenda. Although, a more nuanced regional picture might provide a somewhat different picture.

8.4.4 Ensuring global competitiveness of the regions based on strong local economies

Local specificities and assets are key elements for unlocking local economies' potential in developing business opportunities and employment.

Looking at education and employment figures offers some first hints on the strengths and potentials of local economies.

The share of 30 to 34 year olds holding a tertiary education degree has risen from 31% to 35.7% (+4.7%), reflecting a significant progression. The increase is particularly strong in Central and Eastern Europe. The highest growth is observed in the Czech Republic, Poland, Slovenia, Slovakia, and Hungary, as well as in Latvia and Lithuania.

The economic crisis has led to sharp drops in employment rates employment mainly in some parts of southern Europe. At the same time, differences in employment rates between men and women are narrowing in most European regions, notably in Ireland, Spain, Greece, and in the Former Yugoslav Republic of Macedonia, but also in Southern Italy and Western Turkey.

Household income is another factor of importance for people's everyday life. Between 2008 and 2011, household income has become more volatile in countries hit by the economic downturn.

Overall, it appears that in many regions in Europe the local economies got weaker as a consequence of the crisis. At the same time, there are signs that the some regions are more resilient to economic shocks than others. Equally important is the fact that pre-conditions for stronger economies are improving which might facilitate general growth developments after the crisis.

8.4.5 Improving territorial connectivity for individuals, communities and enterprises

In the everyday life of individual citizens the access to workplaces, shops and various types of services of general interest are of importance. Unfortunately, European analysis stays at much more general levels as the access of individuals is shaped by intra-regional differences, as well as issues such as quality and affordability.

Overall multimodal accessibility has been improving in large parts of Europe. The highest relative changes of multimodal accessibility occurred in regions in Eastern Europe. However, also many Spanish regions had high relative increases, a combination of improvements in rail and road accessibility. In that sense Europe is moving in the right direction, improving accessibility.

In terms of accessibility and economic wealth, there is an overall disparity between the core and North of Europe on the one side and the Eastern and Southern regions of Europe on the other side. This poses a considerably cohesion challenge in Europe.

At the same there is an increasing concentration of population in larger cities. This trend risks to challenge connectivity and accessibility in rural areas and smaller cities in the long run.

8.4.6 Managing and connecting ecological, landscape and cultural values of regions

The nature and biodiversity of Europe's cities and regions continues to be under threat form the loss of land to urban development and built infrastructure. Soil sealing is still increasing around most urban areas in Europe. Furthermore fragmentation of environmental sites is increasing.

Both soil sealing and fragmentation vary considerably across Europe, illustrating different patterns of land use, settlement structures and population densities.

8.4.7 Smart, sustainable and inclusive growth

Reviewing the progress made with regard to the objectives of the Territorial Agenda 2020, shows the delicate balance and mutual interdependencies between cohesion and growth objectives.

As a consequences of the economic crisis developments moving towards more balanced development and integration of territories got interrupted.

Overall, territorial polarisation trends got more pronounced over the last years, e.g. between the core and North of Europe on the on side and the East and South of Europe on the other side.

Also polarisation trends between major urban areas and rural areas incl. smaller cities got more pronounced in many cases.

The refocusing on strong points and the strengths of the strong players might help Europe to achieve the objectives of the Europe 2020 Strategy.

This may imply a weakening of the objectives of the Territorial Agenda 2020. At the same time once economic growth is catching up, there might also be a stronger strive towards balanced development.

This can only succeed if already the path back to growth is more strongly based on the diversity of regional and local development potentials. There is a need for a place-based approach both for achieving the objectives of the Europe 2020 Strategy and successively also the objectives of the Territorial Agenda 2020.

9 ETMS Technical Specifications

9.1 ETMS Portal

The ETMS Portal is built on Joomla v2.5 Content Manager System (CMS).

Joomla is a free and open-source content management system (CMS) for publishing web content. It is built on a model–view–controller web application framework that can be used independently of the CMS.

Joomla is written in PHP, uses object-oriented programming (OOP) (since version 1.5) and software design patterns, stores data in a MySQL, MS SQL (since version 2.5), and includes features such as page caching, RSS feeds, printable versions of pages, news flashes, blogs, polls, search, and support for language internationalization.

As of February 2014, Joomla has been downloaded over 50 million times. Over 7,700 free and commercial extensions are available from the official Joomla! Extension Directory, and more are available from other sources. It is estimated to be the second most used content management system on the Internet after WordPress.

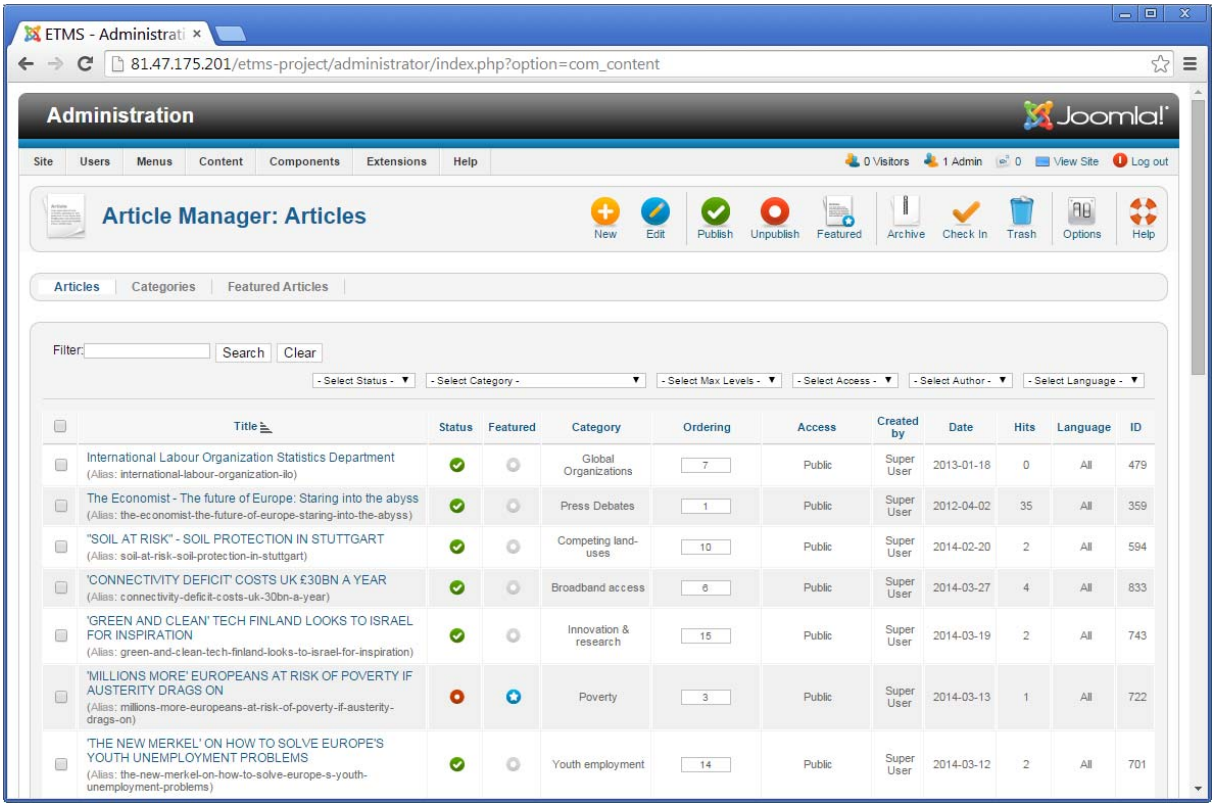


Figure 33. Joomla CMS administrator manager screen shot

9.2 ETMS Data in Maps

9.2.1 Data Analysis Tool components

The application and all needed components are installed on the virtual machine (KVM virtualization infrastructure). This is not necessary condition to run the application. However such

deployment facilitates tasks such as migration, backup, performance tuning. The DAT system is based on following software components:

Ubuntu 12.04.1

LTS Ubuntu LTS is a Debian-based Linux operating system with long-term support, one of the operating systems supported by GeoNode.

GeoNode 1.2c1

GeoNode is an Open Source, Content Management System (CMS) for geospatial data. It is a web-based application and platform for developing geospatial information systems (GIS) and for deploying spatial data infrastructures (SDI).

GeoNode can be easily installed using APT - standard installation management tool for Ubuntu and other Debian-based systems. Beside GeoNode there is also set of core tools and libraries installed - GeoServer, PostgreSQL with PostGIS extension, GeoExplorer, pycsw, Geospatial Python Libraries, jQuery. Some of these components are described more in details below.

GeoServer 2.1-SNAPSHOT

GeoServer is a an open source software server written in Java that provides OGC compliant services which publish data from many spatial data sources. GeoServer is used as the core GIS component inside GeoNode and is used to render the layers in a GeoNode instance, create map tiles from the layers, provide for downloading those layers in various formats and to allow for transactional editing of those layers.

There are actually two GeoServer instances. One is created automatically during the GeoNode installation and is used by GeoNode. The additional one is created for the needs of Data Exploration application.

GeoExplorer 2.1

GeoExplorer is a web application, based on the GeoExt framework, for composing and publishing web maps with OGC and other web based GIS Services. GeoExplorer is used inside GeoNode to provide many of the GIS and cartography functions that are a core part of the application.

PostgreSQL 9.1.6 and PostGIS 2.1.0

PostgreSQL and PostGIS are the database components that store and manage spatial data and information for GeoNode and the django modules that it is composed of, pycsw and GeoServer. All of these tables and data are stored within a geonode database in PostgreSQL. GeoServer uses PostGIS to store and manage spatial vector data for each layer which are stored as a separate table in the database.

The GDAL (OGR), GEOS geospatial software libraries

GDAL 1.7.3, GEOS 3.4.2

GDAL and OGR is a translator library for raster and vector geospatial data formats. GDAL is used to design the raster part of the library, and OGR the vector part for Simple Features.

GEOS stands for Geometry Engine - Open Source, and is a C++ library, ported from the Java Topology Suite. GEOS implements the OpenGIS Simple Features for SQL spatial predicate functions and spatial operators.

