ESPON

CityBench
ESPON CityBench for benchmarking European Urban Zones

Draft Final Report

Scientific Platform / Tools 2013/3/10

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This report presents a more detailed overview of the analytical approach to be applied by the project. This Scientific Platform and Tools Project is conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

Information on the ESPON Programme and projects can be found on www.espon.eu

The web site provides the possibility to download and examine the most recent documents produced by finalised and ongoing ESPON projects.

This basic report exists only in an electronic version.

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List of authors

Geodan: Eduardo Dias
Robert Oortwijn

UJI: Ana Sanchis

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1. Introduction / Executive summary

This CityBench Draft Final Report reports on the on-going efforts in:

- Development of the Webtool prototype towards a draft final version, including an 'Admin Tool';
- Expanding the harvesting of social media data to enable the creation of several Volunteered Geographic Information (VGI) indicators;
- Including LUZ typologies & Transnational Cooperation Programmes in the Webtool;
- The operationalization of the final list of indicators and including them in the Webtool;
- Finalizing dissemination tools, including the communication platform;
- Communication and interaction with stakeholders.

ESPON CU/MC provided the TPG with a (draft) Response document regarding CityBench Intermediate Deliverable II. This, together with the feedback received during the presentation of the CityBench Webtool prototype on the 23th of September 2013, has been used as input for the development of a draft final version of the Webtool. This version includes a very important feature called the 'Admin Tool', which is a functionality enabling a stakeholder administrator to add, modify and/or delete themes and indicators as required. Since numerous data sources, including ESPON and Eurostat, are constantly creating and updating indicators, the Admin Tool guarantees the sustainability of the Webtool after completion of the CityBench project.

2. Activity Report

This Chapter provides a short reporting on the activities, planned and/or realized within the framework of the European Urban Benchmarking Webtool project, the resolution of problems and the definition of delimitations.

Working towards a Webtool survey among stakeholders

In order to populate the Webtool with data, many potential data / indicator sources and the data / indicators they contain have been studied. This study resulted in the proposed list of themes and indicators to be initially included, as presented in Section 7.3 and Annex II of Intermediate Deliverable II (ID II). However, this selection by the TPG may not necessarily reflect the optimal theme and indicator set according to the stakeholders.

A survey had been developed and was pre-tested during the USESPON workshop in Berlin on the 26th of September 2013. Since then however, the Webtool has evolved, also incorporating the comments received from CityBench SG during a meeting held in Luxembourg on the 23th of September 2013. Therefore, a final version of the survey will be submitted to stakeholders once the draft final version of the Webtool is available (after the 30th of November 2013).

The survey among the stakeholders will gather preferences on theme and indicator needs. The stakeholders may then select the ones most important to them and also propose new themes and/or indicators. The outcome of this survey may lead to a set of themes and indicators differing from the one currently proposed by the TPG. The survey will also include sections on the representation of the Webtool and the dissemination tools related to it. The survey results will be presented in the Final Report.

Development of Webtool prototype towards a draft final version

After presentation of the CityBench Webtool prototype to CityBench SG by the TPG during the Luxembourg meeting and building upon the feedback received during the USESPON workshop in Berlin, prototype development towards a draft final version of the Webtool continued. One of the focus points has been the implementation of ‘admin functionality’, i.e. the creation of a user interface enabling ‘admins’ (stakeholder specialists) to upload additional or updated data / indicators to the Webtool.

Expanding the harvesting of social media data

The harvesting of Social media data (VGI) for populating several indicators has continued, now including all 1st tier LUZ areas.

Including LUZ typologies & TNC

ESPON CU has indicated that the Webtool should facilitate the selection of LUZ areas according to a particular typology or Transnational co-operation programme (TNC). To enable this, tables with TNCs and (relevant) typologies have been prepared and linked to the LUZ table in the database.

Operationalization of indicators and including them in Webtool

The operationalization of the proposed indicators was elaborated in the Appendix to Annex II – Indicators Report. Based on the (official) ESPON CU response to ID II and on the outcome of the survey among stakeholders, operationalization of the final set of indicators will be performed shortly, to be included in the Final Report.

Finalizing dissemination tools

Building upon the stakeholder survey results, the draft version of the communication platform (a social network connected to an easy-presentation web page) has been developed into a draft final version.

Communication and interaction with stakeholders

It is of crucial importance that both stakeholders and ESPON CU be closely involved when performing the tasks described here. The TPG is ensuring timely communication during project progress.

Resolution of problems and definition of delimitations

In the reporting period several problems and delimitations were identified and addressed.

- Displaying indicators in the Webtool: the degree to which regional patterns are visible in the map view of the Webtool depends on the classification method used. Several methods have been explored in order to obtain an optimal map view.
- Indicator list: comments were received regarding the proposed final list of indicators, included in Annex 2 to ID II (Indicators Report), therefore the list had to be revised. As the sum of already included ánd requested indicators exceeds the maximum number of included indicators mentioned in the project specification document (15-20), several of them had to be omitted.
- NUTS 2 data: including indicators collected at NUTS 2 level proved to present several problems. Whether they may be overcome is perceived to depend on the topic covered by the indicator.
- Indicator themes: comments were received regarding the proposed list of themes, included in Annex 2 to ID II (Indicators Report), therefore the list had to be revised.
- Including time series: the possibility to include indicator time series depends on the source, type and geographic level of an indicator.

- LUZ list to include Iceland and Liechtenstein: for Iceland only one LUZ (Reykjavik) has been defined (although hardly any data has been collected for it) and for Liechtenstein / Vaduz none. To facilitate the inclusion of Reykjavik, Vaduz and possibly some other cities in Iceland anyway, NUTS 3 data, if available and applicable, may be used instead.
- Integrated data approach: the Webtool and its main data sources, ESPON db and Eurostat db, are currently not equipped for using Linked Open Data (LOD). The efforts to be made to facilitate this have been identified.

These problems and delimitations are covered in more detail in Section 3.1.

3. Draft Final European Urban Benchmarking Webtool

The Webtool prototype was presented to CityBench SG by the TPG during a meeting held in Luxembourg, on the 23th of September 2013. The CityBench SG was provided with a link to the prototype in order to evaluate its look and feel. Furthermore, CityBench SG proposed to test the tool with 'test-drivers', which should be appointed to provide input for a survey on the usefulness, user friendliness and usability of the CityBench Webtool and on the desired final list of themes and indicators.

Based upon the input from stakeholders user experience, survey results and internal discussions and meetings by the TPG, development of the Webtool will continue.

3.1. Data, indicators, themes and methodologies

3.1.1. Displaying indicators in the Webtool

One of the key features of the 'Map' view of the Webtool is the ability to observe regional patterns when showing similarity to a particular LUZ based on the values of one indicator or a combination of more indicators. However, it was found that in some cases 'outliers', i.e. a LUZ with either a very low or a very high value for a particular indicator, cause the regional patterns to be obscured while it is included in the LUZ selection (e.g. Luxembourg, which has a very high GDP per head). Therefore three classification methods (of the standardized values, using five classes) were explored to assess how they affect the map view, in an effort to minimize the effect of outliers on the overall appearance of the map – and preferably maximize visibility of regional patterns. In addition, the effect of using ranks rather than classified values was assessed.

Standardized GDP per head (2009, Metropolitan Region) was taken as sample indicator, with three LUZ for which similarity to other LUZ was shown. The three LUZ are Luxembourg (€ 75,191: highest GDP per head among the LUZ selected for the Webtool), Amsterdam (€ 40,568: intermediate GDP per head among the LUZ selected for the Webtool) and Plovdiv (€ 3,728: lowest GDP per head among the LUZ selected for the Webtool).

The results of different methods to display LUZ similarity information are as follows.

1. **Equal intervals**, where "*the attribute values are divided into n classes with each interval having the same width=Range/n*" (De Smith, Goodchild and Longley 2007). Classes used: 0 - 0.2, 0.2 - 0.4, 0.4 - 0.6, 0.6 - 0.8, 0.8 – 1.

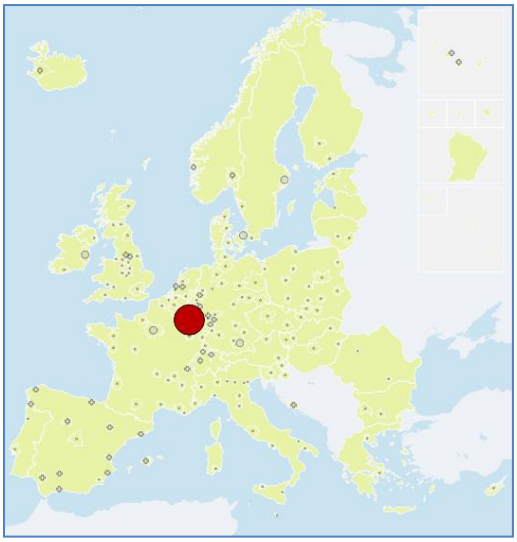

Figure 3-1. Equal interval: similarity to Luxembourg.

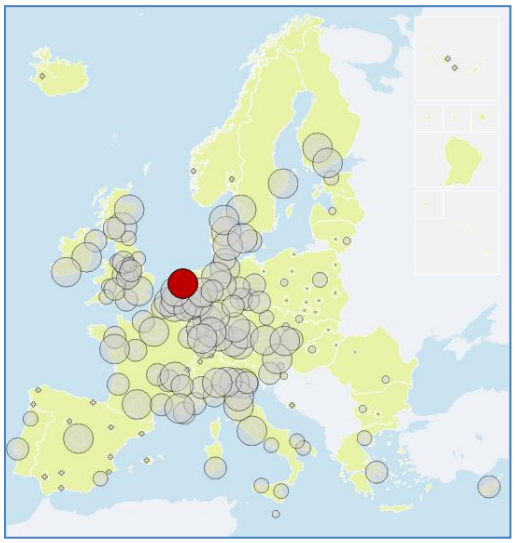

Figure 3-2. Equal interval: similarity to Amsterdam.

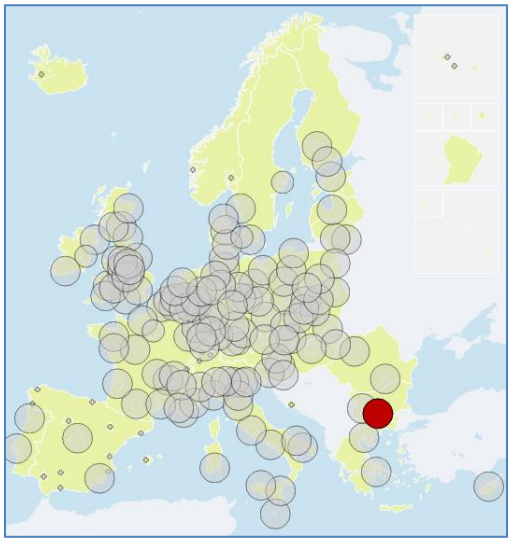

Figure 3-3. Equal interval: similarity to Plovdiv.

The figures above show that equal interval classification works best for LUZ with intermediate indicator values, since regional patterns are visible then. The high outlier (Luxembourg) does stand out, but the low outlier (Plovdiv) not at all; in the latter case any regional pattern is obscured by the high outlier.

2. **Jenks natural breaks**, which is a "…*variance-minimisation classification. Breaks are typically uneven, and are selected to separate values where large changes in value occur*" (De Smith, Goodchild and Longley 2007). Classes used: 0 - 0.156, 0.156 - 0.293, 0.293 - 0.430, 0.430 - 0.617, 0.617 – 1.

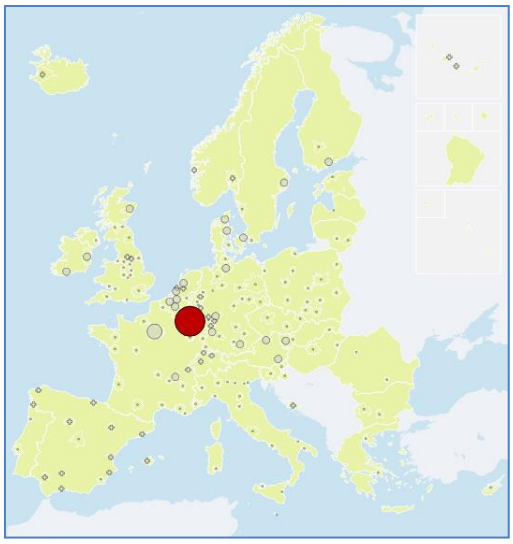

Figure 3-4. Jenks: similarity to Luxembourg.

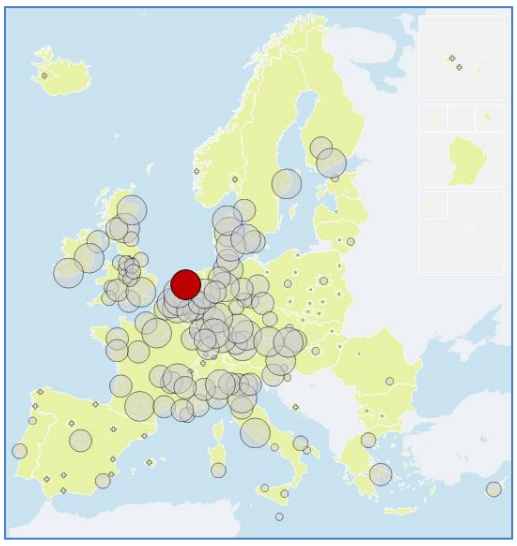

Figure 3-5. Jenks: similarity to Amsterdam.

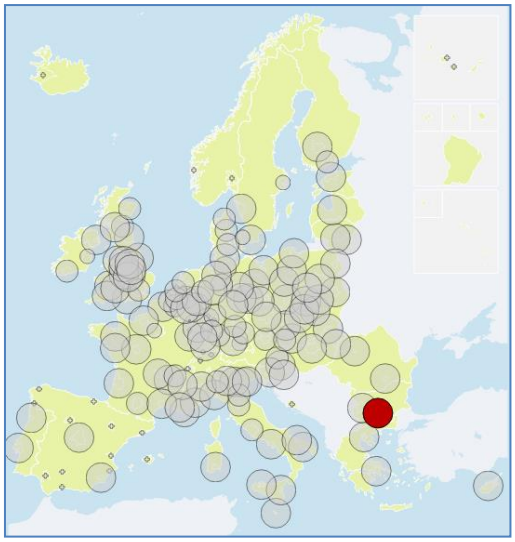

Figure 3-6. Jenks: similarity to Plovdiv.

In this case as well, the high outlier obscures any regional pattern when viewing similarity to a low GDP LUZ. Some pattern can be observed when viewing similarity to the high outlier; but again, patterns are best seen when viewing similarity to a LUZ with intermediate indicator values.

3. **Quintiles**, which means that "*intervals are selected so that the number of observations in each interval is the same*" (De Smith, Goodchild and Longley 2007, p.100). Classes used: 0.000 - 0.577, 0.577 - 0.654, 0.654 - 0.720, 0.720 - 0.838, 0.838 - 1.000.

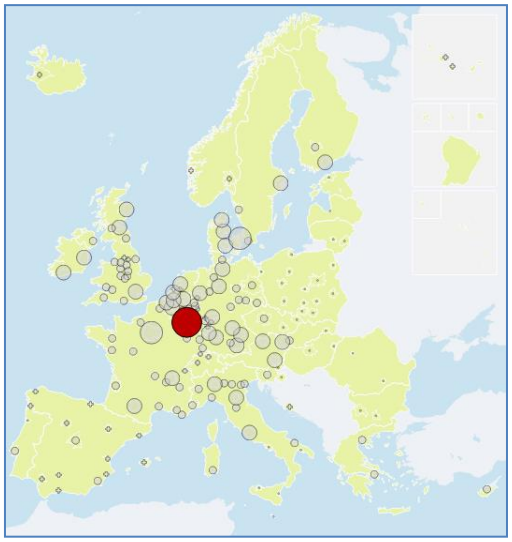

Figure 3-7. Quintiles: similarity to Luxembourg.

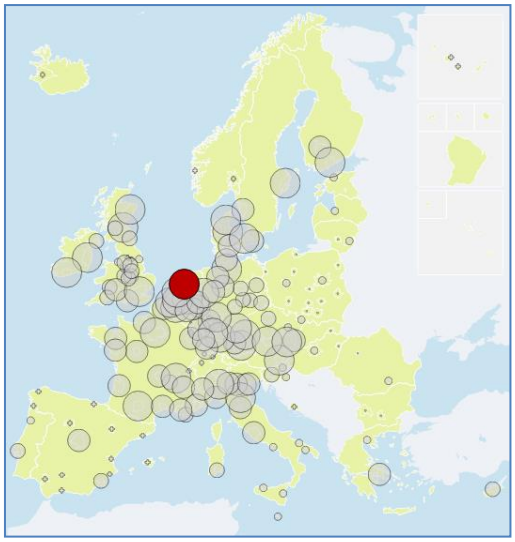

Figure 3-8. Quintiles: similarity to Amsterdam.

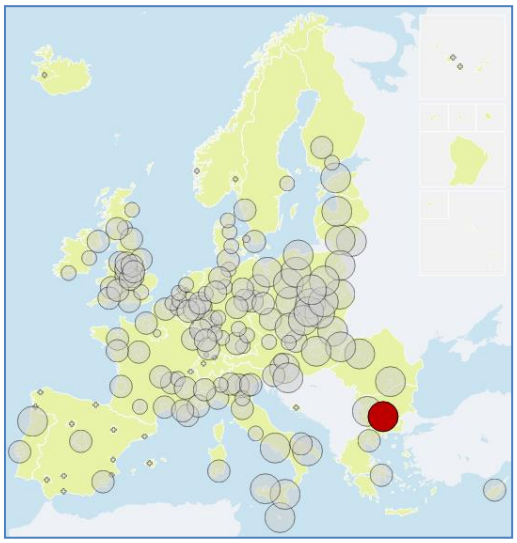

Figure 3-9. Quintiles: similarity to Plovdiv.

Compared to the previous classification methods, the regional pattern in case of the high outlier is clearer, whereas the low outlier shows some kind of regional similarity pattern, although hardly distinct. The intermediate indicator value yields a pattern similar to the ones generated by equal interval and Jenks.

4. **Ranking**: LUZ are ranked from low to high indicator values and assigned the ranking value. Ranking range: 1 – 171.

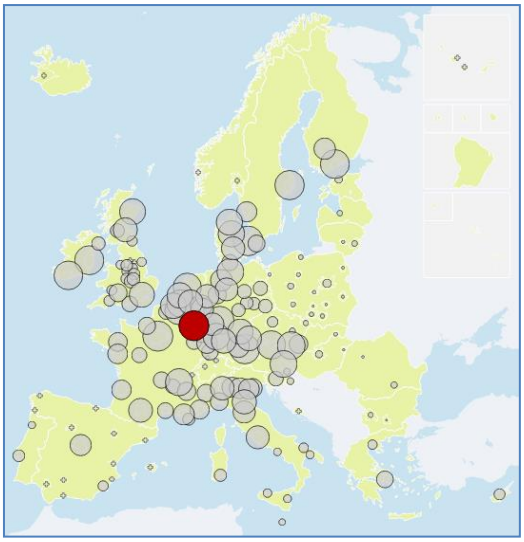

Figure 3-10. Ranking: similarity to Luxembourg.

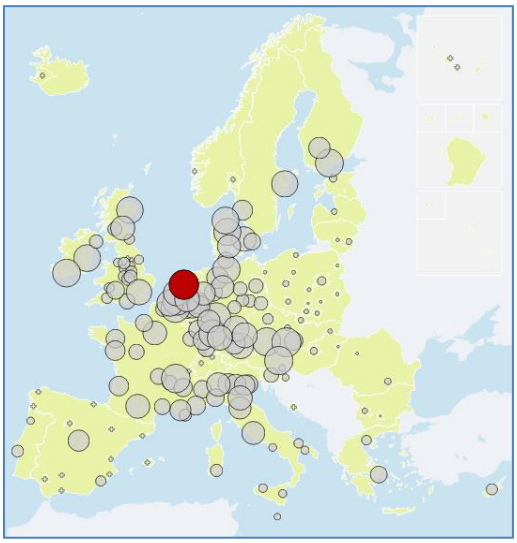

Figure 3-11. Ranking: similarity to Amsterdam.

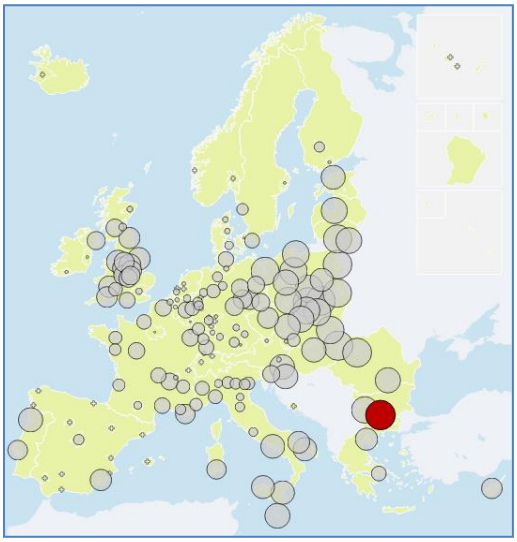

Figure 3-12. Ranking: similarity to Plovdiv.

Using the LUZ GDP ranking values yields rather different maps when showing similarity to high and low outliers: now Luxembourg is part of a pattern covering Central Europe, Ireland and Scandinavia, while Plovdiv shows a clear similarity to Eastern European LUZ. Also note that the maps for Luxembourg and Amsterdam are almost identical, indicating that GDP for Amsterdam reflects an order of magnitude common to Central Europe, Ireland and Scandinavia.

Based on the findings above, it was decided to use ranking values for the map view of the Webtool, since this method best reveals regional patterns. However, this does not apply to the 'radial view': because of its inherent non-geographic representation of similarity it does not show regional patterns. The radial view is therefore created from the true (standardized) values for an indicator. The calculation of similarity (i.e. the distance from a reference LUZ) in the radial view is derived from the values for all indicators selected, however the circle size corresponds to the standardized values of only one of the indicators selected, namely the top one in the list. If it is removed, the new upper one will be used to represent the circle size.

3.1.2. Indicator list

The Indicators Report, an annex to Intermediate Deliverable II, proposed a set of corresponding indicators to be included in the Webtool. They are listed in Table 3-1, which also summarizes the feedback the TPG received from CityBench SG / ESPON CU regarding the proposed themes and indicators.

Table 3-1. Proposed themes and indicators.

Indicator	Source (name), Geographic level (version)	Most recent year with high data completeness	Feedback from ESPON CU / CityBench SG[1]
Theme: Context			***Change into: Economy and Population***
Resident population / Population density	Eurostat, LUZ (2012)	2009-2012	
GDP per inhabitant	Eurostat, MR (NUTS 3 2006?)	2009	
% of persons unemployed	Eurostat, MR (NUTS 3 2006?)	2010	
Theme: Connectivity			
# of in- / outbound flights	OpenFlights, LUZ (2012)	Real-time	Do not use
Potential accessibility, road / rail, standardized ESPON	ESPON TRACC, NUTS 3 (2006)	2006	Include potential connectivity by air
Theme: Demography			
Ageing index	ESPON INTERCO, NUTS 3 (2006)	2008	Check whether more recent data is available
Old age dependency	ESPON INTERCO, NUTS 3 (2006)	2008	Check whether more recent data is available
Theme: Social media			
# of items being posted about 'Crisis'/# items posted in a city	Twitter/YouTube/Flickr, LUZ (2012)	Real-time	
# of items being posted about 'Crisis'/# items about 'Crisis'	Twitter/YouTube/Flickr, LUZ (2012)	Real-time	
Theme: Investment climate			
Ease of doing business	IFC / World Bank, Country	2013	
Gas / Electricity prices for industrial consumers	Eurostat, Country	2012	
Theme: Environment			
% of LUZ consisting of green urban areas	EEA Corine, LUZ (2012)	2006	Make use of the Urban Atlas instead
Residential PM10 => Max. value (=class) in LUZ for 5 x 5 km area	EEA, LUZ (2012)	2008	
Combined adaptive capacity to climate change (2005 – 2011)	ESPON Climate, NUTS 3 (2006)	2011	
Theme: Smartness			
High-Tech (total) patent applications to the EPO per million of inhabitants	Eurostat, MR (NUTS 3 2006?)	2009	Replace with Human Resources in Science and Technology or private R&D expenditure as % of GDP
IP Addresses	ESPON TEL Update, NUTS 3 (2006)	2009	
Share of renewable energy in gross final energy consumption	Eurostat, Country	2011	
Photovoltaic energy potential	ESPON ReRisk, NUTS 2 (2006)	2005	Unsure if photovoltaic potential fits here as it is more of a natural asset while the rest have a human agency smartness dimension
			Include DG Regio perception surveys
			Check possibility to use regional quality of governance indicator produced by Gothenburg University (NUTS 2) and several DG Regio and OECD publications
			The integration of smart indicators should be considered

[1] Derived from either feedback received during CityBench SG meeting in Luxembourg (23-09-2013) or ESPON CU Draft Response document (CU Response Inception and Intermediate Deliverable 2-22-10-2013.docx).

Feedback from CityBench SG / ESPON CU and stakeholder survey results will be taken into account when preparing the final list of included themes and indicators, a draft version of which is presented in Annex I. However, it should be stressed that even the final list will constitute merely an, albeit well thought out, starting point for populating the Webtool with additional themes and/or indicators as needs for them arise. The 'Admin Tool', which is explained in Section 3.2.3, will facilitate this. It will also enable editing (e.g. adding newly collected values) and deactivating or even deleting existing indicators.
A more detailed description of the indicators derived from social networks can be found in Annex III.

3.1.3. Urban Atlas data

At the explicit request of ESPON CU, the Corine Land Cover 2006 data used for calculating the amount of green urban areas within each LUZ will be substituted by Urban Atlas (UA) data. This data is only available in vector format from the European Environment Agency (EEA) website, with separate files for each LUZ. Processing these vector files (downloading, rasterizing, calculating green urban areas for each rasterized LUZ) would be a very time-consuming process. However, the Universitat Autònoma de Barcelona (Spain) has merged and rasterized the entire UA dataset and will make this rasterized data available to the TPG. The final version of the Webtool will incorporate a 'green urban areas' indicator based on UA data. The TPG would like to stress once again that UA data uses LUZ 2004 instead of LUZ 2012 boundaries.

3.1.4. DG Regio Perception Survey results

ESPON CU also requested the inclusion of DG Regio Perception Survey results. Although survey results are available for only part of the 1st tier LUZ selected for the Webtool, the TPG will integrate some of the Perception Survey results into the final version of the Webtool.

3.1.5. NUTS 2 data

Several indicators requested by CityBench SG / ESPON CU have been collected at NUTS 2 level.

1. "Human Resources in Science and Technology": probably reference is made to an indicator with this name in Annex C to the ESPON SIESTA project. However, this data is available in Eurostat rather than ESPON db.
2. "Private R&D expenditure as % of GDP": probably 'Business Expenditure on R&D as % of GDP', also mentioned in Annex C to the ESPON SIESTA project, is meant. An exact match was found in neither Eurostat nor ESPON db, however Eurostat table 'Total intramural R&D expenditure (GERD) by sectors of performance and NUTS 2 regions' seems to correspond well.
3. "Regional quality of governance": this refers to the QoG EU Regional Dataset.

Integrating indicators collected at NUTS 2 level in a tool using the LUZ level as backbone poses several problems.

1. No correspondence table between NUTS 2 and LUZ (or MR) exists, therefore each LUZ has to be linked to a particular NUTS 2 region manually.
2. In some cases, NUTS 2 regions are much larger than the LUZ included and/or they contain more than one LUZ. Figure 3-13 presents some examples of this. The larger a NUTS 2 region is compared to a LUZ within its boundaries, the less realistic it will be to assign NUTS 2 derived indicator values to that LUZ. And if a NUTS 2 region contains more than one LUZ, there is the additional issue of how to allocate (a portion of) the NUTS 2 value to each LUZ.

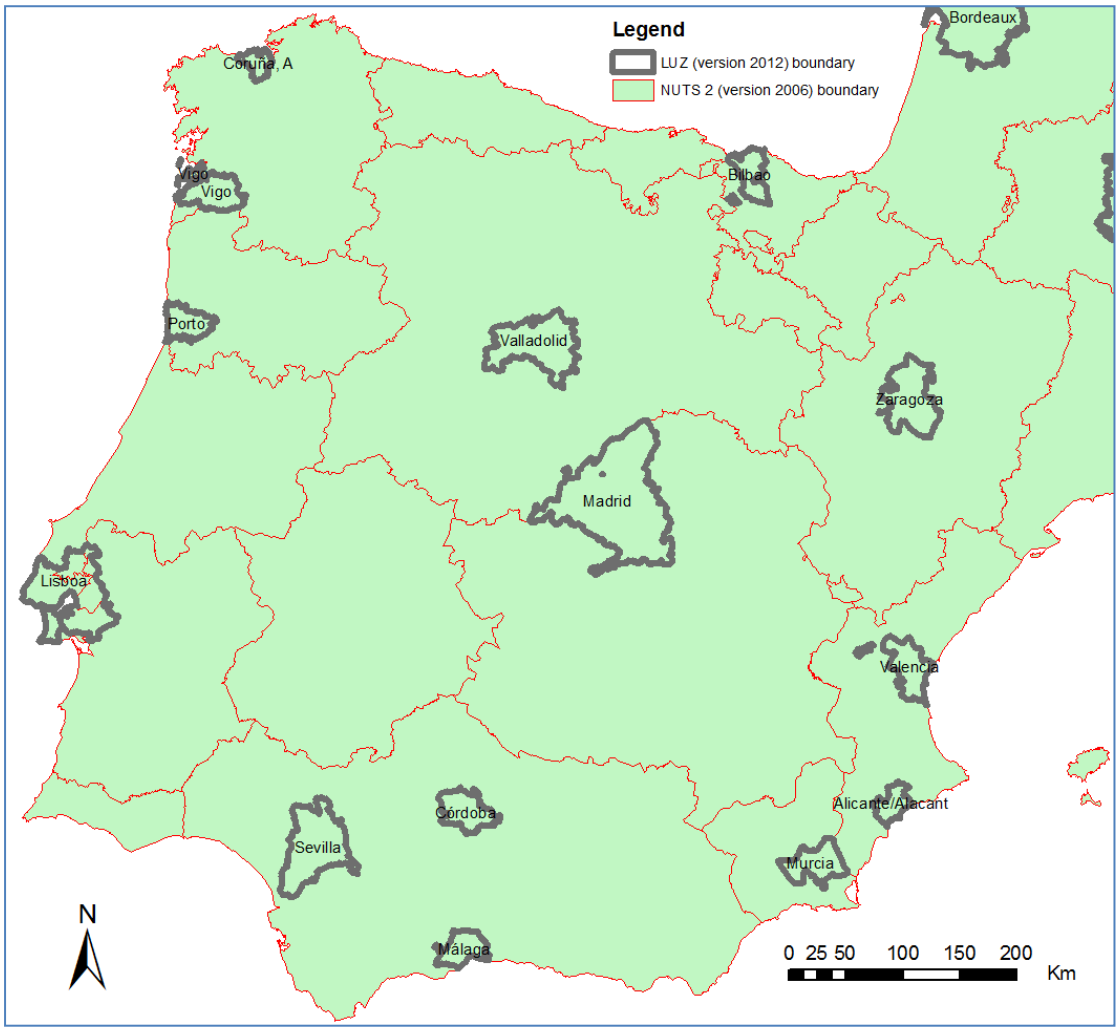

Figure 3-13. Examples of NUTS 2 regions much larger than LUZ or including more than one LUZ: Iberian Peninsula.