MongoDB 2.4.1

MongoDB is an open-source document database, and the leading NoSQL database. Written in C++. MongoDB eschews the traditional table-based relational database structure in favor of JSON-like documents with dynamic schemas (MongoDB calls the format BSON), making the integration of data in certain types of applications easier and faster

nodeJS 0.10.3

Node.js is a platform built on Chrome's JavaScript runtime for easily building fast, scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices.

Apache 2.2.22

Apache Web Server is an open source Web server creation, deployment and management software.The Apache web server is used to serve the Django frontend

Apache Tomcat 6.0.35

Apache Tomcat is an open source web server and servlet container developed by the Apache Software Foundation. Tomcat implements the Java Servlet and the JavaServer Pages (JSP) specifications from Oracle, and provides a "pure Java" HTTP web server environment for Java code to run in. Java Servlet container used for serving the GeoServer web application.

phantomjs 1.4.0

PhantomJS is a headless (GUI-less) WebKit with JavaScript API. It has native support for various web standards: DOM handling, CSS selector, JSON, Canvas, and SVG.

9.2.2 System architecture

The DAT system has 3-tier architecture, which is typical for web applications.

The **database layer** of the system is represented by 2 databases: PostGIS enabled PostgreSQL database, which is a part of the Geonode system and serves as the data store for the Geonode, and the MongoDB, which serves as a store for the configurations. Data rows for geographical areas (regions, NUTS units, etc.) are all stored in the PostGIS DB.

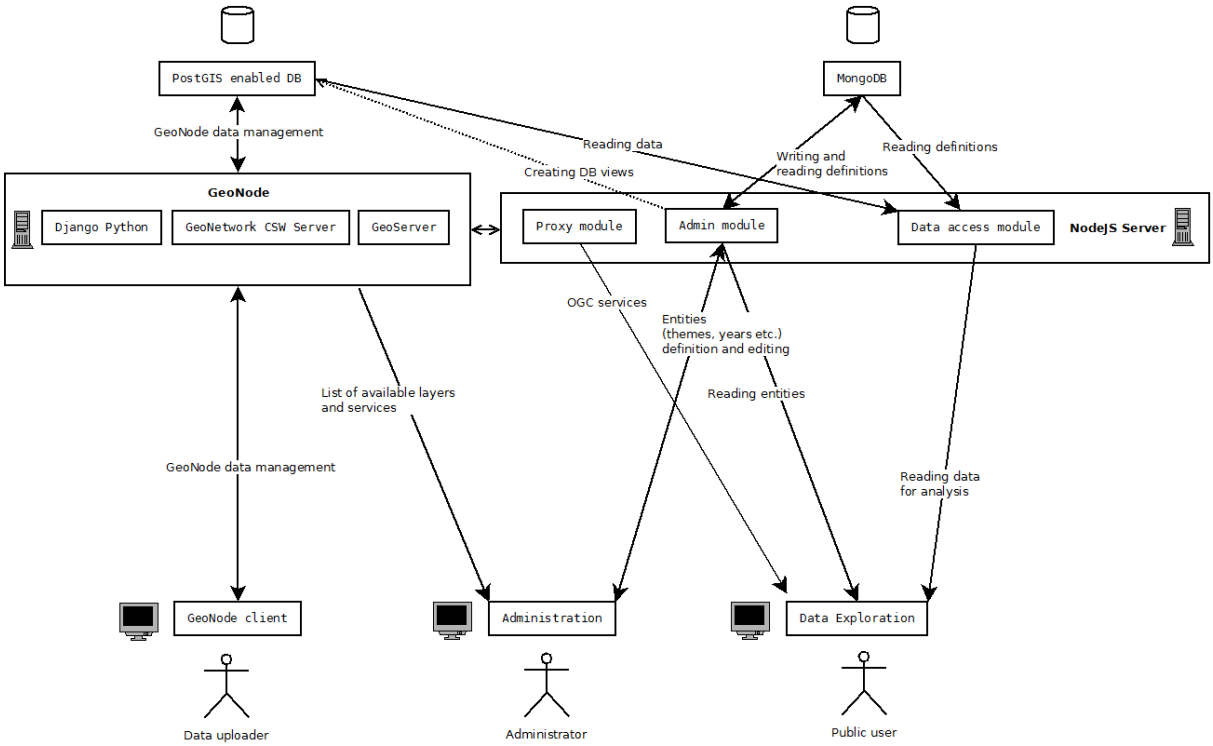


Figure 34. The ETMS DAT system architecture

The **server layer** is represented by the Geonode system and by the ETMS application server side, which was developed by Gisat. Geonode contains client for the users, which enables data upload, metadata fill-in, etc. ETMS application server is developed by Gisat, using the NodeJS platform. It is communicates with the MongoDB heavily to manipulate and read configurations. It also communicates with the PostGIS database, where it manipulates the views created above uploaded data and computes new sets of data through SQL. This database is very important, because it is source for preparing the charts and tables for the Data Analysis application. The ETMS application server also communicates with the Geonode system, when authenticating the user and when forwarding requests to Geoserver in the “proxy” module.

The **end-user side** (administrator, data uploader or public user) has 3 entry points, 3 web clients, where he is able to interact with the application. Data uploader uses Geonode client to upload the data, fill-in metadata, modify layers´ symbologies, manage the layers, etc. Administrator uses the Administration application to link existing Geonode layers to pre-defined abstract structures (configurations of objects), which he also defines here. Everyone is then able to access the Data Analysis Tool web interface, where it is possible to browse the data in an interactive manner. The client for the Data Analysis Tool application communicates heavily with the ETMS application server, where it requests: tables and charts, map layers (these requests are forwarded to the Geoserver at application server), configurations, areas (geographical units like regions, NUTS). This communication uses standard HTTP(S) protocol and in most cases AJAX calls are used.

9.3 ETMS Data in Timelines

9.3.1 Architecture

The ETMS Data in Timelines module is built as a graphical interface embedded as frame inside the Joomla CMS (Content Management System) used for the ETMS web portal based on a Document Object Model (DOM).

Data is imported in the system via an Excel table prepared from ETMS raw datasets obtained from external data provides (ESPON DB, EURSTAT, EEA, …) by automated VBA scripts contained in the ETMS database.

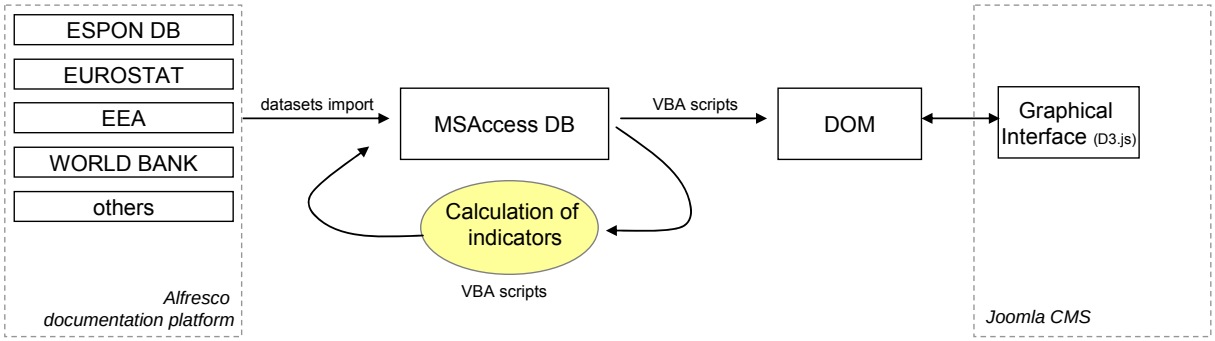


Figure 35. Architecture of the *Data in Timelines* module

9.3.2 Data Management

9.3.2.1 Database

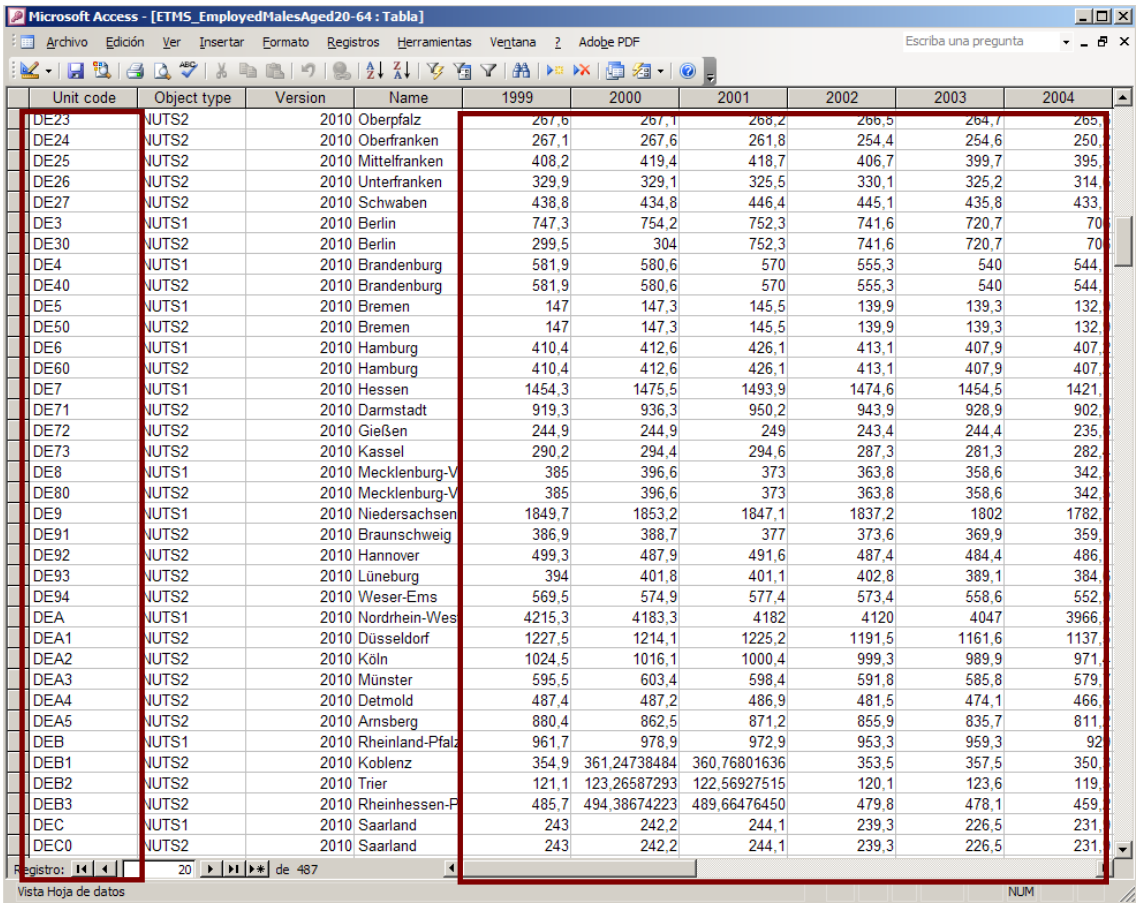
The “Data in Timelines” module is supported by an MSAccess database. The database is fed by the ETMS raw datasets, collected from official data providers (ESPON DB, EUROSTAT, EEA…), and stored in the ETMS Alfresco module

The database contains four (4) types of tables:

- ETMS datasets: there is a table for each ETMS dataset, as imported from the Alfresco server using the ESPON DB data and metadata templates.