3. In other cases, one LUZ covers (parts of) more than one NUTS 2 region, which is exemplified in Figure 3-14. The problem here is deriving an indicator value at LUZ level from several NUTS 2 values, which necessitates taking into account e.g. NUTS 2 weighting factors (area? population?) and area of each NUTS 2 included in a LUZ.

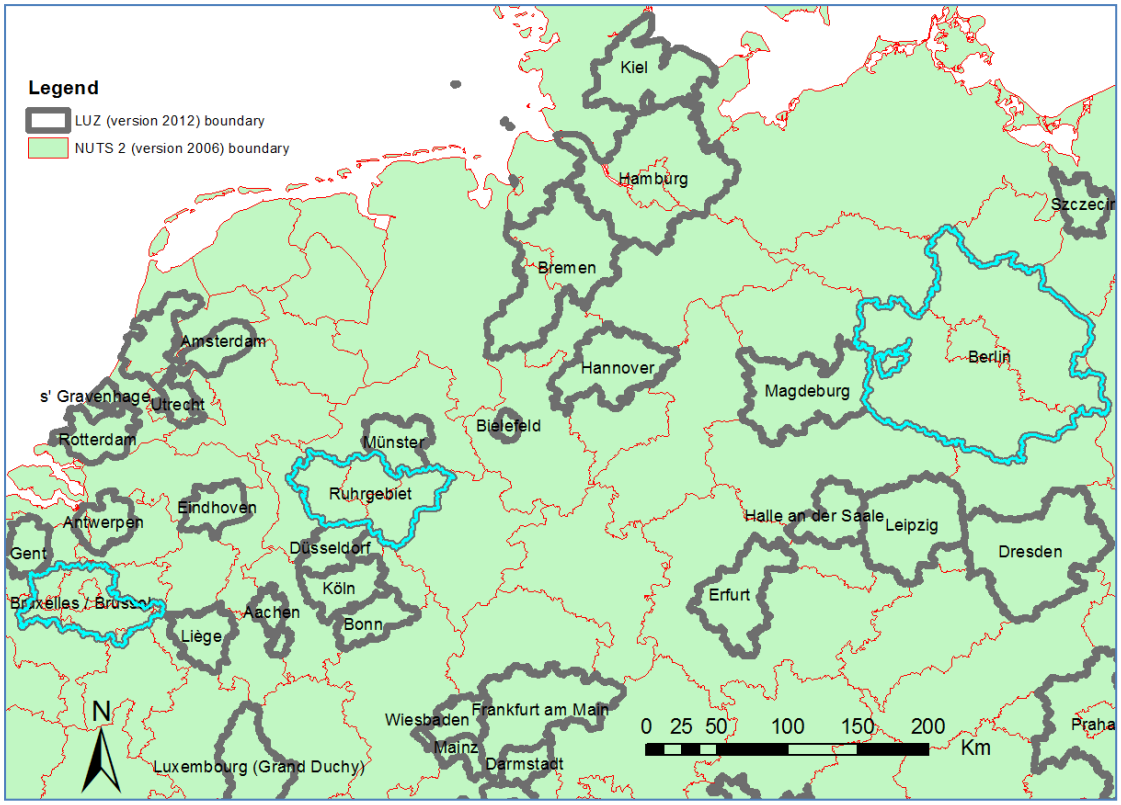

Figure 3-14. Examples of LUZ covering (parts of) more than one NUTS 2 region: Bruxelles, Ruhrgebiet and Berlin.

Whether these problems may be overcome depends on the topic covered by the indicator. NUTS 2 level indicators covering environmental variables, e.g. hours of sunshine, can be used as proxy for the LUZ level, since they are unlikely to differ much at these geographic levels. However, societal (demographic, economic, etc.) variables do tend to vary within and between adjacent regions. In the latter case the usage of indicators collected at NUTS 2 level is not recommended by the TPG.

3.1.6. Indicator themes

Regarding the themes, the TPG is asked to ensure that "The naming of the themes included in the web tool should be coordinated with the M4D and ETMS Projects" (CU Draft Response document, p.3). Table 3-2 presents an overview of ESPON db themes, current CityBench themes and themes useful to EIB (as listed in CityBench Project Specifications document and CU Response document). ETMS themes have not been included, since they are as yet unknown. The ETMS project has been contacted regarding this; the TPG is awaiting its answer.

Table 3-2. Comparison of themes.

ESPON db themes	CityBench Webtool themes	Themes useful to EIB
Population and living conditions	Demography	Population age; Wealth
Labour market	Context => rename to Economy and Population	Education and Employment
Education		Education and Employment; Workforce Skills
Health and safety		Quality of life
Information society	Social media	
Agriculture and fisheries		
Transport and accessibility	Connectivity	Transport/accessibility
Environment and energy	Environment	Energy profile; Greenhouse gases
Science and Technology	Smartness	
Governance	Investment Climate	Business environment
Territorial structure	[Typologie, TNC]	
		Development demands

Table 3-2 shows that while there is a certain degree of correspondence between the theme lists, some differences exist as well. In particular, the number of Webtool themes is lower than that of either the ESPON db or the EIB wish list. The main reason for this is that the Webtool will initially be populated with 15 to 20 indicators. To ensure that every theme contains two or three indicators, a maximum of seven themes was decided upon. Also, ESPON db theme 'Agriculture and fisheries' was not considered relevant for the Webtool's purpose of comparing cities.

Similar to the indicators, the Admin Tool will facilitate adding, editing (i.e. renaming) and deleting of themes. In the latter case, all indicators belonging to that theme will move to the 'Other indicators' group. The Admin Tool functionality is explained in more detail in Section 3.2.3.

3.1.7. Including time series

ESPON CU, in its Response document, indicated that "…the European Urban Benchmarking web tool should integrate time series (ten years) in a selected number of indicators" (p.6). Whether time series can already be included depends on 1) data availability and 2) consistency of geographic units for data collection over time. 1) is self-explaining: if for a particular indicator values for multiple years are (yet) lacking, no time series can be integrated into the Webtool for that indicator. 2) means that if for a particular indicator

values from several years have been collected, comparable NUTS 3 / MR / LUZ boundaries should have been used for each collection year. If this is not the case, the time series may show fluctuations in indicator values which are not related to actual changes but to the varying size (or shape) of the geographic unit used for collecting from one year to the next. Generally the following observations apply.

1. Indicators covering several years created by ESPON projects (e.g. INTERCO, TRACC, TEL Update) are usually based on NUTS 3 version 2006 delineations, which can be aggregated to Metropolitan Region (MR) version 2006 level. Therefore time series for these indicators can be integrated in the Webtool. Indicators include: *Potential accessibility by rail / road / air, Ageing index, Old age dependency, IP addresses*.
2. Eurostat provides a Metropolitan regions database (*met*), which includes various indicators covering different years. Although metadata for the various tables is not available, it may be safely assumed that the same NUTS 3 version was used to calculate the yearly values. This data can therefore be used for time series. Indicators include: *GDP per inhabitant, % of persons unemployed, High-Tech patent applications to the EPO per million of inhabitants*.
3. Eurostat Urban Audit LUZ data should be approached with more care, as previous collection rounds used different LUZ delimitation versions. The latest Urban Audit data collection, released in October 2013, uses the LUZ version 2012 delineations. These may differ from previous delineations to a more or lesser extent (see also CityBench Indicators Report, Chapter 3). This is reflected by the fact that the Urban Audit database (*urb*) does not contain indicator values collected by previous Urban Audits for those LUZ that have been modified considerably, i.e. LUZ codes ending with *2*. Approximately 50% of the LUZ selected for 1st tier inclusion in the Webtool have a code ending with 2, thus Urban Audit time series for these are not possible. Indicators include: *Resident population, Population density*.
4. For indicators collected at country level inclusion of time series is straightforward, since country boundaries do no tend to change. Indicators include: *Ease of doing business, Gas / electricity prices for industrial consumers, Share of renewable energy in gross final energy consumption*.
5. Gridded data covering different years, e.g. provided by the European Environment Agency, can be converted to indicator values for any geographic unit desired, such as LUZ 2012. If the same delineations are used for each year, the creation of a time series is straightforward. Indicators include: *% of LUZ consisting of green urban areas, Residential PM_{10} / CO_2*.
6. Within the framework of the CityBench project, Social Media data is harvested real-time from various sources: Twitter, YouTube and Flickr. As the project is progressing, ever more data is collected. Provided that data collection will continue after its completion, this may serve as input for a time series of indicators derived from it. Indicators include: *Number of items being posted about 'Crisis' / 'Unemployment', Number of items being posted 'by tourists' per inhabitant*.

3.1.8. Database and Services

As explained in the Prototype report available in the previous Interim Report, functionality requires, at least, the availability of the following components:

Database

Storing data about:

- Cities (e.g. ID, Name, Alternative Name or Geographical definition). They allow locating cities and searching for them, and relating them to other information in the database.
- City characteristics (e.g. Country, Languages, Typology, Transnational Regions or Indicators having information about the city). They allow us filtering and selecting groups of cities, which might have same interests.
- Indicators (e.g. ID, Name, Description or Units). They allow us searching for indicators, and relating them to other information in the database.
- Indicators characteristics (e.g. Data Source, Theme or Geographical level to which the data are referenced). They allow us filtering and selecting groups of indicators, which might define a coherent comparison scenario.
- Values (e.g. Indicator, City or Year). They are the core of this tool and allow us to compare and evaluate relations between cities, like similarity or 'distance', graphically represented in the web tool.

The Spatial Database has been implemented using an Open Source product, namely PostgreSQL with PostGIS extension for spatial support. This database stores at the moment data and metadata about cities and indicators.

We have identified relevant entities and their relations; this has resulted in a logical data model that has been implemented using Postgres database. Figure 3-15 shows a diagram of the CityBench data model.

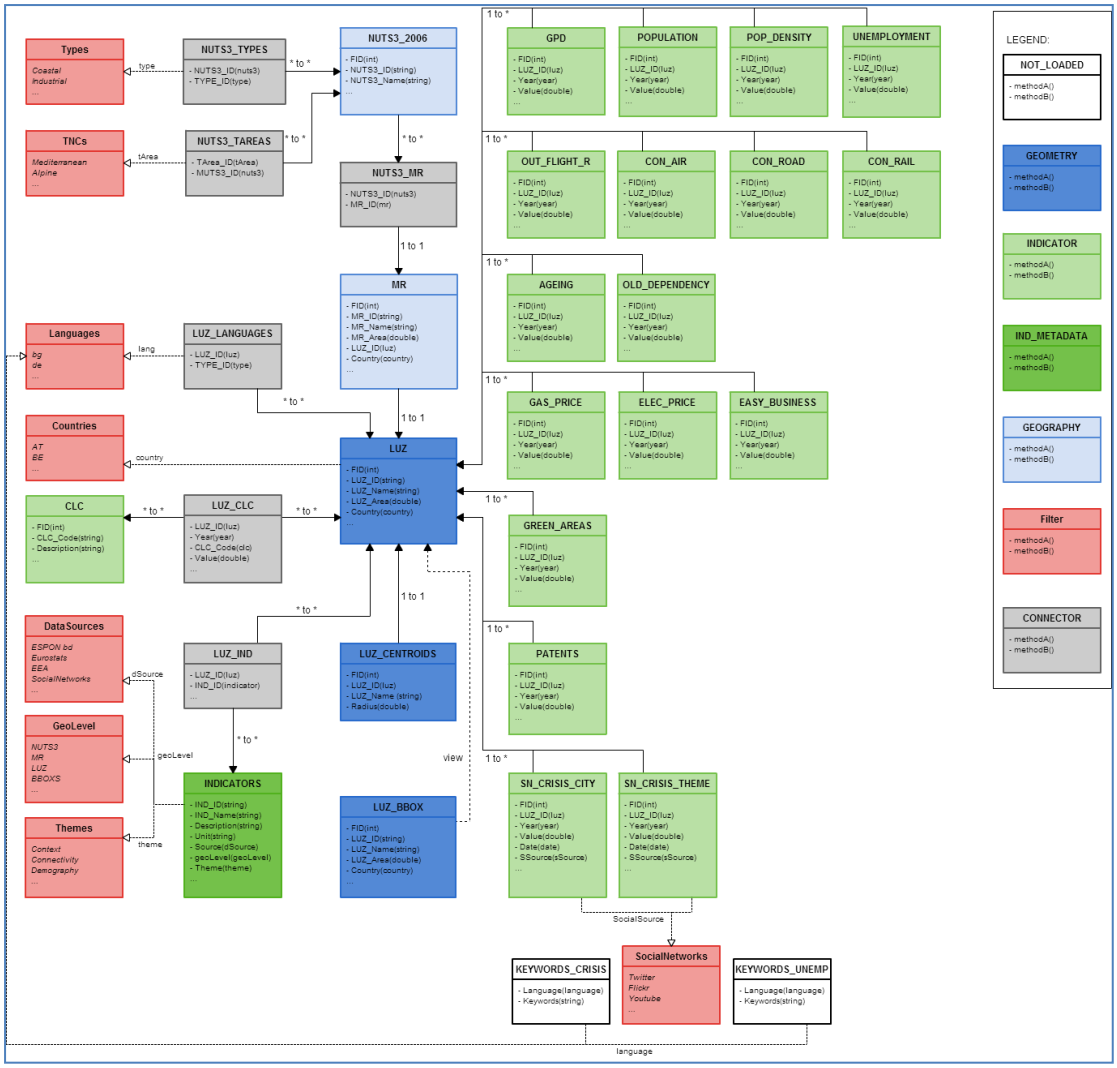

Figure 3-15. CityBench data model.

There we can see, in the middle column, the cities data and their relation with the different geographical levels. In the left part of the model we can see the filtering data, for both cities and indicators, and at its bottom, the definition of indicators and their relation with cities. The right part of the model represents the indicators values, each row representing the source of the data that contain.

ETLs

Both the official data and the social data ETLs are tools implemented using Java programing language and SQL to support modifications of the CityBench database.

These tools work on the first load and the futures updates after delivering the tool to ESPON.

The official ETL is described under the Admin Tool chapter and takes into account the necessary data; the original format and data source and the CityBench data model to define data transformations from standard ESPON Excel sheets to the CityBench data model. It also

delivers a document describing how new data from other ESPON projects should be submitted.

The social data ETL collects data obtained through the APIs offered by different social networks. The data collected is used for gathering information from European cities regarding different subjects of interest. For this is utilized different BigData technologies used for the collection, storage and processing of the data. The social networks selected for extracting data include Twitter, YouTube, Linked In, etc. The information extracted is loaded into the CityBench database.

The indicators are generated through the use of different software used for collecting; storing and aggregating social networks data. The general workflow is presented in the figure below. The whole process is implemented using technologies for handling big data volumes, as is the case data coming from social networks. The data is collected by a service called Apache Flume, which allows reliably obtaining data from the different social networks and storing it in HDFS. HDFS (Hadoop Distributed File System) is the storage component of the social ETL. This file system is in charge of keeping the data obtained from the social networks for later analysis and indicators value extraction. A graphical overview of the social networks ETL is provided in Figure 3-16.

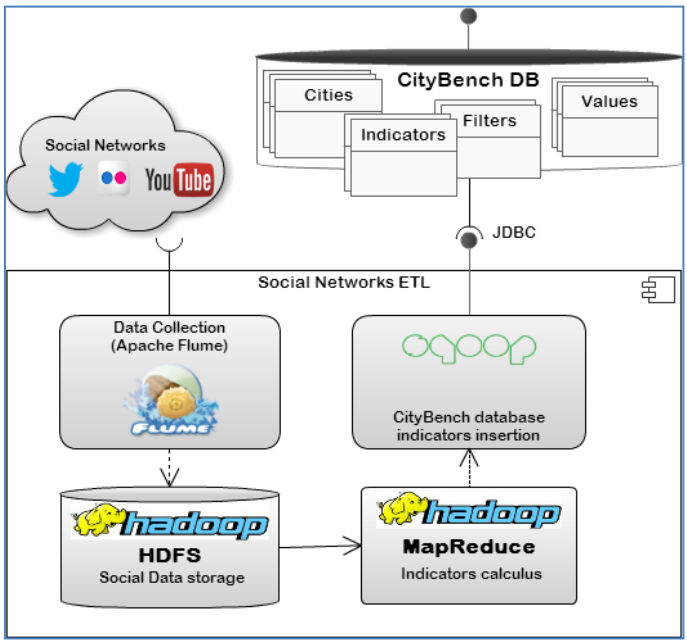

Figure 3-16. Social networks ETL.

The data analysis is performed later by algorithms implemented using Hadoop MapReduce framework, which allows running algorithms appropriate for extracting the indicators values from potentially large data volumes.

Later, the indicators values are loaded into the CityBench database by a Sqoop service which takes them form the output of the MapReduce algorithms implemented.

Besides these tools, first load of the database has been supported using the Open Source Software GeoKettle[1] and PgAdmin[2].

Services

According to INSPIRE, our system should provide a set of predefined functionality through standard-based services. These services offer the discovery, view, and download functionality. The GIS services to manage the map have been dropped from the prototype to improve usability and ease-of-use. The functionality has been moved to the web client and future modifications on this will depend new requirements analysed from the feedback received from the prototype users.

Other more specific functionality is offered by the rest of services in the CityBench Services Layer. They are components specifically developed for the CityBench system. They have been implemented in Java (server side) and JavaScript (client side). These web services expose a Restful interface and work with well-known formats such as JSON, so the API can be easily described and they can be reused for future uses.

A detailed description of the services implemented can be found on Annex V.

3.1.9. LUZ list to include Iceland and Liechtenstein

In their Response document, ESPON CU has stated that the TPG should "Ensure the full coverage of the ESPON space in particular Liechtenstein and Iceland". Although the TPG had already included Iceland by means of Reykjavik LUZ, data availability as yet proves to be limited (e.g. no Urban Audit data). Moreover, no Metropolitan Region (MR) has been defined for Reykjavik. Other parts of Iceland have not been taken into account because of the nonexistence of additional Icelandic LUZ and/or MR. Similarly, neither LUZ nor MR has been defined for Liechtenstein (i.e. Vaduz). The TPG feels that the only way to include both Vaduz and (more indicator values for) Reykjavik would be to use NUTS 3 data where appropriate, i.e. for indicators collected at NUTS 3 level and aggregated to MR level for the other LUZ. Reykjavik and Vaduz could just be assigned their NUTS 3 value then. But in case of indicators already collected at MR or LUZ level, including values for Reykjavik and Vaduz values will prove difficult.

3.1.10. Enabling the integration of Linked Open Data

In the past the usage of Linked Open Data (LOD) has been suggested, both for current (e.g. CityBench Webtool) and future applications. It is also referred to in Intermediate Deliverable II (p.34):

> "*A potentially important development with respect to the CityBench project is the emergence of 'linked data',*[...] *When published in this way rather than e.g. as downloadable tables (currently usually the case), it might become much more straightforward to automatically combine data from different*

[1] http://www.spatialytics.org/projects/geokettle

[2] http://www.pgadmin.org/

sources to create new indicators and/or integrate new indicators into the Webtool. However, more research into the challenges, possibilities and requirements of linked data is needed, in addition to gaining an insight into ESPON / Eurostat intentions regarding the implementation of this technique for their data."

The advantages to ESPON / Eurostat of using LOD could be summed up as follows.

- ESPON / Eurostat data can be found, accessed and interpreted much more easily, both by persons and by systems / applications capable of handling LOD.
- This may lead to increased usage of all the valuable data stored within ESPON / Eurostat db.
- Since data is linked rather than uploaded, LOD indicators included in the CityBench Webtool are updated automatically as the data source (ESPON / Eurostat db) is updated.
- If other ESPON project databases are LOD-enabled as well, each project will benefit from the fact that data needs to be updated at one location (the data source) only, instead of having to update each project database separately.
- Additionally, external data used by ESPON projects can remain at the source; there is no need to copy the data.
- Inclusion of new LOD indicator(s) in the Webtool using the ETL tool is much easier than uploading manually created sheets containing new indicator(s) with their metadata, because only a link to the new indicator(s) needs to be specified. Since the metadata format is standardized, there is no need to specify this manually; it is added automatically and error-free.
- Seamless combination of data with metadata and semantics.

The website 5 Star Data (5stardata 2012) provides an overview of costs and benefits associated with different ways of presenting data.

It should be stressed that implementation of LOD requires considerable effort, both on Eurostat / ESPON site (changes to the databases to be able to publish data as LOD) as on TPG site (usage of LOD needs to be enabled for the CityBench Webtool).

Another aspect to consider is that the backbone of the Webtool is the LUZ (alternatively: MR) level. This implies that source data collected at country or NUTS 2/3 level, before inclusion in the Webtool, has to be (dis)aggregated somehow (i.e. summing, averaging based on NUTS 3 size / pop number, etc., depending on the particular indicator). This can be done either at the source (i.e. in the ESPON / Eurostat db) or in the Webtool itself. The latter option requires that the proper (dis)aggregation method is specified during the adding of new indicators in the ETL tool. The advantage of populating the source (EPSON / Eurostat db) with (dis)aggregated values at MR or LUZ level is that it can subsequently be used by everyone or every system with an interest in MR or LUZ (provided the source is LOD).

Bearing all this in mind, the TPG is interested to learn both the opinion of ESPON CU regarding the idea of implementing LOD for the Webtool and whether ESPON CU has ever considered using (or experimenting with) LOD in general in the past.

3.2. CityBench Webtool setup

3.2.1. Usage scenarios: interrogation paths and application flow chart

The use cases delivered by ESPON CU and EIB served as input for the creation of 'interrogation paths', i.e. scenarios for approaches and interests corresponding to different user groups when accessing the Webtool. Four user groups were defined:

1. Private investor, looking for business opportunities.
2. Local official, comparing his/her own city to others or searching for cities similar to his/her own city.
3. European official, interested in regional / geographic performance (based on TNC and/or typology).
4. EIB investor, wishing to invest in under-achieving city, city type (typology) or region (TNC).

The objectives of the latter two user groups were perceived to overlap to a large extent; they were therefore combined into one interrogation path. The interrogation paths are shown in Figure 3-17, Figure 3-18 and Figure 3-19.

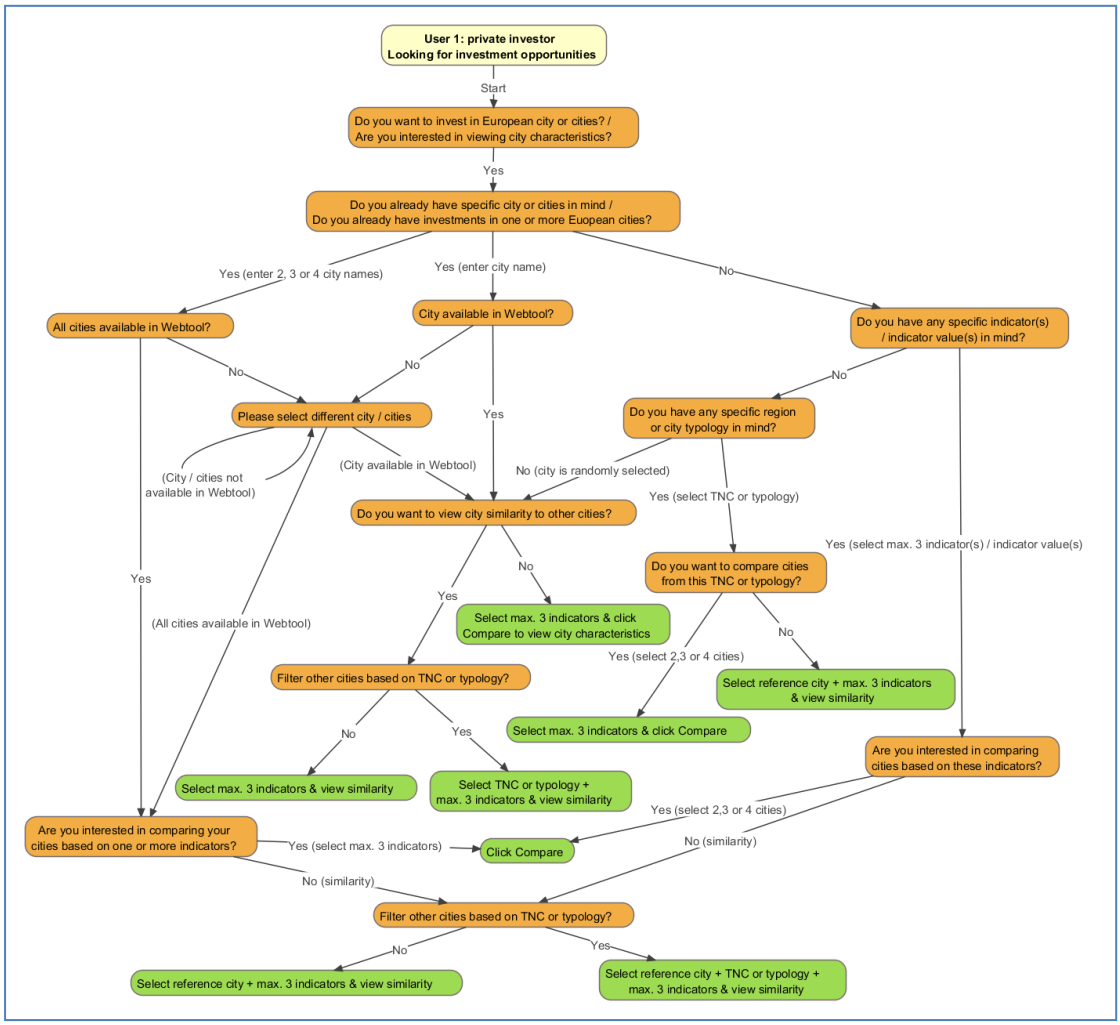

Figure 3-17. Interrogation path for private investor.

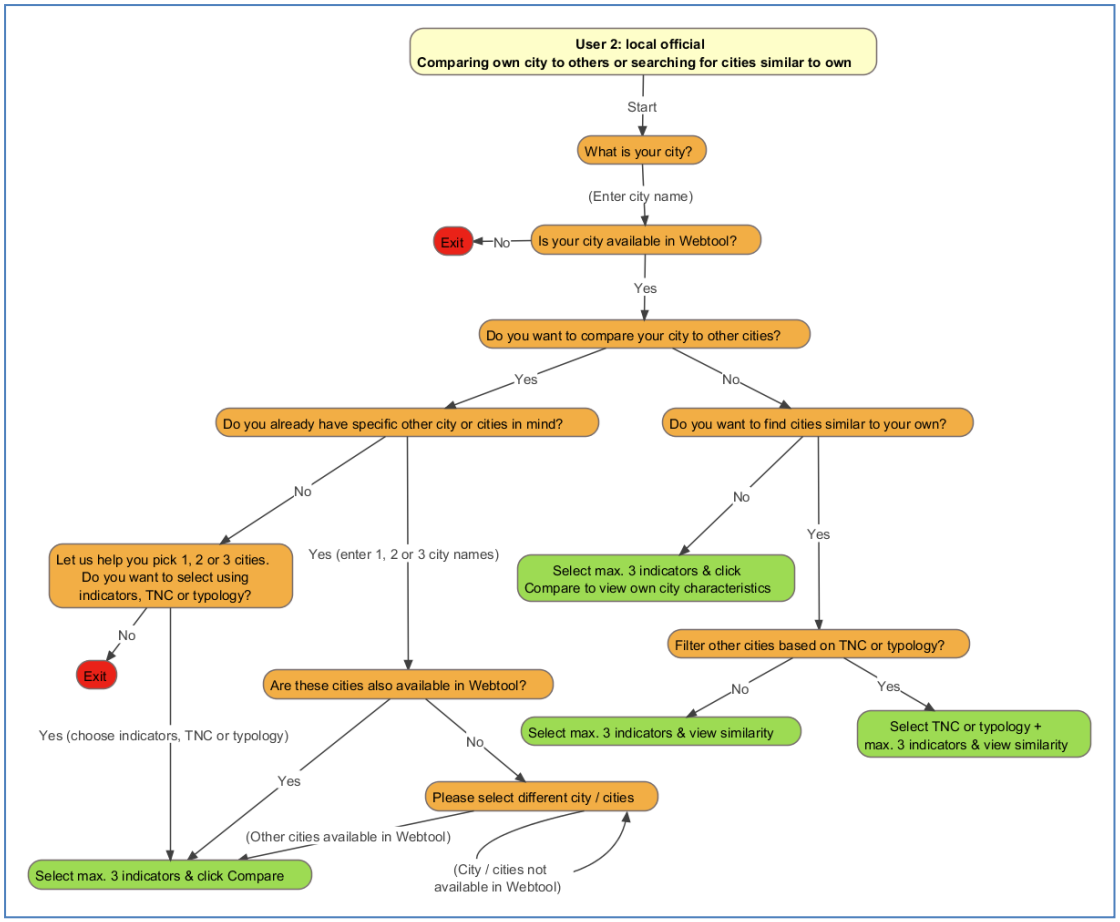

Figure 3-18. Interrogation path for local official.