  Basic dataset tables are codified as “ETMS_dataset_name”, where name stands for the name of the indicator. Forecast tables are codified as “ETMS_Forecast_dataset_name” and Europe in the World datasets are codified as “ETMS_Global_datasets_name”.

  All tables have the following data structure:
  - Unite code: it contains NUTS code
  - Object type: it contains data about nuts level: NUTS0, NUST1, NUSTS2 and NUTS3
  - Version: it contains the year of NUTS code updating
  - Name: it contains the name of each NUTS unit
  - It contains a column for each year successively



Unit code	Object type	Version	Name	1999	2000	2001	2002	2003	2004
DE23	NUTS2	2010	Oberpfalz	267,6	267,1	268,2	266,5	264,7	265,
DE24	NUTS2	2010	Oberfranken	267,1	267,6	261,8	254,4	254,6	250,
DE25	NUTS2	2010	Mittelfranken	408,2	419,4	418,7	406,7	399,7	395,
DE26	NUTS2	2010	Unterfranken	329,9	329,1	325,5	330,1	325,2	314,
DE27	NUTS2	2010	Schwaben	438,8	434,8	446,4	445,1	435,8	433,
DE3	NUTS1	2010	Berlin	747,3	754,2	752,3	741,6	720,7	70
DE30	NUTS2	2010	Berlin	299,5	304	752,3	741,6	720,7	70
DE4	NUTS1	2010	Brandenburg	581,9	580,6	570	555,3	540	544,
DE40	NUTS2	2010	Brandenburg	581,9	580,6	570	555,3	540	544,
DE5	NUTS1	2010	Bremen	147	147,3	145,5	139,9	139,3	132,
DE50	NUTS2	2010	Bremen	147	147,3	145,5	139,9	139,3	132,
DE6	NUTS1	2010	Hamburg	410,4	412,6	426,1	413,1	407,9	407,
DE60	NUTS2	2010	Hamburg	410,4	412,6	426,1	413,1	407,9	407,
DE7	NUTS1	2010	Hessen	1454,3	1475,5	1493,9	1474,6	1454,5	1421,
DE71	NUTS2	2010	Darmstadt	919,3	936,3	950,2	943,9	928,9	902,
DE72	NUTS2	2010	Gießen	244,9	244,9	249	243,4	244,4	235,
DE73	NUTS2	2010	Kassel	290,2	294,4	294,6	287,3	281,3	282,
DE8	NUTS1	2010	Mecklenburg-V	385	396,6	373	363,8	358,6	342,
DE80	NUTS2	2010	Mecklenburg-V	385	396,6	373	363,8	358,6	342,
DE9	NUTS1	2010	Niedersachsen	1849,7	1853,2	1847,1	1837,2	1802	1782,
DE91	NUTS2	2010	Braunschweig	386,9	388,7	377	373,6	369,9	359,
DE92	NUTS2	2010	Hannover	499,3	487,9	491,6	487,4	484,4	486,
DE93	NUTS2	2010	Lüneburg	394	401,8	401,1	402,8	389,1	384,
DE94	NUTS2	2010	Weser-Ems	569,5	574,9	577,4	573,4	558,6	552,
DEA	NUTS1	2010	Nordrhein-Wes	4215,3	4183,3	4182	4120	4047	3966,
DEA1	NUTS2	2010	Düsseldorf	1227,5	1214,1	1225,2	1191,5	1161,6	1137,
DEA2	NUTS2	2010	Köln	1024,5	1016,1	1000,4	999,3	989,9	971,
DEA3	NUTS2	2010	Münster	595,5	603,4	598,4	591,8	585,8	579,
DEA4	NUTS2	2010	Detmold	487,4	487,2	486,9	481,5	474,1	466,
DEA5	NUTS2	2010	Arnsberg	880,4	862,5	871,2	855,9	835,7	811,
DEB	NUTS1	2010	Rheinland-Pfalz	961,7	978,9	972,9	953,3	959,3	92
DEB1	NUTS2	2010	Koblenz	354,9	361,24738484	360,76801636	353,5	357,5	350,
DEB2	NUTS2	2010	Trier	121,1	123,26587293	122,56927515	120,1	123,6	119,
DEB3	NUTS2	2010	Rheinhessen-P	485,7	494,38674223	489,66476450	479,8	478,1	459,
DEC	NUTS1	2010	Saarland	243	242,2	244,1	239,3	226,5	231,
DEC0	NUTS2	2010	Saarland	243	242,2	244,1	239,3	226,5	231,

Figure 36. Structure of an ETMS dataset table in the MSAccess

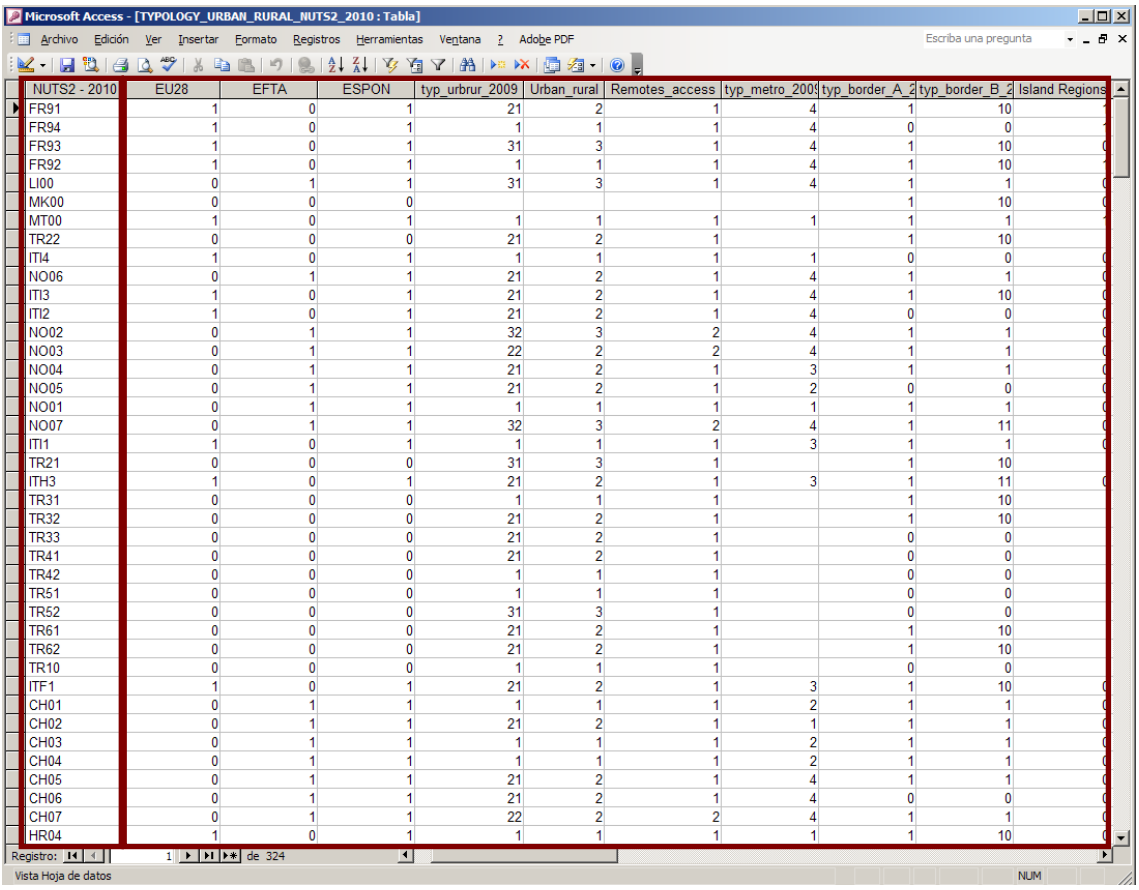
- Typology tables: these tables classify NUTS units under different typologies (e.g. urban-rural, KIT scientific regions, SIESTA EU2020S performance).

  Typology tables are codified as “TYPOLOGY_name_table“. There are 3 tables, corresponding to the typological classification of NUTS3, NUTS2 and NUTS0 respectively. All typologies are defined using NUTS 2010 versions. All tables have the same data structure:

  - NUTSX - 2010: it contains NUTS code at NUTS2 or NUTS3 level. This field allows linking typology tables to dataset tables. (previous bullet)
  - It contains a column for each typology. IDs of a typology allow linking typology tables with legend tables (next bullet).

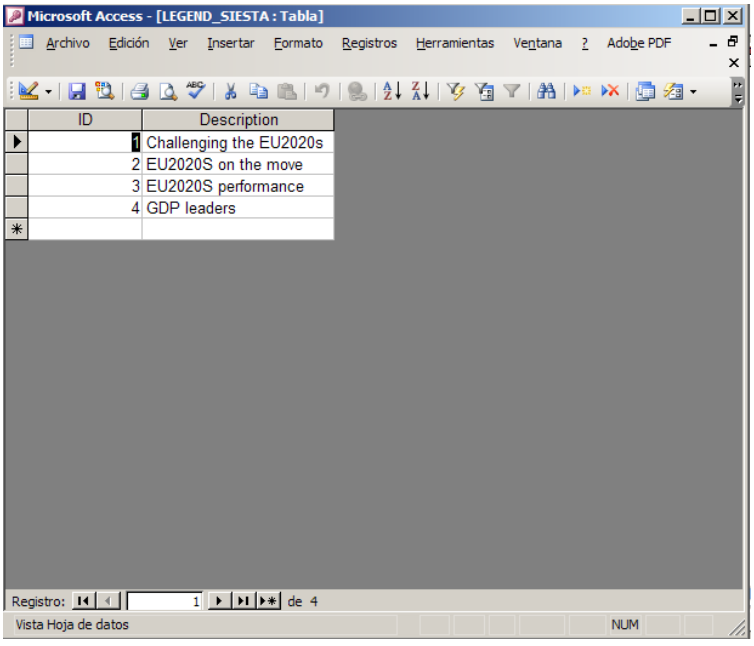
- Legend tables: these tables contain the description of each possible category within a typology. Legend tables are codified as “LEGEND_nametypology”. Twenty-four (24) legend tables are designed. All tables have the same data structure:

  - CODE/ ID: it contains the number scale for each typology. This field allows linking typology tables with legend tables.
  - Description: it contains de description of each number



NUTS2 - 2010	EU28	EFTA	ESPON	typ_urbrur_2009	Urban_rural	Remotes_access	typ_metro_200	typ_border_A_2	typ_border_B_2	Island Regions
FR91	1	0	1	21	2	1	4	1	10	
FR94	1	0	1	1	1	1	4	0	0	
FR93	1	0	1	31	3	1	4	1	10	0
FR92	1	0	1	1	1	1	4	1	10	
LI00	0	1	1	31	3	1	4	1	1	0
MK00	0	0	0					1	10	0
MT00	1	0	1	1	1	1	1	1	1	
TR22	0	0	0	21	2	1		1	10	
ITI4	1	0	1	1	1	1	1	0	0	0
NO06	0	1	1	21	2	1	4	1	1	0
ITI3	1	0	1	21	2	1	4	1	10	0
ITI2	1	0	1	21	2	1	4	0	0	0
NO02	0	1	1	32	3	2	4	1	1	0
NO03	0	1	1	22	2	2	4	1	1	0
NO04	0	1	1	21	2	1	3	1	1	0
NO05	0	1	1	21	2	1	2	0	0	0
NO01	0	1	1	1	1	1	1	1	1	0
NO07	0	1	1	32	3	2	4	1	11	0
ITI1	1	0	1	1	1	1	3	1	1	0
TR21	0	0	0	31	3	1		1	10	
ITH3	1	0	1	21	2	1	3	1	11	0
TR31	0	0	0	1	1	1		1	10	
TR32	0	0	0	21	2	1		1	10	
TR33	0	0	0	21	2	1		0	0	
TR41	0	0	0	21	2	1		0	0	
TR42	0	0	0	1	1	1		0	0	
TR51	0	0	0	1	1	1		0	0	
TR52	0	0	0	31	3	1		0	0	
TR61	0	0	0	21	2	1		1	10	
TR62	0	0	0	21	2	1		1	10	
TR10	0	0	0	1	1	1		0	0	
ITF1	1	0	1	21	2	1	3	1	10	0
CH01	0	1	1	1	1	1	2	1	1	0
CH02	0	1	1	21	2	1	1	1	1	0
CH03	0	1	1	1	1	1	2	1	1	0
CH04	0	1	1	1	1	1	2	1	1	0
CH05	0	1	1	21	2	1	4	1	1	0
CH06	0	1	1	21	2	1	4	0	0	0
CH07	0	1	1	22	2	2	4	1	1	0
HR04	1	0	1	1	1	1	1	1	10	0

Figure 37. View NUTS2 typology table



ID	Description
1	Challenging the EU2020s
2	EU2020S on the move
3	EU2020S performance
4	GDP leaders

Figure 38. Legend table for ESPON SIESTA EU2020S Performance Typology

- Indicator tables per typology: these tables contain the evolution over time of ETMS indicators at a typology level (aggregates, averages, depending on the indicator). There are 3 tables: for European Trends, for Europe in the World and for European Forecasts.

  These are the tables imported into the DOM of the Data in Timelines module

  All tables have the same data structure:
  - Indicator: it contains the name of the final indicator
  - Units: it contains the unit of each indicator: %, €, inhabitants, €/ inhabitant…
  - IndDescription: it contains the description of each indicator and data source.
  - Typology: it contains the name of the typology
  - Description: it contains the category within each typology. The indicator results are aggregated at this level.
  - It contains a column for each year which. The ETMS indicators are aggregated at typology level.

1_European Trends : Tabla

Indicator	Units	IndDescription	Tipology	Description	2000	2001	2002	2003
Birth rate	‰	Children born y	Northern countries	Estonia	9,5476108744	9,2175405407	9,4766397158	9,6132502977
Birth rate	‰	Children born y	EU2020 performance	EU2020S on th	10,346525626	10,100771373	9,9715435439	10,007410965
Birth rate	‰	Children born y	EU2020 performance	EU2020S perfo	11,490941397	11,18282703	11,119315649	11,196446852
Birth rate	‰	Children born y	EU2020 performance	GDP leaders	13,872316963	14,150583759	13,529625979	13,887683542
Birth rate	‰	Children born y	Scientific regions	Scientific regior	11,679483489	11,435406528	11,370438398	11,464513074
Birth rate	‰	Children born y	Scientific regions	Research inten	10,026591144	9,7483901244	9,6352852984	9,5141964813
Birth rate	‰	Children born y	Scientific regions	Regions with nc	10,33458527	10,064651660	9,9176177782	9,9283732569
Birth rate	‰	Children born y	Northern countries	Poland	9,8880120203	9,6252792685	9,2506453016	9,1859103637
Birth rate	‰	Children born y	Northern countries	Denmark	19,135950541	18,600870667	18,155844734	18,280462903
Birth rate	‰	Children born y	Eastern-Western divide	Western Europ	10,923594407	10,731619545	10,618595706	10,691205845
Birth rate	‰	Children born y	Northern countries	Finland	10,972478498	10,844962909	10,694140273	10,877216908
Birth rate	‰	Children born y	Northern countries	Germany	9,3350360346	8,9288744809	8,7244942277	8,5728672391
Birth rate	‰	Children born y	Northern countries	Iceland	15,481152056	14,433884691	14,132426066	14,386194799
Birth rate	‰	Children born y	Northern countries	Latvia	8,5241097277	8,3819725128	8,6718576311	9,1985265657
Birth rate	‰	Children born y	Northern countries	Lithuania	9,723314486	8,9432227951	8,5511155007	8,7358374494
Birth rate	‰	Children born y	Urban Rural (OECD)	Predominantely	11,101208360	10,929021642	10,915381791	11,019417625
Birth rate	‰	Children born y	Scientific regions	Human capital i	11,061398849	10,936222358	10,938189987	11,258373847
Birth rate	‰	Children born y	Structural funds eligibility 2014 - 2020	Transition regio	10,518970131	10,402009593	10,249809397	10,368072196
Birth rate	‰	Children born y	Urban Rural (OECD)	Intermediate	10,4019209	10,158355578	10,018211038	10,055339505
Birth rate	‰	Children born y	Urban Rural (OECD)	Predominantely	10,340712264	10,019068210	9,8537884895	9,8898137166
Birth rate	‰	Children born y	Urban Rural (DG Regio)	Urban	11,101208360	10,929021642	10,915381791	11,019417625
Birth rate	‰	Children born y	Urban Rural (DG Regio)	Intermediate ac	10,415452983	10,16586894	10,022831078	10,058663773
Birth rate	‰	Children born y	Urban Rural (DG Regio)	Intermediate rer	1883415128487	9,834170107	9,8166038865	9,9034800674
Birth rate	‰	Children born y	Urban Rural (DG Regio)	Rural accessibl	10,360454703	10,022512779	9,8435575105	9,7838807398
Birth rate	‰	Children born y	EU2020 performance	Challenging the	10,342543727	10,257766855	10,207887214	10,340347622
Birth rate	‰	Children born y	Structural funds eligibility 2014 - 2020	Less developed	10,219170495	9,8494339434	9,6544116457	9,647212369
Birth rate	‰	Children born y	Eastern-Western divide	Central and Eas	9,9775016017	9,5055088103	9,4898259645	9,53262775
Birth rate	‰	Children born y	Structural funds eligibility 2014 - 2020	More developed	10,900570309	10,69779447	10,663161218	10,744692915
Birth rate	‰	Children born y	Metropolitan regions	Other regions	10,298770995	9,9923899951	9,8476608275	9,8808812106
Birth rate	‰	Children born y	Metropolitan regions	Capital metros	11,947319790	11,803595242	11,831891734	12,072038544
Birth rate	‰	Children born y	Metropolitan regions	Second Tier me	10,640234614	10,452777108	10,399036392	10,378069483
Birth rate	‰	Children born y	Metropolitan regions	Smaller metros	10,476533441	10,268660655	10,127710796	10,192688330
Birth rate	‰	Children born y	ESPON Area	ESPON Area	10,671920078	10,438672072	10,34262337	10,407387217
Birth rate	‰	Children born y	Northern countries	Sweden	10,206145151	10,296987704	10,754700123	11,090409481
Birth rate	‰	Children born y	Urban Rural (DG Regio)	Rural remote	10,276988199	10,007872703	9,8864535313	10,228635995

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Figure 39. Table with European Trend indicators by typology