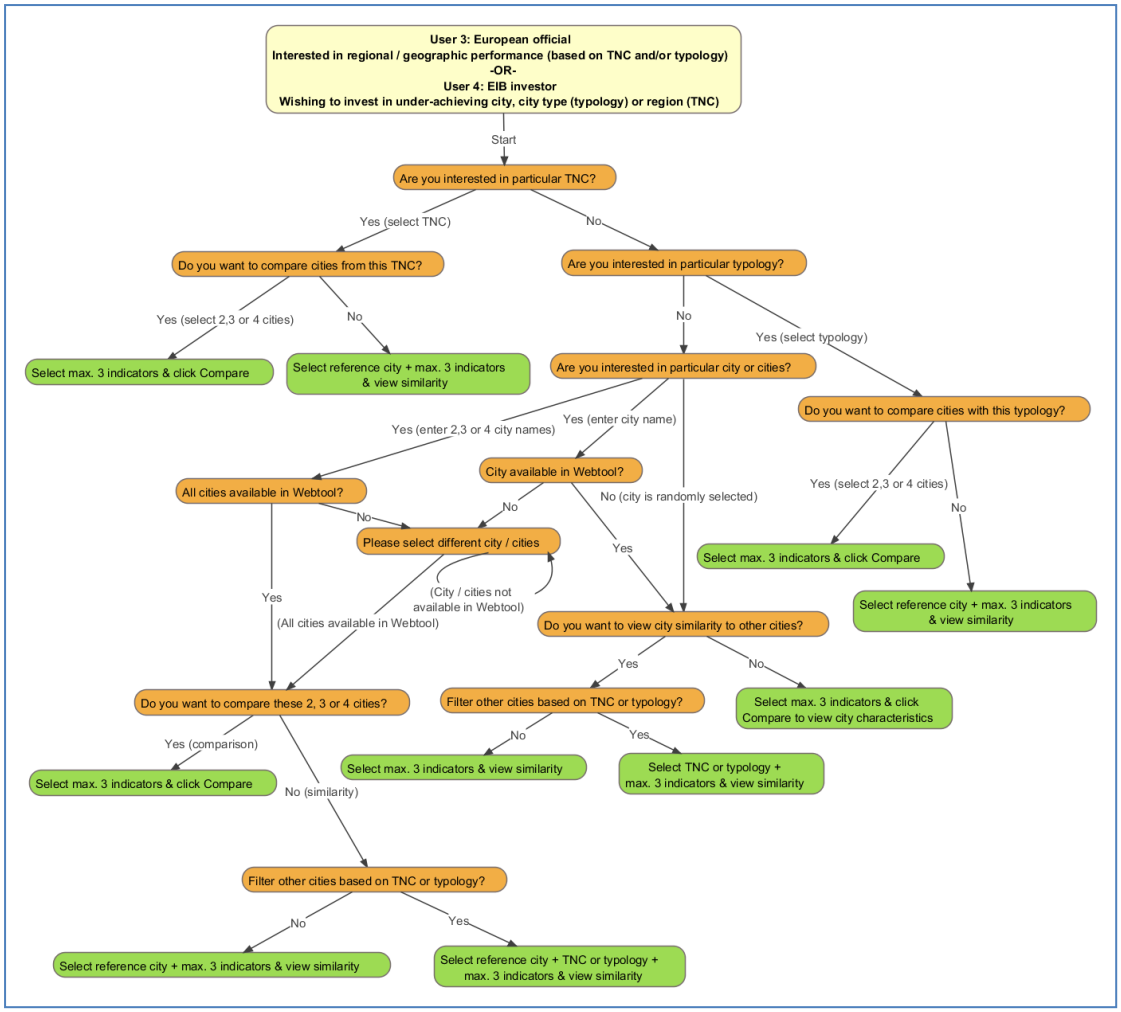

Figure 3-19. Interrogation path for European official or EIB investor.

Based on the interrogation paths in the previous Figures, a flowchart for the CityBench Webtool was designed, see Figure 3-20. The flowchart is an effort to combine the approaches and interests as reflected by the different user groups into a comprehensive application setup. This is especially useful for designing the Webtool Wizard, which is launched every time a user accesses the Webtool.

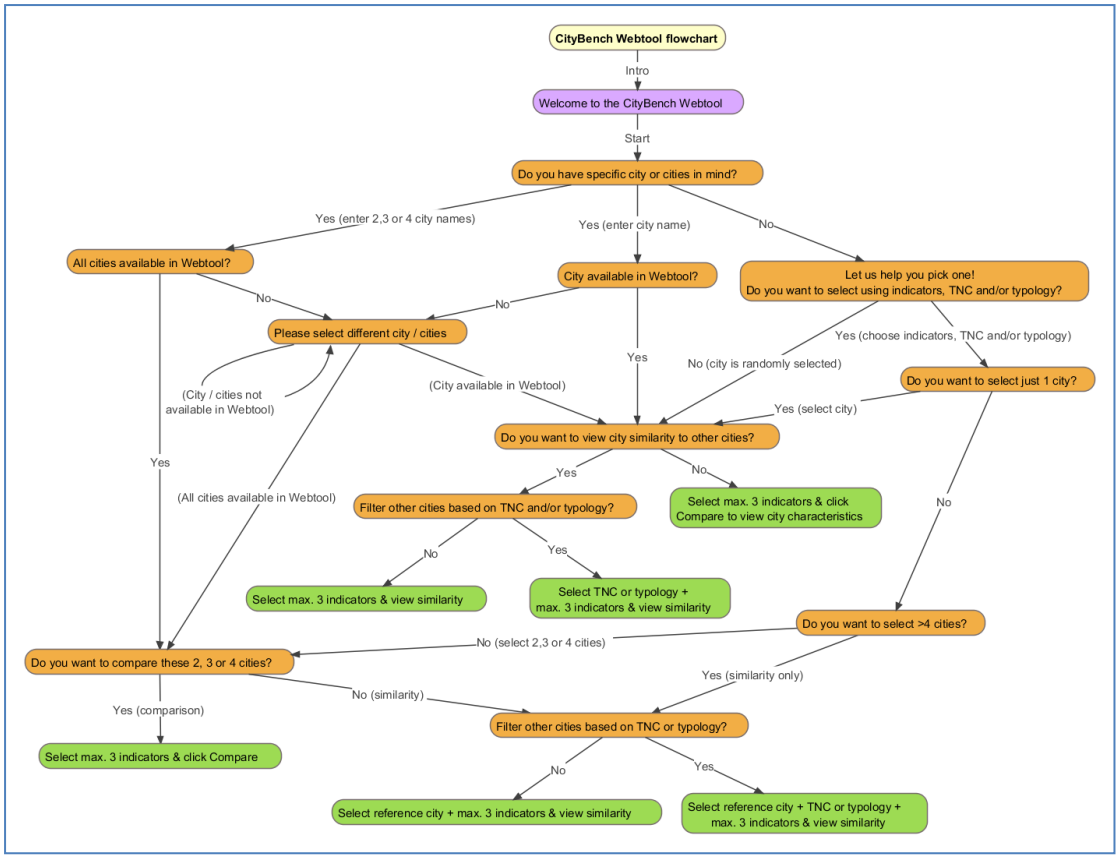

Figure 3-20. Application flowchart.

3.2.2. Webtool Wizard

The flowchart presented in Figure 3-20 served as a starting point for the design of the Webtool Wizard, which guides the user through the process of selecting a city or cities. Please note that although the Wizard launches every time a user visits the Webtool homepage, it can be discarded at any time. This is especially useful for experienced Webtool users.

The Wizard consists of 3 or 4 steps.

- Step 0: introductory screen, providing information about the Webtool.
- Step 1: screen for selecting city or cities (see Figure 3-21). When a city name is being typed, the Webtool will automatically complement it, provided that it includes that particular city. A circle on the map represents the location of the city. Once a city is specified, Step 2 will turn blue and become clickable. The user may specify up to four cities before continuing. The screen contains two additional buttons: 'random city' and 'help me choose'. When the 'random city' button is clicked, the Webtool will randomly select one or more cities for the user. The 'help me choose' button will direct to a screen displaying the indicators and TNCs / Typologies. Here the user may set values for preferred indicators using sliders and/or filter based on TNC or Typology. The cities within the resulting selection will become visible in the Map view, from which the user may select up to four by clicking them.

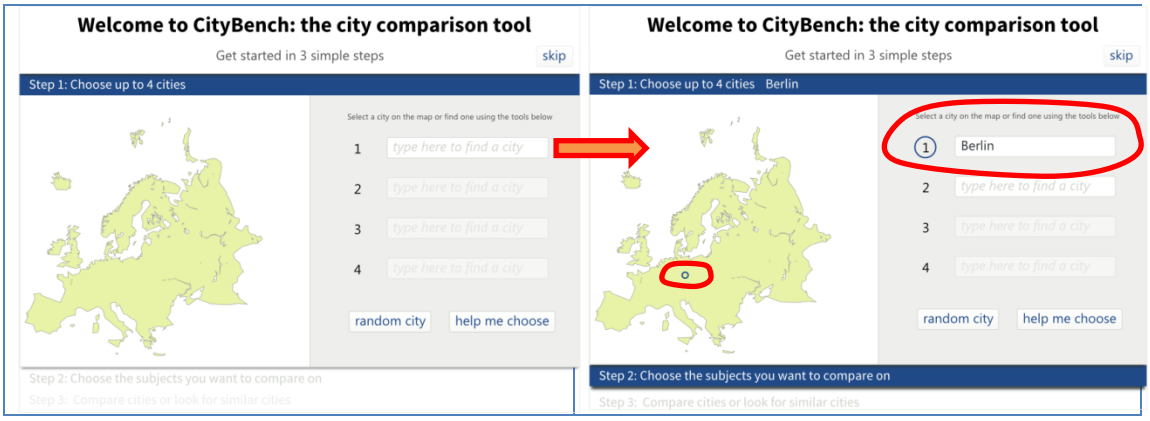

Figure 3-21. Wizard step 1: selecting a city or cities.

- Step 2: screen for selecting indicators and/or TNC / typology (see Figure 3-22). The indicators are available from a dropdown list, which becomes visible when a 'select an indicator' field is clicked. Similarly, clicking the 'select a region' or 'select a typology' field brings up dropdown lists of TNC and typologies, respectively. Once an indicator has been selected, Step 3 will turn blue and become clickable. Up to three indicators can be specified. The Webtool also enables a user to compare his/her city or cities to a sub selection, based on either region (TNC) or typology, of the included cities.

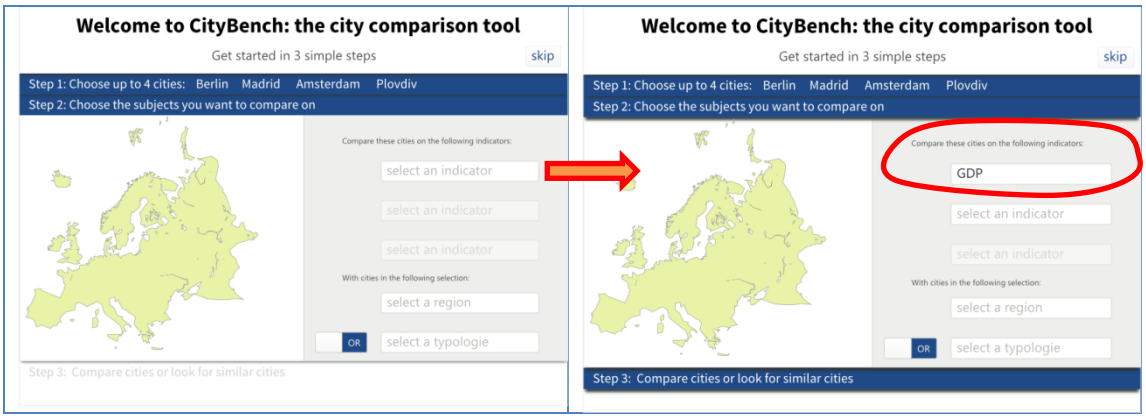

Figure 3-22. Wizard step 2: selecting indicators and/or TNC / typology.

- Step 3: screen providing – and explaining - the choice between comparing cities and looking for similar cities (see Figure 3-23). As the difference between 'comparing' and 'looking for similar' cities may not be clear to all, this step provides some text on both methods. Depending on the choice made here, the Wizard jumps to the Webtool presenting either a page with graphs and charts or a map and similarity graph.

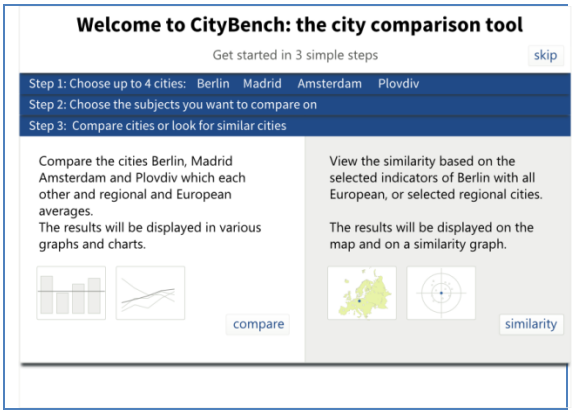

Figure 3-23. Wizard step 3: explaining and providing the choice between comparing cities and looking for similar cities.

3.2.3. Admin Tool

Following the project specifications, the CityBench project has pre-populated the Webtool with a limited set of indicators, belonging to a limited set of themes. Requests by the stakeholders regarding the themes and indicators to be included have been taken into account as much as possible. However, the current indicator set is far from exhaustive: numerous national and European statistical institutes and enterprises have collected hundreds of indicators and are constantly in the process of updating them.

Thus, in order to warrant the sustainability of the Webtool after completion of the CityBench project, the TPG has created a functionality (the 'Admin Tool') which enables an administrator to add one or more new indicators, update already included ones with newly collected data, and deactivate or delete indicators no longer needed. In addition, themes may be renamed, added and deleted as well. The Admin Tool ensures that at any given time, the stakeholders are equipped with a tailor-made set of themes and indicators corresponding to their needs.

Using an automated upload tool entails that the data be presented in a standardized format. The template to be used for new / updated indicator values and accompanying metadata is provided as a separate deliverable. The template contains several drop down lists from which, for each new indicator, values have to be selected for:

- Data unit;
- Data source;
- Geographic level of source data;
- Theme it belongs to.

The template also contains an (optional) field where the EU average for that indicator can be filled in. Figure 3-24 shows a screenshot of the template, including some sample data.

	A	B	C	D	E
1					
2	official indicator id	EC1001V			
3	name of indicator	Economically active population, total			
4	description	Absolute number of persons who are economically active			
5	unit				
6	data source				
7	geographic level				
8	indicator theme				
9	EU average				
10					
11	Luz_id	2009	2010	2011	
12	DE001L1	2653984	2650595	2670565	
13	DE002L1	1656380	1661756	1674038	
14	DE003L1	1388061	1397356	1417868	
15	DE004L1	929496	929102	949500	
16	DE005L1	1268753	1273160	1301089	
17	DE007L1	1377314	1377464	1396450	
18	DE008L2	517845	522515	520027	
19	DE009L2	706706	704289	699229	
20	DE011L1	746018	740236	755335	
21	DE012L1	603271	610917	621801	
22	DE013L1	634007	636344	644834	
23	DE014L1	673871	677122	686079	
24	DE018L1	224823	222604	222890	
25	DE019L2	275022	271014	273872	
26	DE020L1	224961	226022	231567	
27	DE021L1	189015	188968	191237	
28	DE025L1	221069	221513	225610	
29	DE026L1	107100	107888	108681	
30	DE027L1	311175	313041	320272	
31	DE028L1	229039	230362	234609	
32	DE030L1	77847	77966	78332	
33					
34					

Choose data source

Figure 3-24. Screenshot of the data upload template with some sample data.

The drop down lists will be pre-populated with various values. However, the lists may be modified by a Webtool administrator as required. If for example a particular data source not included in the data source drop down list is being used more often, the administrator can add that source as an entry to the data source list, after which it will be available from the drop down list.

It should be stressed that, for the moment, the Webtool does not automatically convert data collected at other than LUZ level to the LUZ level. Preparing non-LUZ (NUTS 2 / 3, country, etc.) data for usage in the Webtool therefore involves manual processing of indicator values. In general the following processing steps apply.

1. Retrieve data from a data source (ESPON, Eurostat, EEA, etc.).
2. Process according to geographic level of data.
    a. Country level data: assign country value to each LUZ within its boundaries.
    b. NUTS 3 level data: using the NUTS 3 – MR correspondence table, aggregate NUTS 3 values to MR level by summing, (weighted) averaging, etc., depending on the topic covered by the indicator. Exceptions: Reykjavik and Vaduz, for which the NUTS 3 values are considered to represent the MR value.
    c. NUTS 2 level data: use NUTS 2 value as an approximation for LUZ value. Please note that NUTS 2 data should be approached carefully (see Section 3.1.5).
    d. Raster data: depending on the topic covered by the indicator, calculate the average, maximum, minimum, median, etc. for each LUZ.
    e. MR level data: no processing necessary.
3. If absolute indicator values are to be converted to relative values, choose the appropriate division unit, e.g. LUZ area or number of residents.

4. Standardize the indicator values.

When uploading MR or aggregated (to MR) NUTS 3 level indicators the Admin Tool will automatically convert the MR codes in the data to the corresponding LUZ codes. For example, Berlin MR code (DE001M) is changed into Berlin LUZ code (DE001L1), which is recognized by the Webtool.

More information on the Admin Tool workflow is available in Annex IV.

3.2.4. Draft final web text sections

This Chapter presents the final version of the textual content of the Webtool. Attention will be directed primarily at key website sections: Home, About, How to Use, FAQ, etc. The main prerequisite to be taken into account is that the text blocks should be in plain English, implying that the use of technical and/or scientific phrases should be restricted as much as possible. The text blocks should be considered mere suggestions, which are open to discussion with the stakeholders.

Home

Welcome to the CityBench Webtool. With this tool you can compare many European 'Larger Urban Zones' (LUZ) on the basis of one or more indicators. The indicators cover several themes: Economy and Population, Connectivity, Demography, Social Media, Investment Climate, Environment and 'Smartness'.

About

The CityBench Webtool has been developed within the framework of a project funded by the European Observation Network for Territorial Development and Cohesion (ESPON), an EU programme. The goal of the Webtool is to provide an easy-to-use interface that enables a quick benchmarking / comparison of two or more European Larger Urban Zones (LUZ). This information may be useful to a wide audience. Target groups for the Webtool include, but are not restricted to, policy makers, investors and companies in search of a new business location.

The indicators, or the data from which an indicator was derived, originate from various sources, most notably the ESPON and Eurostat databases. Other sources include the European Environment Agency (EEA), Doing Business and social media (Twitter, YouTube and Flickr).

More info on the CityBench project can be found here.

How to use

Video tutorials will be created reflecting various use-cases and interrogation paths.

FAQ

Every time I access the CityBench Webtool, the city I am in (or near to) is initially selected. Why is that?

The CityBench Webtool is able to derive your (approximate) location from the IP address of the device you are using. We assume that this is also the city you are most interested in.

What is a Larger Urban Zone (LUZ)?

The CityBench Webtool is aimed at benchmarking / comparing Larger Urban Zones (LUZ) rather than cities. A LUZ is "…an approximation of the functional urban area extending beyond the core city"; the core city being "…the city as defined by its administrative and/or political boundaries" according to Eurostat. In practice this means that a LUZ is virtually always larger than the city it contains and that values collected for LUZ level will, to a greater or lesser extent, differ from (core) city values.

What is NUTS 1/2/3?

According to Eurostat, "The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU…". The most commonly used levels are:

- NUTS1: major socio-economic regions (not used in Webtool)

- NUTS2: basic regions for the application of regional policies

- NUTS3: small regions for specific diagnoses

In case of the NUTS3 indicators in the Webtool, the NUTS3 values have been aggregated to metropolitan region level, as an approximation of the LUZ level.

In case of the NUTS2 indicator in the Webtool, the NUTS2 values have been assigned to each LUZ it contains.

Indicators which have been derived from NUTS 2/3 data are marked as such in the Webtool.

What is a metropolitan region (MR) and how does it compare to a LUZ?

A metropolitan region is an aggregation of one or more NUTS3 units and is considered the NUTS3 approximation of a larger urban zone. Please note that although many MR - LUZ pairs show a good correspondence, correspondence is poor in some cases (MR much larger than LUZ or vice versa).

Which LUZ are included and why?

171 LUZ are currently included in the Webtool. They were selected according to the following criteria:

Inclusion of all European cities that are part of another online city comparison tool, the OECD Metropolitan Explorer.

Inclusion of capitals of European countries not included in OECD to cover ESPON Space (i.e. EU27 plus Iceland, Liechtenstein, Norway and Switzerland).

Inclusion of all remaining LUZ with a population number of > 400,000.

Inclusion of additional LUZ in underrepresented countries, i.e. countries with only one or even zero LUZ with a population of > 400,000 by including a second city, provided that its population exceeds 200,000.

At a later stage, the number of LUZ will be increased to include all LUZ as defined by Eurostat.

Why isn't my city included in the Webtool?

If you are in a city which does not comply to any of the criteria specified above, it is currently not included. However, as indicator data availability increases, more and more (smaller) LUZ will be added to the Webtool, possibly including your city as well.

What do the various indicator themes represent?

The indicators are grouped according to 'themes', each covering a different topic.

- Theme Economy and Population: provides general information about a LUZ.
- Theme Connectivity: provides information on the degree to which a LUZ is connected to 'the rest of the world'.
- Theme Demography: provides information on the build-up of the LUZ population.
- Theme Social Media: includes indicators derived from data harvested from social media (Volunteered Geographic Information or VGI).
- Theme Investment Climate: provides indicators potentially of interest to investors.
- Theme Environment: provides an indication of the environmental / air quality of a LUZ.
- Theme 'Smartness': provides an indication of the degree to which a LUZ is prepared for future developments.

How can I get more information for a specific indicator?

In the bar above each indicator, this icon: ⓘ is displayed. When clicked a popup window shows additional information about the indicator: detailed description, geographic level at which it was collected, source, update frequency, etc. The additional information may include (part of) the next text block:

(For several indicators no data at LUZ level was available. In those cases data collected at other geographic levels (NUTS2/3, country) was used. NUTS3 units, which are usually smaller than a LUZ, may be aggregated to create a Metropolitan Region (MR), which is considered a good approximation of a LUZ.

The current set of indicators, although limited, in many cases provides a good starting point for LUZ comparison. However, stakeholders may add custom indicators as desired.)

Why are some indicators not available for the city or cities I'm interested in?

Because of gaps in the source data, unfortunately completeness for most indicators is not 100%. This means that they do not cover all LUZ included in the Webtool. A small icon in the bar above an indicator displays its degree of completeness. It looks like this:  . Dark blue represents the proportion of LUZ for which indicator values are available.

Is it possible to show indicator values for different years (time series)?

No, for now that is not possible. However, as new data keeps being collected, in future we will add the option to show indicator values for different years.

How can I compare two or more cities?

The CityBench Webtool allows the comparison of up to four LUZ, based on up to three indicators. To select LUZ for comparison, just click on the buttons below the map of Europe: 'Select the 1st (2nd/3rd/4th) city'. Also, select one, two or three indicators on which the comparison will be based by clicking 'remove' and/or 'Select a 1st/2nd/3rd indicator'. Once you have selected one or more LUZ and one or more indicators, click 'Compare'.

Rather than comparing between cities, can I compare a city to other geographic units?

Yes, you can. The CityBench Webtool has the option to compare LUZ indicator values to the average value of the country it belongs to or to the European average. Also, you are able to compare the city you are interested in to the capital of the country it belongs to.

How is the similarity between cities calculated?

By similarity we mean the degree to which indicator(s) values are comparable.

Two processing steps are involved in deriving similarity values:

1) All indicators are normalized, i.e. for each indicator the lowest LUZ value is assigned a value of 0 and the highest a value of 1.
2) For one, two or three normalized indicators, the 'Euclidean' distance between the indicator(s) values for one LUZ and one or more other LUZ (or country / European average) is calculated. Euclidean distance (or Euclidean metric) is the distance between two points as measured with a ruler and using the Pythagorean formula to derive the (metric) distance. The more indicators are selected, the more dimensions are involved in the calculation (one dimension for each indicator added).

For example, if you selected 3 (normalized) indicators (a, b and c) and two LUZ (A and B) then the similarity between these LUZ is calculated as follows: sqrt ((aA - aB)2 + (bA - bB)2 + (cA - cB)2).

If the calculated distance is 0, there is full similarity; if the distance is equal to the sqrt(number of dimensions), there is maximal dissimilarity. In other words, the closer the number is to 0, the higher the degree of similarity between the selected LUZ, based on the chosen indicators. Conversely, the closer the number is to 1 (or even exceeds 1, which occurs as more indicators are added), the more different the LUZ are.

What is shown on the different tabs: Map / Radial?

Map

Being the main tab, the Map view shows how all included LUZ compare based on one, two or three indicators. The LUZ currently selected serves as the reference LUZ, to which the others are compared. The size of the circle representing a LUZ corresponds to the similarity of each LUZ to the reference LUZ: the larger the circle, the greater the similarity (and vice versa). See for an explanation of the calculation of similarity: How is the similarity between cities calculated?

Radial

The Radial view provides, for one, two or three indicators, an alternative way to show the similarity between the LUZ you selected and all other LUZ. See for an explanation of the calculation of similarity: How is the similarity between cities calculated?

4. Draft 'European Urban Benchmarking Webtool Demonstration Report'

Rather than preparing a descriptive report, high quality video tutorials are being produced. A preview of the Webtool is currently available at the following address: http://espon.geodan.nl/CityBench. As an example, Figure 4-1 shows the landing page of the Webtool.

However, please note that the Webtool is still under development; therefore this preview version will be updated and improved to reflect the progress. As the provided address is a test URL, it may not be available between updates. Please check with the TPG before planning important test moments or sharing the URL. The final version will be available from the ESPON servers, using a dedicated URL.

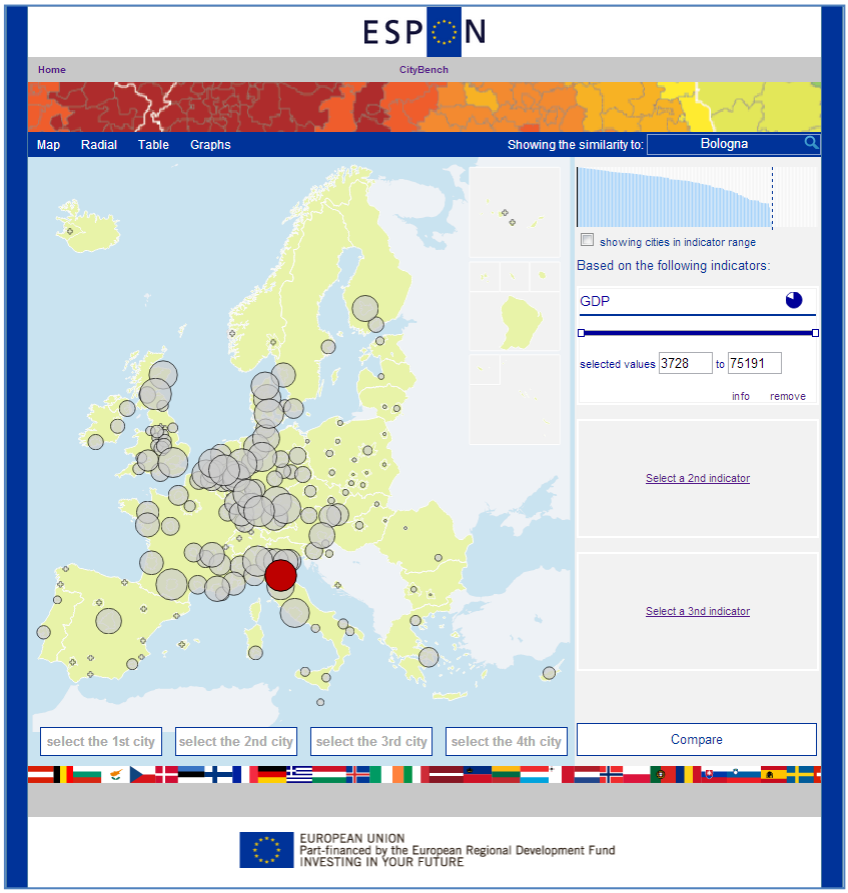

Figure 4-1. Landing page of CityBench Webtool.

5. Communication Platform

Info Web

Being an informative web page for potential users and stakeholders to know more about the project, this web will host institutional/ technical easy-to-read information. The text blocks should be considered mere suggestions, which are open to discussion with the stakeholders, and can be consulted here (*http://lsivirtual27.dlsi.uji.es/web/*).

More detailed information was published on Interim delivery II. Waiting for feedback, this platform will evolve for next delivery.