1_FORECAST : Tabla

Indicator	Units	IndDescription	Tipology	Description	2000	2001	2002	2003	2004
Total population	inhabitants	Total residents	Southern countries	Greece	10903757	10931206	10968708	11006377	11040650
Total population	inhabitants	Total residents	Northern countries	Lithuania	3512074	3486998	3475586	3462553	3445857
Total population	inhabitants	Total residents	Northern countries	Norway	4478497	4503436	4524066	4552252	4577457
Total population	inhabitants	Total residents	Northern countries	Poland	38263303	38253955	38242197	38218531	38190608
Total population	inhabitants	Total residents	Northern countries	Sweden	8861426	8882792	8909128	8940788	8975670
Total population	inhabitants	Total residents	Western countries	Austria	8002186	8020946	8063640	8100273	8142573
Total population	inhabitants	Total residents	Western countries	Belgium	10239085	10263414	10309725	10355844	10396421
Total population	inhabitants	Total residents	Western countries	France	59232795	59663371	60104236	60540682	60965137
Total population	inhabitants	Total residents	Western countries	Germany	82163475	82259540	82440309	82536680	82531671
Total population	inhabitants	Total residents	Western countries	Ireland	3777565	3832783	3899702	3964191	4028851
Total population	inhabitants	Total residents	Western countries	Liechtenstein	32426	32863	33525	33863	34294
Total population	inhabitants	Total residents	Western countries	Luxembourg	433600	439000	444050	448300	454960
Total population	inhabitants	Total residents	Western countries	Switzerland	7164444	7197638	7255653	7313863	7364148
Total population	inhabitants	Total residents	Northern countries	Latvia	2381715	2364254	2345768	2331480	2319203
Total population	inhabitants	Total residents	Southern countries	Cyprus	690497	697549	705539	715137	730367
Total population	inhabitants	Total residents	Western countries	Netherlands	15863950	15987075	16105285	16192572	16258032
Total population	inhabitants	Total residents	Southern countries	Italy	56929477,063	56967734,969	56993742	57321070	57888245
Total population	inhabitants	Total residents	Southern countries	Malta	380201	391415	394641	397296	399867
Total population	inhabitants	Total residents	Southern countries	Portugal	10195014	10256658	10329338	10407463	10474685
Total population	inhabitants	Total residents	Southern countries	Slovenia	1987755	1990094	1994026	1995033	1996433
Total population	inhabitants	Total residents	Southern countries	Spain	40049708	40476723	40964244	41663702	42345342
Total population	inhabitants	Total residents	Eastern countries	Bulgaria	8190876	8149468	7891095	7845841	7801273
Total population	inhabitants	Total residents	Eastern countries	Croatia					
Total population	inhabitants	Total residents	Eastern countries	Czech Republic	10278098	10266546	10206436	10203269	10211455
Total population	inhabitants	Total residents	Eastern countries	Hungary	10221514	10200298	10174853	10142362	10116742
Total population	inhabitants	Total residents	Eastern countries	Romania	22455485	22430457	21833483	21772774	21711252
Total population	inhabitants	Total residents	Eastern countries	Slovakia	5398657	5378783	5378951	5379161	5380053
Total population	inhabitants	Total residents	Eastern countries	Slovenia	1987755	1990094	1994026	1995033	1996433
Total population	inhabitants	Total residents	Urban Rural (OECD)	Intermediate	161928037,20	162160918,5	161698007,84	161974040,6	162286721,03
Total population	inhabitants	Total residents	Southern countries	Croatia					
Total population	inhabitants	Total residents	Urban Rural (DG Regio)	Urban	295924455,46	297062897,28	298318216,29	299962727,90	301717738,78
Total population	inhabitants	Total residents	Metropolitan regions	Smaller metros	153204547,61	153600436,85	153926622,1	154481228,09	155080303,1
Total population	inhabitants	Total residents	Metropolitan regions	Second Tier metros	166659285,97	167171799,82	167308193,73	168078946,29	168899368,73
Total population	inhabitants	Total residents	Metropolitan regions	Other regions	63955562,416	64053160,492	63978123,736	64137046,746	64315291,679
Total population	inhabitants	Total residents	Metropolitan regions	Capital metros	96299470,844	96703635,938	97136192,063	97653087,125	98197518,313

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Figure 40. Table with European Forecast indicators by typology

1_Europe in the World : Tabla

Indicator	Units	IndDescription	Description	1961	1962	1963	1964	1965
Total population	inhabitants	Total residents	Advanced economies	296905000	300984000	305018000	309040000	312864000
Total population	inhabitants	Total residents	BRIC countries	1315181064,9	1333609416,4	1363554083,4	1393324224,9	1424261701
Total population	inhabitants	Total residents	ESPON Area	422101056	425957633	429853279	433678256	437301364
Total population	inhabitants	Total residents	Neighborhood	168420219,4	172147961,8	175896658,2	179677185,6	183457627
Total population	inhabitants	Total residents	Other countries	1668695684,3	1707339949,1	1746559273	1787214230,2	1828681577
Cash surplus (+) or deficit (-)	%	Public deficit / s	Advanced economies					
Cash surplus (+) or deficit (-)	%	Public deficit / s	BRIC countries					
Cash surplus (+) or deficit (-)	%	Public deficit / s	ESPON Area					
Cash surplus (+) or deficit (-)	%	Public deficit / s	Neighborhood					
Cash surplus (+) or deficit (-)	%	Public deficit / s	Other countries					
Central government debt	%	Central governn	Advanced economies					
Central government debt	%	Central governn	BRIC countries					
Central government debt	%	Central governn	ESPON Area					
Central government debt	%	Central governn	Neighborhood					
Central government debt	%	Central governn	Other countries					
Current account balance	%	Current accoun	Advanced economies					
Current account balance	%	Current accoun	BRIC countries					
Current account balance	%	Current accoun	ESPON Area					
Current account balance	%	Current accoun	Neighborhood					
Current account balance	%	Current accoun	Other countries					
Domestic credit to private sector	%	Domestic credit	Advanced economies	70,581219288	74,216218070	79,363326631	80,960806521	84,032242495
Exports of goods and services	%	Exports of gooc	Neighborhood	14,698881659	11,397453963	11,596703544	11,793085008	11,607569804
Exports of goods and services	%	Exports of gooc	Other countries	8,4841485905	8,6393600963	8,7966907986	8,9929559246	8,7857251018
Foreign direct investment	%	Foreign direct in	Advanced economies					
Foreign direct investment	%	Foreign direct in	BRIC countries					
Domestic credit to private sector	%	Domestic credit	BRIC countries	14,550237025	13,169455567	12,260805453	11,123207101	11,579117865
Domestic credit to private sector	%	Domestic credit	ESPON Area	37,212313297	38,287653836	41,796513462	42,582149834	43,639251465
Domestic credit to private sector	%	Domestic credit	Neighborhood	12,680627271	14,114618074	14,060776617	14,756461377	16,948349234
Domestic credit to private sector	%	Domestic credit	Other countries	61,295752238	61,474665177	65,037697021	67,117224772	68,738560037
Exports of goods and services	%	Exports of gooc	Advanced economies	6,6982415893	6,6682155619	6,6982292094	7,0646971918	7,1514696135
Exports of goods and services	%	Exports of gooc	BRIC countries	5,9540717281	3,9667635580	6,9050035888	5,1579051422	5,7774885024
Exports of goods and services	%	Exports of gooc	ESPON Area	20,819510379	20,268682712	20,083670124	20,192728787	20,458461800
Foreign direct investment	%	Foreign direct in	ESPON Area					
Foreign direct investment	%	Foreign direct in	Neighborhood					
Foreign direct investment	%	Foreign direct in	Other countries					

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Figure 41. Table with Europe in the World indicators by regional aggrgates

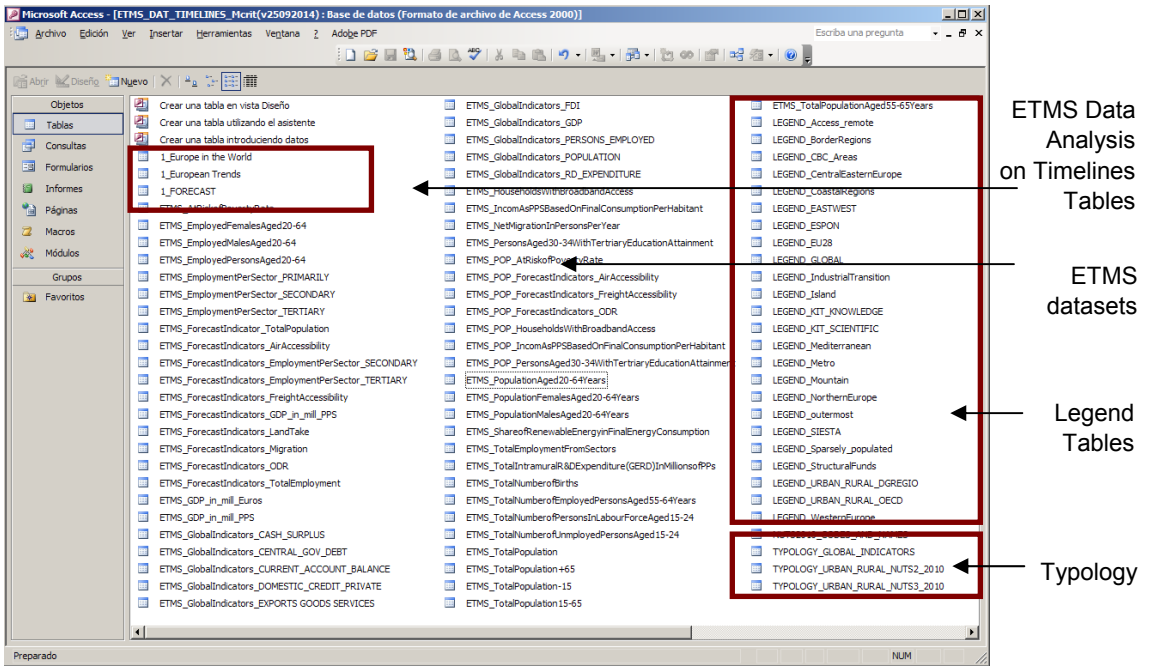


Figure 42. View of all tables of ETMS.