Social Network

http://lsivirtual27.dlsi.uji.es/wp-login.php?redirect_to=http%3A%2F%2Flsivirtual27.dlsi.uji.es%2F&reauth=1

(Log in details: user: guest2013; password: guest2013)

Designed for stakeholders relations, each user will be able to comment, share documents and media and be part of the different groups of interest defined and created (or deleted) by the administrators.

Administrators will be able to ask for participation in different activities, such as surveys, and send notifications to users when there is news or updates on the project.

Waiting for feedback, this platform will evolve for next delivery.

Surveys

For receiving specific feedback from stakeholders, a survey was designed based on prototype I and presented on the USESPON Berlin Meeting and to the Polish National Contact Point. Waiting for feedback to evolve not only the Webtool but also the Communications Platform, survey can be consulted below.

Based on the next presentation of prototype II, a new survey will be developed and sent by mail and other social platforms to potential stakeholders, in order to receive more feedback to be taken into account for final delivery.

How important is it to compare cities?

What are the key points to consider for achieving a meaningful city comparison?

About the Webtool

User profile

1. You want to compare and look for similar cities in Europa because you are…
   a) A potential investor
   b) A city administrator
   c) A researcher

d) Other

2. You are…
   a) Male
   b) Female
3. You work in…
   a) Austria
   b) Belgium
   c) Bulgaria
   d) Croatia
   e) Cyprus
   f) Czech Republic
   g) Denmark
   h) Estonia
   i) Finland
   j) France
   k) Germany
   l) Greece
   m) Hungary
   n) Iceland
   o) Ireland
   p) Italy
   q) Latvia
   r) Lithuania
   s) Luxembourg
   t) Malta
   u) Netherlands
   v) Norway
   w) Poland
   x) Portugal
   y) Romania
   z) Slovakia
   aa) Slovenia
   bb) Spain
   cc) Sweden
   dd) Turkey
   ee) United Kingdom
   ff) Other
4. Your age is between…
   a) <30
   b) 30 and 50
   c) >50
5. You work for ESPON or an ESPON project
   a) Yes
   b) No

Indicators

1. We have split the set of indicators into different themes. Please rank them according to their importance (with 1 being the most important):
   a) Context
   b) Connectivity
   c) Demography
   d) Social Media
   e) Investment climate
   f) Environment
   g) Smartness
2. Would you like to propose another theme? If so, please specify:
3. We are now showing 10 indicators, but we plan to show 19, please choose your 5 favourites from the list below:
   a) Resident population/ Population density
   b) GDP per inhabitant
   c) % of persons unemployed
   d) # of in/outbound flights
   e) Potential accessibility by road/ rail
   f) Ageing index
   g) Old age dependency
   h) # of items being posted about 'Crisis'/per inhabitant
   i) # of items being posted about 'Unemployment'/per inhabitant
   j) # of items being posted by tourists/(per inhabitant?)
   k) Ease of doing business
   l) Gas/ Electricity prices for industrial consumers
   m) % of LUZ consisting of green urban areas
   n) Residential PM10
   o) Combined adaptive capacity to climate change
   p) High-Tech (total) patent applications to the EPO per million of inhabitants
   q) IP Addresses
   r) Share of renewable energy in gross final energy consumption
   s) Photovoltaic energy potential
4. We plan to add other indicators, please choose your 5 favourites from the list below:
   a) Air, Multimodal, Road and Rail Accessibility
   b) # of railway / freeway links leading to/from city
   c) Percentage of journeys to work by car or motor cycle
   d) Road and (high speed) rail connections
   e) Avg. speed on major roads and/or freeways
   f) Gross Domestic Product (GDP) per inhabitant
   g) Euro / Purchasing power standard per inhabitant
   h) (Employment (jobs) in various sectors)) / (Employment (jobs) – employees + Employment (jobs) – self-employed) x 100
   i) # of residents with ISCED level 0,1,2 / 3,4 / 5,6 / economically active population

j) Employment (jobs) in various sectors / GDP 1999-2011
k) (Green urban areas) / (other land use)
l) Mean minimum January / maximum July temperature
m) temperature / rainfall / sunshine
n) (Number of residents (aged 25-64) with ISCED level 5 or 6 as the highest level of education) / Total Resident Population 20-64) x 100
o) (number of residents (aged 15-64) with ISCED level 5 or 6 as the highest level of education 2011) – (number of residents (aged 15-64) with ISCED level 5 or 6 as the highest level of education 2001)
p) # of universities in 50 km radius
q) # of high-impact publications
r) Life expectancy at birth by sex and NUTS 2 regions
s) Pop in/-decrease (Tot Res Pop 2012 / Tot Res Pop 2005) x 100
t) Employment
u) People at risk of poverty or social exclusion by NUTS 2 regions
v) (Persons employed, 20-64, female / male) / (Female / Male Resident Population 20-64) x 100
w) Individuals reliant on social security benefits
x) Number of jobless households with / without children
y) (Students leaving compulsory education without having a diploma) / (Total students registered for final year of compulsory education) x 100
z) Number of overcrowded households (>1 persons/room)

5. Do you miss any indicator in the previous list? If so, please specify:

Representation

1. We are presenting the similarity between cities by using two types of graphical views. Which one do you like best?
   a) The map view.
   b) The radial view.
   c) Neither of them, I'd prefer to get some tables and bars/pie charts.
2. In the map view, the size of a circle representing a city corresponds to its similarity to the reference city: the more similar, the bigger the circle. What is your opinion on this?
   a) I like it.
   b) I'd better understand the map if the city size is the value of one of the indicators being considered in the comparison.
   c) I think both representations are useful and I'd like to be able to switch between them.
3. In the radial view, the similarity of a city to the reference city is represented by both its circle size and its distance to the reference city. Its position in any of the quadrants is random. What is your opinion on this?
   a) I like it.
   b) I'd understand better the radial view if the city size is the value of one of the indicators being considered in the comparison and its position in the quadrants represents the positive or negative

relation between cities' vales for indicators 2 and 3 and the reference city value for those indicators.

c) I'd better understand the radial view if the city size is the value of one of the indicators being considered in the comparison and its position in the quadrants more or less corresponds to its actual geographic location (for example, Athens positioned in the lower-right / south-eastern quadrant).
d) None of the above; I'd prefer an intermediate solution, even if we don't exploit all the radial representation potential.

4. When clicking on a city, you should obtain some information about that city. You'd prefer to see:
   a) Name of the city, indicators values and distance rank from the reference city.
   b) Name of the city and distance rank from the reference city.
   c) Only the name of the city.
5. When clicking on an indicator, you should obtain some information about that indicator. You'd prefer to see:
   a) Name, theme, short description, data source, year and geographic level of the original data.
   b) Same as a), but also calculation procedure.
   c) Something simpler than a).

<u>About the dissemination tools</u>

1. The information portal introduces the project in a very straightforward way and provides access to different documents and tools. To accomplish this, it is divided into 9 sections. Please rank them according to their importance (with 1 being the most important):
   a) The ESPON initiative
   b) The CityBench project
   c) Project keywords
   d) Geographical level and cities
   e) Indicators available
   f) The webtool
   g) Documents to download
   h) News/ blog
   i) Community
2. Would you like to propose another section? If so, please specify:
3. Would you remove any section?
4. Do you think having a social network where news and updates are divided in groups according to different interests and roles inside the project is interesting? Or you think enabling comments into the news/blog section of the web is enough for exchanging ideas?
   a) Need for a social network
   b) Comments into the news/blog section of the web is enough
5. Do you think that requiring registration to access the social network, thus knowing who is who, is beneficial?

a) Yes, mandatory registration preserves the project communications privacy.
b) Yes, but I think unregistered visitors should be allowed to be involved in some groups
c) No, I think social network should be open to everyone and no matter who says what in the different groups. The main objective is participation.

6. References

5stardata (2012): **5 ★ Open Data** [Internet]. Available from: <http://5stardata.info/> [Accessed 07 November 2013].

De Smith, M. J., Goodchild, M.F and Longley, P. (2007): **Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools.** Troubador Publishing Ltd, Leicester.

Eurostat (2012): **NUTS - Nomenclature of territorial units for statistics** [Internet]. Available from: <http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction> [Accessed 12 November 2013].

Eurostat (2013): **European cities - spatial dimension** [Internet]. Available from: <http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/European_cities_-_spatial_dimension> [Accessed 12 November 2013].

Annex I. Draft final list of themes and indicators

	Indicator	Source (code)	Source (name)	Most recent year	Geographic level (version)
Theme: Economy and Population					
01	Resident population / Population density	2	Eurostat	2009-2012	LUZ (2012)
02	GDP per inhabitant	2	Eurostat	2009	MR (NUTS 3 2006?)
03	% of persons unemployed	2	Eurostat	2010	MR (NUTS 3 2006?)
Theme: Connectivity					
04	Potential accessibility by rail, standardised ESPON	1	ESPON TRACC	2006	NUTS 3 (2006)
05	Potential accessibility by road, standardised ESPON	1	ESPON TRACC	2006	NUTS 3 (2006)
06	Potential accessibility by air, standardised ESPON	1	ESPON TRACC	2006	NUTS 3 (2006)
Theme: Demography					
07	Ageing index	1	ESPON INTERCO	2008	NUTS 3 (2006)
08	Old age dependency	1	ESPON INTERCO	2008	NUTS 3 (2006)
Theme: Social media					
09	# of items being posted about 'Crisis'/·# items posted in the city	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
10	# of items being posted about 'Crisis'/·# items posted about 'Crisis'	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
11	# of items being posted by tourists(not yet implemented)	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
Theme: Investment climate					
12	Ease of doing business	3	IFC / World Bank	2013	Country
13	Gas / Electricity prices for industrial consumers	2	Eurostat	2012	Country
Theme: Environment					
14	% of LUZ consisting of green urban areas	3	Urban Atlas	2005-2007	LUZ (2004)
15	Residential PM10	3	EEA	2008	LUZ (2012)
16	Combined adaptive capacity to climate change	1	ESPON Climate	2011	NUTS 3 (2006)
Theme: Smartness					
17	High-Tech (total) patent applications to the EPO per million of inhabitants	2	Eurostat	2009	MR (NUTS 3 2006?)
18	IP Addresses	1	ESPON TEL Update	2009	NUTS 3 (2006)
19	Share of renewable energy in gross final energy consumption	2	Eurostat	2011	Country
Theme: Perception					
20	Perception survey results	3	DG Regio	2012	City

Source codes:
1 = ESPON project data
2 = Eurostat db
3 = Other

Annex II. Draft final list of 1st tier LUZ

Final list of 1st tier LUZ and corresponding MR to be included in the Webtool.

	LUZ 2012 code	LUZ 2012 name	Corresponding MR 2012 code (based on NUTS 3 V2006)	MR 2012 name
1	AT001L2	Wien	AT001M	Wien
2	AT002L2	Graz	AT002M	Graz
3	AT003L2	Linz	AT003M	Linz
4	BE001L2	Bruxelles / Brussel	BE001M	Bruxelles / Brussel
5	BE002L2	Antwerpen	BE002M	Antwerpen
6	BE003L2	Gent	BE003M	Gent
7	BE005L2	Liège	BE005M	Liège
8	BG001L2	Sofia	BG001M	Sofia
9	BG002L2	Plovdiv	BG002M	Plovdiv
10	CH001L1	Zürich	CH001M	Zürich
11	CH002L1	Genève	CH002M	Genève
12	CH003L1	Basel	CH003M	Basel
13	CH004L1	Bern	CH004M	Bern
14	CY001L1	Lefkosia	CY001M	Lefkosia
15	CZ001L1	Praha	CZ001M	Praha
16	CZ002L1	Brno	CZ002M	Brno
17	CZ003L1	Ostrava	CZ003M	Ostrava
18	DE001L1	Berlin	DE001M	Berlin
19	DE002L1	Hamburg	DE002M	Hamburg
20	DE003L2	München	DE003M	München
21	DE004L1	Köln	DE004M	Köln
22	DE005L1	Frankfurt am Main	DE005M	Frankfurt am Main
23	DE007L1	Stuttgart	DE007M	Stuttgart
24	DE008L2	Leipzig	DE008M	Leipzig
25	DE009L2	Dresden	DE009M	Dresden
26	DE011L1	Düsseldorf	DE011M	Düsseldorf
27	DE012L1	Bremen	DE012M	Bremen
28	DE013L1	Hannover	DE013M	Hannover
29	DE014L1	Nürnberg	DE014M	Nürnberg
30	DE017L0	Bielefeld	DE017M	Bielefeld
31	DE018L1	Halle an der Saale	DE018M	Halle an der Saale
32	DE019L2	Magdeburg	DE019M	Magdeburg
33	DE020L1	Wiesbaden	DE020M	Wiesbaden
34	DE025L1	Darmstadt	DE025M	Darmstadt
35	DE027L1	Freiburg im Breisgau	DE027M	Freiburg im Breisgau
36	DE028L1	Regensburg	DE028M	Regensburg
37	DE032L1	Erfurt	DE032M	Erfurt
38	DE033L2	Augsburg	DE033M	Augsburg
39	DE034L1	Bonn	DE034M	Bonn
40	DE035L1	Karlsruhe	DE035M	Karlsruhe

41	DE037L1	Mainz	DE037M	Mainz
42	DE038L1	Ruhrgebiet	DE038M	Ruhrgebiet
43	DE039L1	Kiel	DE039M	Kiel
44	DE040L1	Saarbrücken	DE040M	Saarbrücken
45	DE084L1	Mannheim-Ludwigshafen	DE084M	Mannheim-Ludwigshafen
46	DE504L1	Münster	DE504M	Münster
47	DE507L1	Aachen	DE507M	Aachen
48	DK001L2	Köbenhavn	DK001M	Köbenhavn
49	DK002L1	Århus	DK002M	Århus
50	DK003L1	Odense	DK003M	Odense
51	DK004L1	Aalborg	DK004M	Aalborg
52	EE001L1	Tallinn	EE001M	Tallinn
53	EL001L1	Athina	EL001M	Athina
54	EL002L1	Thessaloniki	EL002M	Thessaloniki
55	ES001L1	Madrid	ES001M	Madrid
56	ES002L1	Barcelona	ES002M	Barcelona
57	ES003L1	Valencia	ES003M	Valencia
58	ES004L1	Sevilla	ES004M	Sevilla
59	ES005L1	Zaragoza	ES005M	Zaragoza
60	ES006L1	Malaga	ES006M	Malaga
61	ES007L1	Murcia	ES007M	Murcia
62	ES008L1	Las Palmas	ES008M	Las Palmas
63	ES009L1	Valladolid	ES009M	Valladolid
64	ES010L1	Palma de Mallorca	ES010M	Palma de Mallorca
65	ES019L1	Bilbao	ES019M	Bilbao
66	ES020L1	Córdoba	ES020M	Córdoba
67	ES021L1	Alicante/Alacant	ES021M	Alicante/Alacant
68	ES022L1	Vigo	ES022M	Vigo
69	ES025L1	Santa Cruz de Tenerife	ES025M	Santa Cruz de Tenerife
70	ES026L1	Coruña (A)	ES026M	Coruña (A)
71	FI001L2	Helsinki	FI001M	Helsinki
72	FI002L2	Tampere	FI002M	Tampere
73	FR001L1	Paris	FR001M	Paris
74	FR003L2	Lyon	FR003M	Lyon
75	FR004L2	Toulouse	FR004M	Toulouse
76	FR006L2	Strasbourg	FR006M	Strasbourg
77	FR007L2	Bordeaux	FR007M	Bordeaux
78	FR008L2	Nantes	FR008M	Nantes
79	FR009L2	Lille	FR009M	Lille
80	FR010L2	Montpellier	FR010M	Montpellier
81	FR011L2	Saint-Etienne	FR011M	Saint-Etienne
82	FR013L2	Rennes	FR013M	Rennes
83	FR215L2	Rouen	FR015M	Rouen
84	FR016L2	Nancy	FR016M	Nancy