9.3.2.2 VBA scripts

In order to calculate ETMS indicators systematized, 6 scripts have been programmed in VBA. The aims of these scripts are to automate the calculation of *Indicator tables per typology* from raw datasets imported from external providers. The scripts establish the necessary links between datasets, typologies and legend tables and run the queries needed to produce *Indicator tables per typology*, which are the ones to be imported into the DOM.

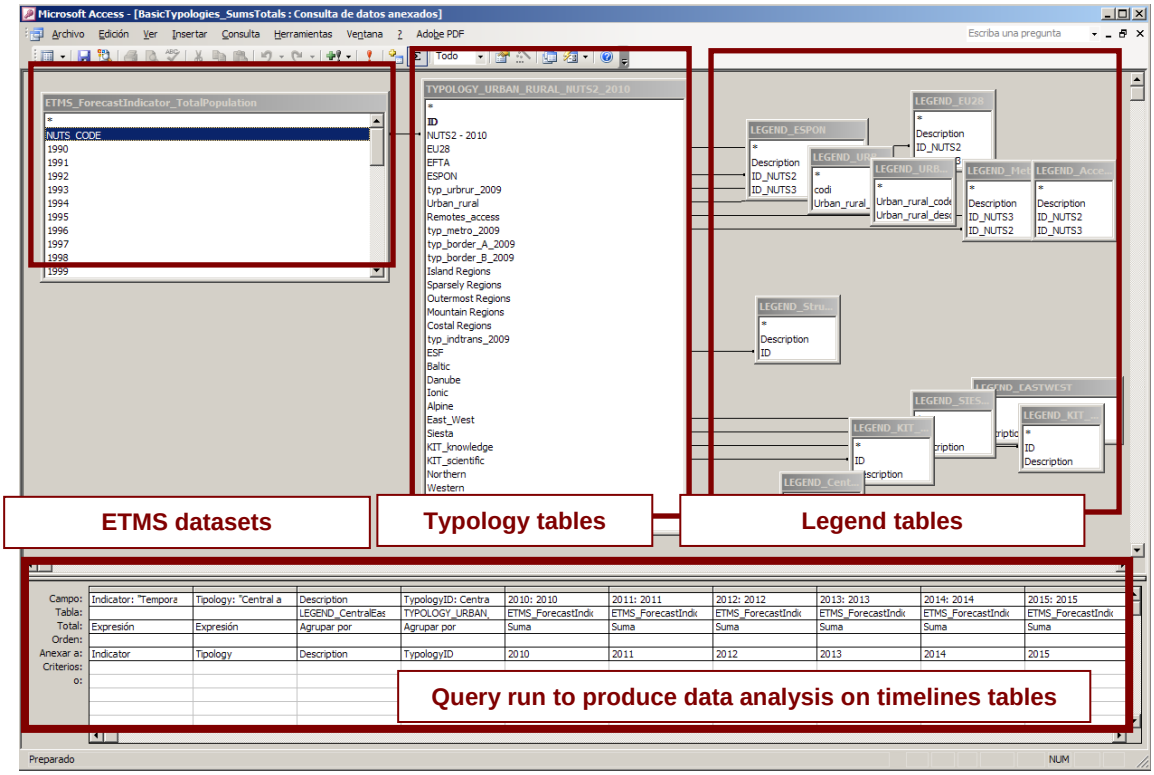


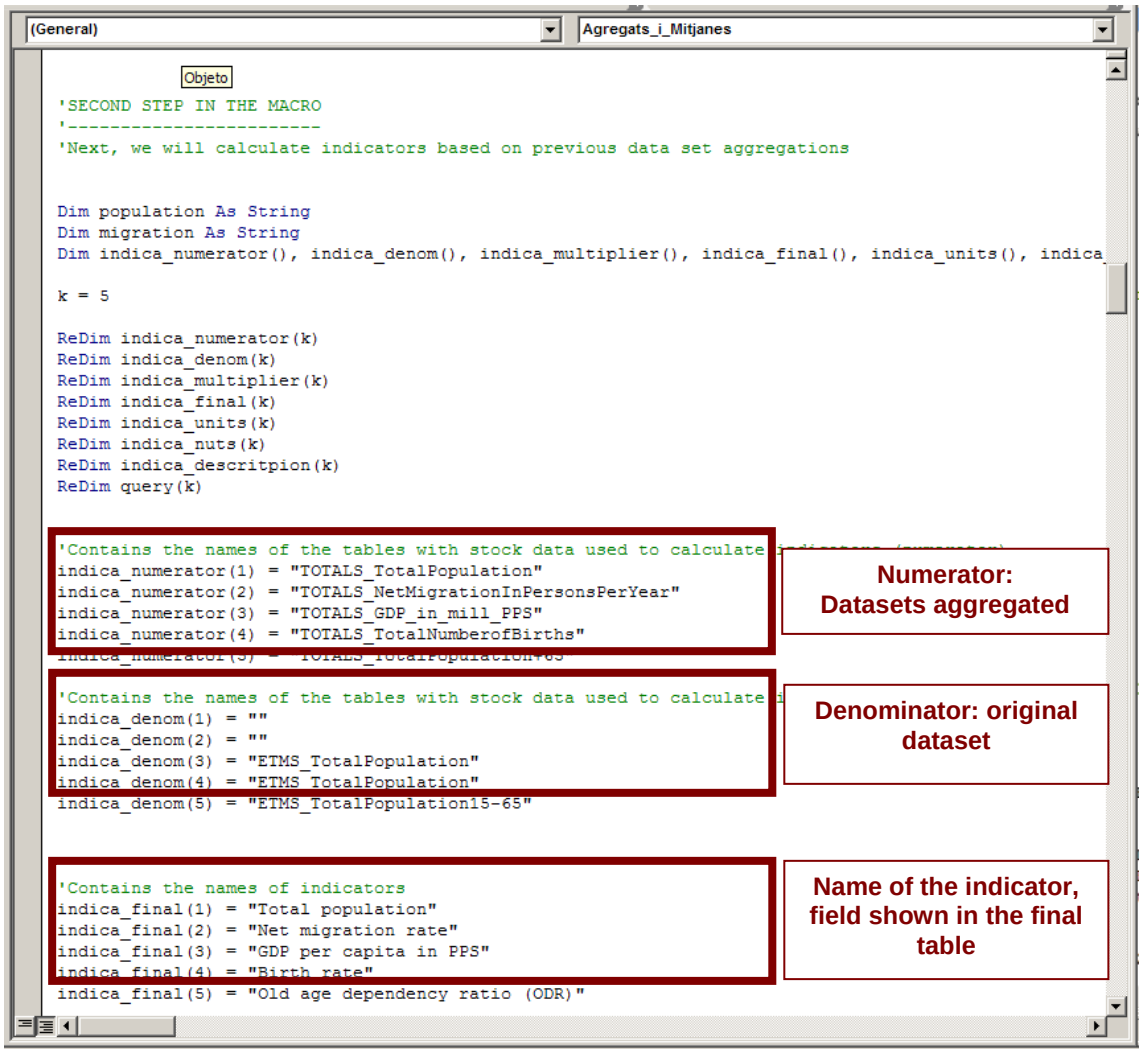
Figure 43. Links between ETMS datasets and typology and legend tables. Query to be run to produce Data Analysis on Timelines

Each script has in 2 steps:

1. First step: aggregates datasets by typology. For any of the datasets available (all in stock), values are added for any nuts sharing a common typology.

Figure 44. First script step "typological aggregation"

2. Second step: calculation of indicators. This script calculates indicators based on the aggregation performed in the previous step. Variables (numerator, denominator, multipliers, name, description and units of the indicators) are defined individually for each indicator in order to systematize the script:



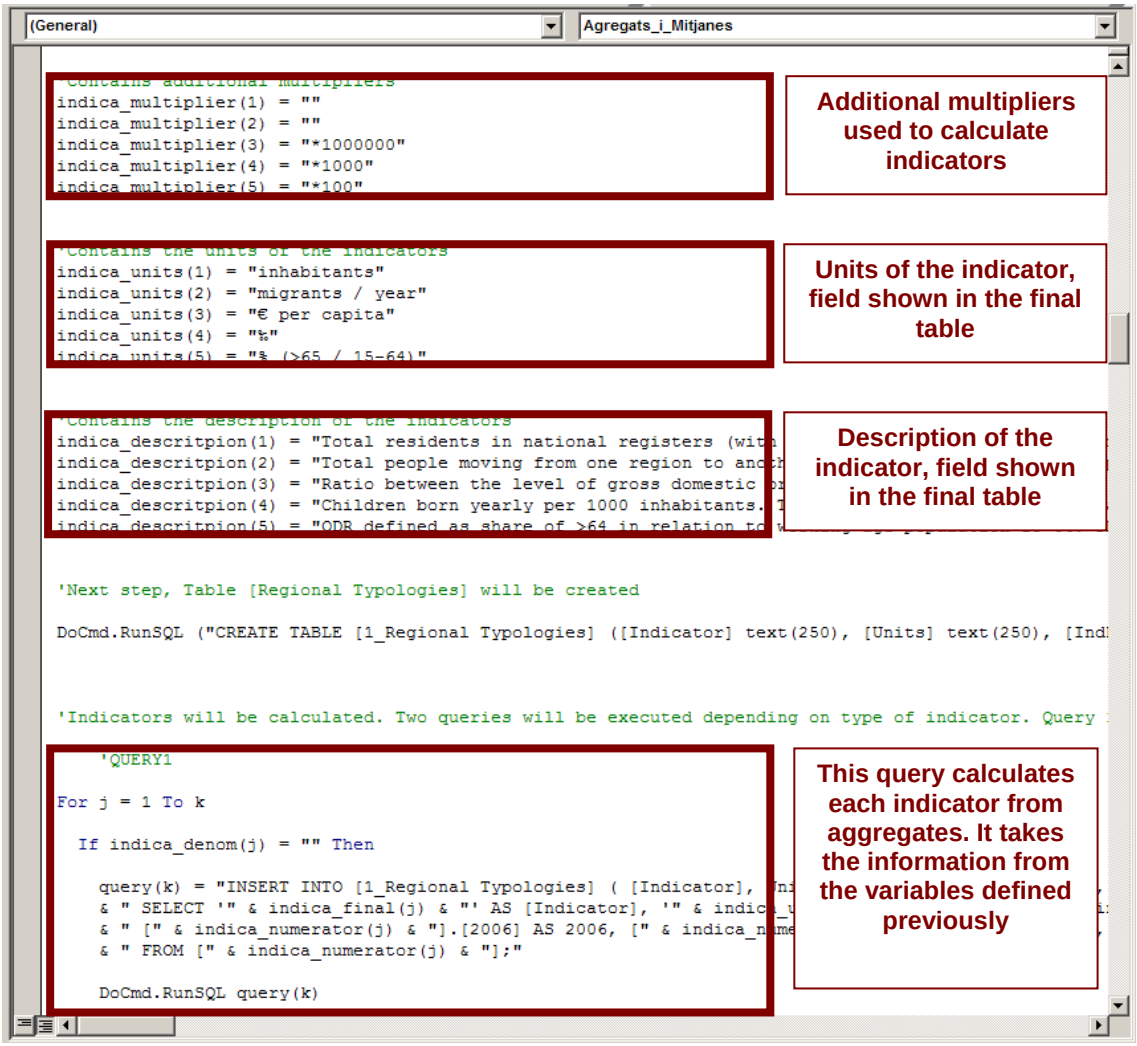


Figure 45. Second script step “indicator calculation”

The following code is needed for proper aggregation of indicators when null values are present in indicator numerators for a number of NUTS units. This code prevents from considering such NUTS units in the denominator.

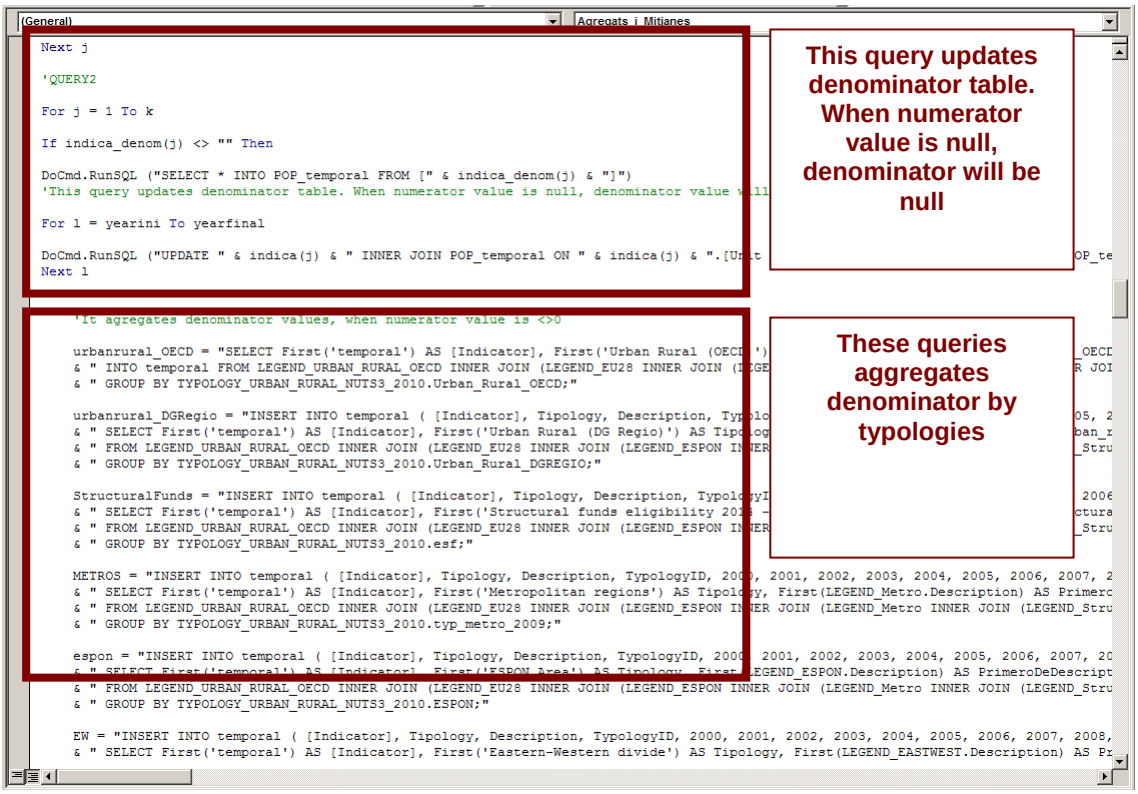


Figure 46. Denominator SCRIPT to improve final results

9.3.3 Graphical interface

9.3.3.1 Technical specifications

Graphical data of the “ETMS Data in Timelines” is shown as frame inside the Joomla CMS (Content Management System) used in ETMS web portal.

The technology used in order to manage interactive graphics is based on html5: css, html and javascript, including specific libraries like “jQuery” (multi-purpose library), “d3” (graphical library), and one d3 extension from MIT called “d3.legend” that allow developers work with legends. The end graphics are compatible with most common browsers like Firefox, Chrome, Safari, Opera and newest versions of Internet Explorer. “JQuery” used version is 1.9.1 and 3.4.8 for “d3”.

Data sources are exported as multiple text-plain files (utf-8 encoded) from source database. Data is read via ajax calls and send to svg objects that are dynamically created when pages are loaded. Interactivity between user and graphics is done by “select” “form” components and javascript.

SVG is a powerful xml 2D-image format that supports interactivity animation, currently integrated in browsers and without the need of third part applications installation.

9.3.3.2 Component libraries

jQuery (http://jquery.com/) is a fast feature-rich JavaScript library. It makes HTML documents traversal and manipulation, event handling, animation, and Ajax much simpler, with an easy-to-use API that works across a multitude of browsers.

D3.js (http://d3js.org/) is a JavaScript library for manipulating documents based on data. D3 helps you bring data to life using HTML, SVG and CSS. D3’s emphasis on web standards gives you the full capabilities of modern browsers without tying yourself to a proprietary framework, combining powerful visualization components and a data-driven approach to DOM (Document Object Model) manipulation.

jQuery and D3.js are open source copyrights free libraries, with no use restrictions.

9.3.3.3 Compatibility

jQuery and D3.js support IE9+, Chrome, Firefox, Safari 5.1+, Opera 12.1x, iOS 6.1+ and Android 2.3, 4.0+.

9.4 ETMS Documentation System

A crucial aspect for ensuring ETMS sustainability towards the future is system documentation.

“To document” means “to record the details of an event, a process, etc.” Therefore, storing all the details about ETMS will be the way to have the system well-documented and, therefore, to ensure it can be maintained and updated in the future.

The ETMS documentation covers basically four big aspects:

- ETMS Indicators: indicators, their metadata and calculation procedures
- ETMS Tools: software design and functional specifications
- ETMS Products: Facts & Figures and State of Territory Reports
- ETMS System Reports: testing, sustainability and business plan reports

9.4.1 The Alfresco Content Management System

All the documentation in relation to the ETMS should be safely stored, and a mechanism of revision and update should be established within the ETMS Sustainability report.

We have set up a shared documentation system based on open source technology, named Alfresco[12], which is a cloud connected content platform that allows secure file sharing, versioning control, access documents on any device, collaborate on content, automation of processes like document format conversions, etc. Moreover, all information is regularly backed up to prevent the system from any information loss.

Alfresco has been used during the project development in order to share content amongst partners, but it is also proposed as the platform for ETMS documentation.

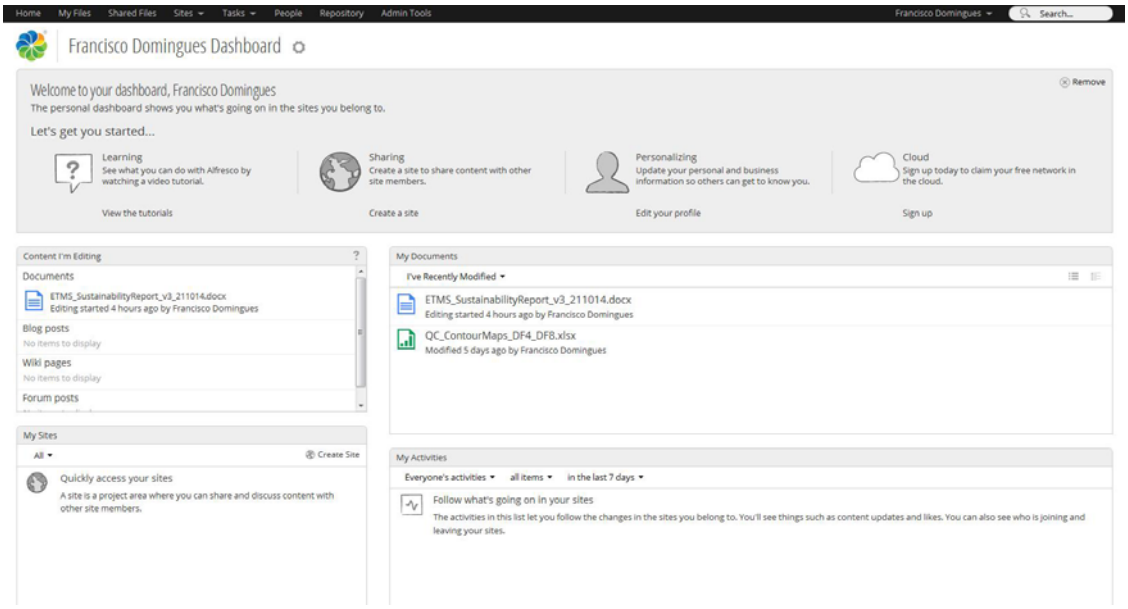


Figure 47. Homepage of standard user in Alfresco

In this content management system all types of file formats can be uploaded and downloaded and some of them either edited online or offline. The ability to have a common workspace where users from different places around the world can work together is what best suits the ETMS group to use this product, among other very particular tools.

In Alfresco, the ETMS group has been able to share a particular folder structure designed for their needs, with security privileges, and the possibility to access through a web browser or an ftp client, like Filezilla. All data uploaded to alfresco keep a record of who are the responsible/owner and other features like, date, hour, description and type of document.

[12] For more references, go to http://www.alfresco.com/products

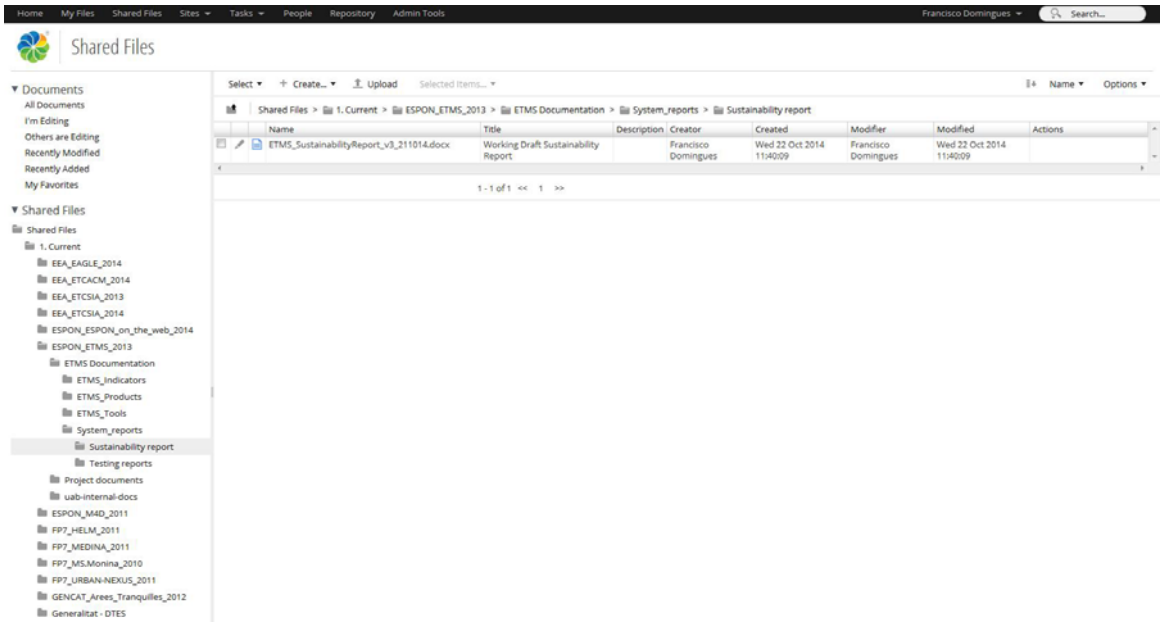


Figure 48. File system table view in Alfresco

The users are able to manage versions, so each time they upload and substitute a version of a document for another, the track of what has been done in the past is saved, and the user can go back and retrieve whatever document he needs. Basically, every document uploaded has a backup, being or not replaced by a newer version.

The edition is mainly done offline, this means the user download the document/file, and it stays blocked until the user uploads another version. All the members can read which user is blocking the file and can download the last version uploaded. The option to edit online is restricted to txt and html files; to edit word or excel files, for example, the files should be integrated with google docs[13].

[13] For more references, go to http://docs.google.com

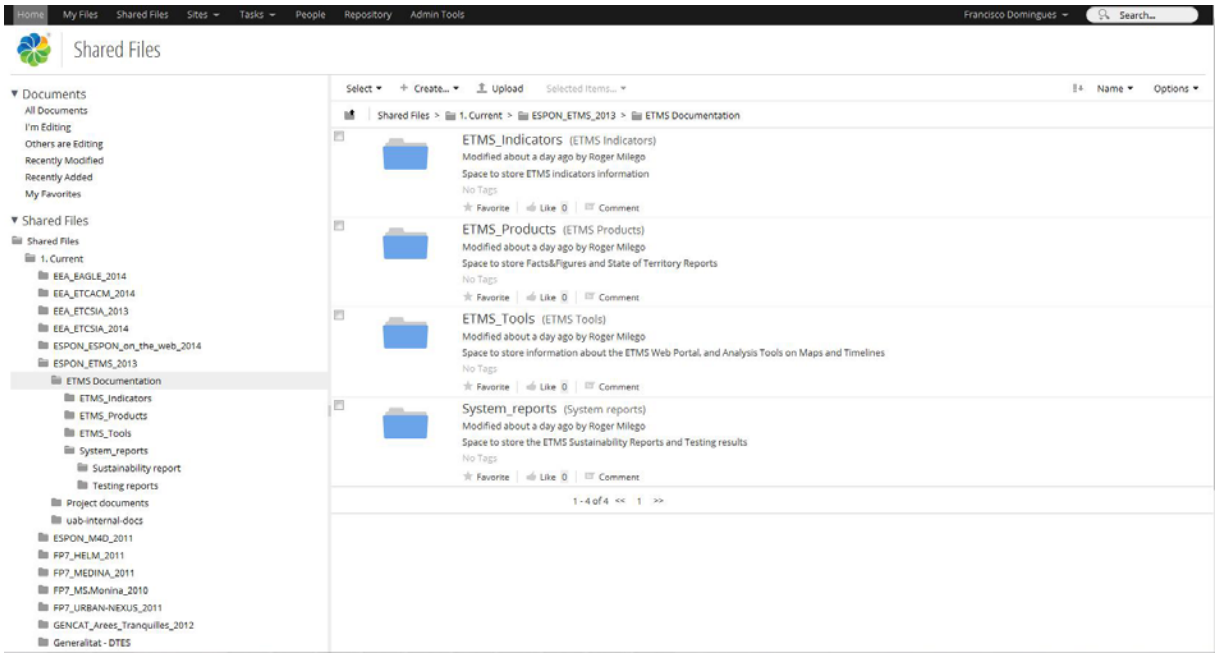


Figure 49. Detailed view of folders in Alfresco

Additionally, users can easily share their folders/files by sending a unique link. Any user with privileges will go directly to the workspace/file shared and is able to see the same as the owner, depending on its privileges. Alfresco permits as well more than 5 types of workspace views, hide folders, filter by, ordering and search items.

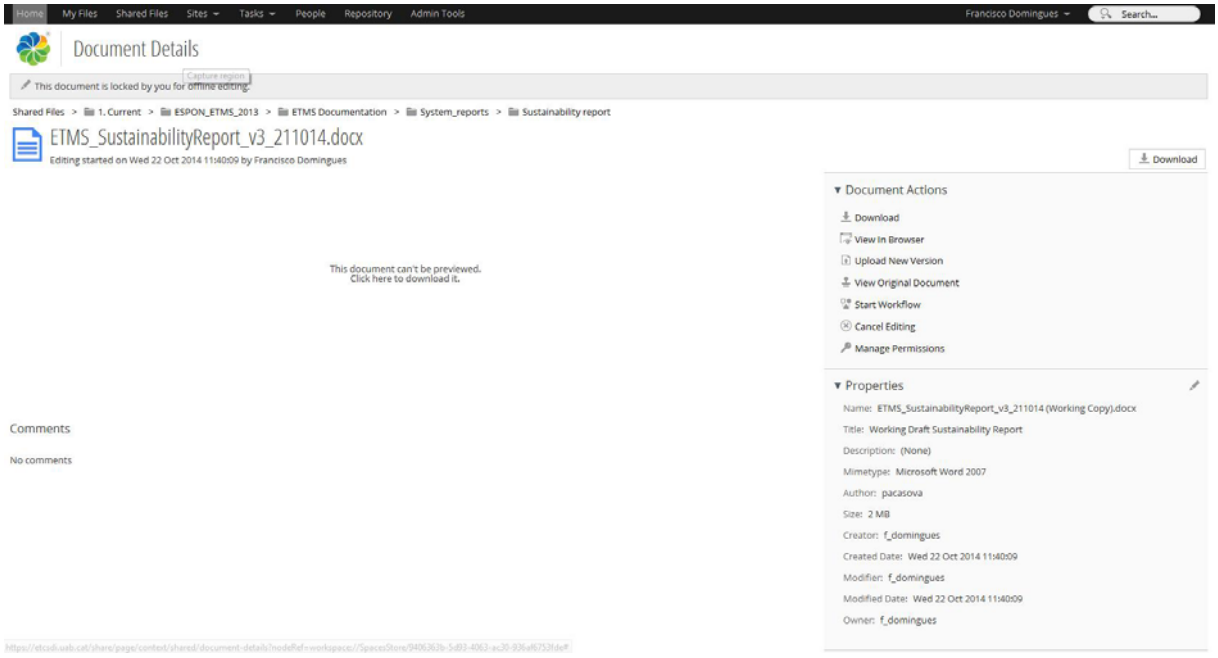


Figure 50. Properties view of file in Alfresco

In this regard, the Alfresco CMS, being an open-source technology, has been adopted as the Documentation System for ETMS, both during the development of the project and also to ensure its sustainability.

9.4.2 ETMS Documentation Platform Structure

Currently, this is the folder tree of the ETMS Documentation:

- ETMS Indicators
  - Compass indicators
    - ETMS-CON (Access to territory and services) – 9 indicators
    - ETMS-ECO (Economic Competitiveness) – 15 indicators
    - ETMS-ENV (Environmental Qualities) – 4 indicators
    - ETMS-HUM (Human Capital) – 6 indicators
    - ETMS-SOC (Social inclusion) – 6 indicators
  - Templates and procedures
- System reports
  - Sustainability report
  - Testing reports
- ETMS Products
  - Facts&figures Reports
  - State of Territory Reports
- ETMS Tools
  - ETMS Web Portal
  - ETMS Data Analysis - Maps
  - ETMS Data Analysis - Timelines