85	FR017L2	Metz	N/A (no corresponding MR)	
86	FR022L2	Clermont-Ferrand	FR022M	Clermont-Ferrand
87	FR026L2	Grenoble	FR026M	Grenoble
88	FR032L2	Toulon	FR032M	Toulon
89	FR035L2	Tours	FR035M	Tours
90	FR203L2	Marseille	FR203M	Marseille
91	FR205L2	Nice	FR205M	Nice
92	HR001L2	Grad Zagreb	HR001M	Grad Zagreb
93	HR005L2	Split	HR005M	Split
94	HU001L2	Budapest	HU001M	Budapest
95	HU005L2	Debrecen	HU005M	Debrecen
96	IE001L1	Dublin	IE001M	Dublin
97	IE002L1	Cork	IE002M	Cork
98	IS001L1	Reykjavík	IS001 **(NUTS 3 version 2006 code)**	Höfuðborgarsvæði **(NUTS 3 version 2006 name)**
99	IT001L2	Roma	IT001M	Roma
100	IT002L2	Milano	IT002M	Milano
101	IT003L2	Napoli	IT003M	Napoli
102	IT004L2	Torino	IT004M	Torino
103	IT005L2	Palermo	IT005M	Palermo
104	IT006L2	Genova	IT006M	Genova
105	IT007L2	Firenze	IT007M	Firenze
106	IT008L2	Bari	IT008M	Bari
107	IT009L1	Bologna	IT009M	Bologna
108	IT010L2	Catania	IT010M	Catania
109	IT011L2	Venezia	IT011M	Venezia
110	IT012L2	Verona	IT012M	Verona
111	IT022L2	Taranto	IT022M	Taranto
112	IT027L1	Cagliari	IT027M	Cagliari
113	IT028L2	Padova	IT028M	Padova
114	IT029L2	Brescia	IT029M	Brescia
115	LT001L1	Vilnius	LT001M	Vilnius
116	LT002L1	Kaunas	LT002M	Kaunas
117	LU001L1	Luxembourg	LU001M	Luxembourg
118	LV001L0	Riga	LV001M	Riga
119	MT001L1	Valletta	MT001M	Valletta
120	NL001L2	Den Haag	NL001M	Den Haag
121	NL002L2	Amsterdam	NL002M	Amsterdam
122	NL003L2	Rotterdam	NL003M	Rotterdam
123	NL004L2	Utrecht	NL004M	Utrecht
124	NL005L2	Eindhoven	NL005M	Eindhoven
125	NO001L2	Oslo	NO001M	Oslo
126	NO002L2	Bergen	NO002M	Bergen
127	PL001L2	Warszawa	PL001M	Warszawa
128	PL002L2	Łódź	PL002M	Łódź

129	PL003L2	Kraków	PL003M	Kraków
130	PL004L2	Wroclaw	PL004M	Wroclaw
131	PL005L2	Poznan	PL005M	Poznan
132	PL006L2	Gdansk	PL006M	Gdansk
133	PL007L2	Szczecin	PL007M	Szczecin
134	PL008L2	Bydgoszcz	PL008M	Bydgoszcz
135	PL009L2	Lublin	PL009M	Lublin
136	PL010L2	Katowice	PL010M	Katowice
137	PL011L2	Bialystok	PL011M	Bialystok
138	PL012L2	Kielce	PL012M	Kielce
139	PL024L2	Czestochowa	PL024M	Czestochowa
140	PT001L2	Lisboa	PT001M	Lisboa
141	PT002L2	Porto	PT002M	Porto
142	RO001L1	Bucuresti	RO001M	Bucuresti
143	RO002L1	Cluj-Napoca	RO002M	Cluj-Napoca
144	SE001L1	Stockholm	SE001M	Stockholm
145	SE002L1	Göteborg	SE002M	Göteborg
146	SE003L1	Malmö	SE003M	Malmö
147	SI001L1	Ljubljana	SI001M	Ljubljana
148	SI002L1	Maribor	SI002M	Maribor
149	SK001L1	Bratislava	SK001M	Bratislava
150	SK002L1	Košice	SK002M	Košice
151	UK001L2	London	UK001M	London
152	UK002L2	West Midlands urban area	UK002M	Birmingham
153	UK003L1	Leeds	UK003M	Leeds
154	UK004L1	Glasgow	UK004M	Glasgow
155	UK005L0	Bradford	UK005M	Bradford
156	UK006L2	Liverpool	UK006M	Liverpool
157	UK007L1	Edinburgh	UK007M	Edinburgh
158	UK008L2	Manchester	UK008M	Manchester
159	UK009L1	Cardiff	UK009M	Cardiff
160	UK010L2	Sheffield	UK010M	Sheffield
161	UK011L2	Bristol	UK011M	Bristol
162	UK012L1	Belfast	UK012M	Belfast
163	UK013L2	Newcastle upon Tyne	UK013M	Newcastle upon Tyne
164	UK014L1	Leicester	UK014M	Leicester
165	UK016L1	Aberdeen	UK016M	Aberdeen
166	UK018L2	Exeter	UK018M	Exeter
167	UK023L1	Portsmouth	UK023M	Portsmouth
168	UK025L2	Coventry	UK025M	Coventry
169	UK026L1	Kingston upon Hull	UK026M	Kingston upon Hull
170	UK027L1	Stoke-on-Trent	UK027M	Stoke-on-Trent
171	UK029L1	Nottingham	UK029M	Nottingham
172	LI000 **(NUTS 3 version 2006 code)**	Liechtenstein **(NUTS 3 version 2006 name)**	LI000 **(NUTS 3 version 2006 code)**	Liechtenstein **(NUTS 3 version 2006 name)**

Annex III. Social Media Indicators

Introduction

When studying the existing information to analyse and compare cities we cannot forget new trends in digital information and social media. Nowadays bottom-up initiatives complement the ecosystem of information available online. Regular citizens are sharing information about their surrounding and their cities through a large number of social networks. This increasing amount of information cannot be ignored, since it provides in most cases, real time information about places and events, which have impact on society. In this context we witness how location analytics industry is moving from a paradigm of lower volume, higher accuracy data to one of higher volume and lower accuracy. CityBench project aims to generate indicators not only using official data but also indicators which offer a social view analysing data shared by citizen through social networks.

Social Media Indicators

Recent trends in information technology show that citizens are increasingly willing to share information using tools provided by crowdsourcing platforms to describe events with social impact. This is fuelled by the proliferation of location-aware devices such as smartphones and tablets, users are able to share information in these crowdsourcing platforms directly from the field at real time, augmenting this information with its location. However, there is still difficult to extract useful information from this big volume of raw data. It is necessary to generate indicators that resume in useful information the analysis of these data. As such content refers to phenomena that are bound to a location, georeferenced user-generated content is acquiring a fundamental role in a wide range of applications.

Simple georeferenced messages from social networks such as Twitter[3] may play a major role in response actions to emergencies (Schade et al., 2012)(Roche et al., 2012). Not only tweets but other types of data such as videos, audio files and pictures may also be related to a location, and being used in diverse situations such as volunteered–based map creation (Neis et al., 2012), collect in situ biodiversity data (Newell et al., 2012) and forestry data (Aragó et al., 2011). Although georeferenced user-generated data still represents a small percentage, its growth is being greatly accelerated largely by the use of sensor-enabled devices. It is thus reasonable to foresee that huge amounts of georeferenced data will be available in an immediate future.

Next, we define in detail three groups of social media indicators which will be added to the City Bench project in order to complement the information of cities to be studied.

Attitude/informed about current circumstances

It is of interest of the project to provide social media information about current circumstances regarding Crisis, Politics, Economy and unemployment. The interest of citizens of talking, asking or informing about these issues provides an overview about social concern and worries of citizens and therefore it could influence in vulnerable fields such as financial

[3] https://twitter.com/

markets. This also could provide useful information to support decision making to local government or a potential investor.

After studying first results obtained from social media sources, we have defined a starting set of indicators related to a topic inside a LUZ delimitation, and can be defined as:

a) Topic items in a city per total items in that city, intended to describe the social media interest of that city in the cited topic;

b) Topic items in a city per total topic items in all cities, intended to describe the participation of that city into the European concern on that topic.

Table AIII-1. Attitude/information about current circumstances indicators.

Source	Indicator	Spatial level (+ version)	Year	Unit / format	Remarks
Twitter/Flickr/ YouTube	**# items posted in a city containing topic keywords per total items posted in that city**	**LUZ (2012)**	**2013**	**%**	**Data is stored daily. Accumulated values are also stored to reach an annual indicator value.**
Twitter	# of tweets containing topic keywords per total city tweets	LUZ (2012)	2013	%	idem
Flickr	# of pics containing topic keywords per total city pics	LUZ (2012)	2013	%	idem
YouTube	# of videos containing topic keywords per total city videos	LUZ (2012)	2013	%	idem
Twitter/Flickr/ YouTube	**# items posted in a city containing topic keywords per total items posted containing topic keywords**	**LUZ (2012)**	**2013**	**%**	**Data is stored daily. Accumulated values are also stored to reach an annual indicator value.**
Twitter	# of tweets containing topic keywords per total topic tweets	LUZ (2012)	2013	%	idem
Flickr	# of pics containing topic keywords per total topic pics	LUZ (2012)	2013	%	idem
YouTube	# of videos containing topic keywords per total topic videos	LUZ (2012)	2013	%	idem

Calculation procedure:

- Generate lists of keywords (in every language) that illustrate the topic field to create a query to send to the Social Media Networks.
- Create a batch process to send this query to Twitter/Flikckr/YouTube and store the number of items posted in a city. This is done for every city, on a daily basis.
- Indicator can be calculated in different temporal resolution: daily/weekly/monthly/yearly.

Alternative methods (to be investigated):

- Search a trending topic or hashtag related to the previous terms

Topics proposed:

- Crisis
- Unemployment
- Economy
- Politics
- Others

Crisis:

Image 1. Recession concept.[4]

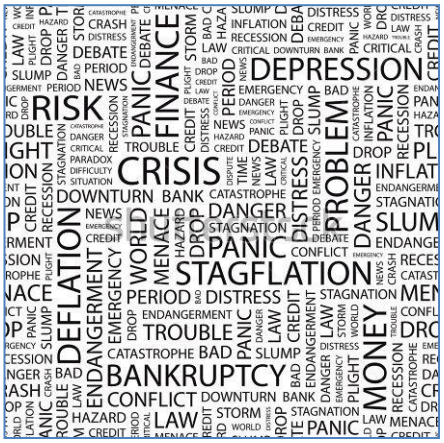

Image 2. Crisis concept.[5]

- Query (UK001L2, en): service=Twitter&q= bailout, bank, business, bubble, capital, crash, corruption, credit, crisis, debt, deflation, bankruptcy, economy, euro, financial, investment, market, money, price, rate, recession, sme, stock market &bbox=&lat=3.212.622,546lon=3.635.630,281 &radius=70000&format=atom&end=26062013&start=26062013
- Projection: ETRS89_ETRS_LAEA
- Keywords (en, English): bailout, bank, business, bubble, capital, crash, corruption, credit, crisis, debt, deflation, bankruptcy, economy, euro, financial, investment, market, money, price, rate, recession, sme, stock market

Table AIII-2. Crisis keywords for the EU27+4 official languages.

language, LUZ	Keywords
bg,Bulgarian	bailout, банка, business, bubble, capital, crash, корупцията, кредит, криза, дълг, дефлация, несъстоятелност, икономиката, euro, финансови, инвестиционни, пазар, пари, цена, rate, рецесия, мсп, stock market
hr,Croatian	bailout, banka, business, bubble, kapital, crash, korupcija, kreditne, kriza, dug, ispuhavanja, stečaj, ekonomija, euro, financijska, investicijska, tržište, novac, cijena, stopa, recesija, malog i srednjeg poduzetništva, burza
cs,Czech	výpomoci, banka, business, bubble, kapitál, crash, korupce, úvěr, krize, zadlužení, deflace, konkurs, ekonomika, euro, finanční, investiční, trh, peníze, cena, rychlost, recese, malých a středních podniků, stock market
da,Danish	redningen, bank, business, bubble, capital, crash, korruption, credit, krise, gæld, deflation, konkurs, economy, euro, finansielle, investment, markedsaktører, money, pris, rate, recession,

[4] http://www.123rf.com/photo_16212574_recession-and-crisis-concept-in-wort-tag-cloud-on-white-background.html
[5] From www.shutterstock.com: 75051070

	sme, stock market
nl,Dutch	bailout, bank, business, bubble, hoofdstad, crash, corruptie, krediet, crisis, schuld, deflatie, faillissement, economie, euro, financieel, investering, markt, geld, prijs, tarief, recessie, kmo, stock market
et,Estonian	kautsjoni, bank, business, bubble, capital, crash, korruptsiooni-, krediidi, kriisi, võlakirjad, deflatsioon, pankrot, majandus, euro, finants-, investeeringute, turg, raha, hind, rate, allakäik, vkede, stock market
fi,Finnish	bailout, bank, business, bubble, capital, crash, korruptio, luotto, kriisi, velka, deflaatio, konkurssi, talous, euro, rahoitus-, sijoitus, market, money, hinta, rate, lama, pk-yritysten, stock market
fr,French	renflouement, banques, business, bulle, capital, crash, la corruption, crédit, crise, dette, la déflation, la faillite, économie, euro, financiers, d'investissement, le marché, l'argent, le prix, taux, récession, pme, stock market
de,German	bailout, bank, business, blase, capital, unfall, korruption, kredit, krise, schulden, deflation, bankrott, wirtschaft, euro, finanzen, investitionen, markt, geld, preis, preise, rezession, kmu, stock market
el,Greek	διάσωσης, τράπεζα, επαγγελματικός, φυσαλίδας, capital, crash, διαφθορά, credit, κρίση, χρέος, αποπληθωρισμός, την πτώχευση, οικονομία, ευρώ, χρηματιστηριακές, επενδυτικές, αγορά, χρήματα, τιμή, τιμή, ύφεση, μμε, χρηματιστήριο
en,English	bailout, bank, business, bubble, capital, crash, corruption, credit, crisis, debt, deflation, bankruptcy, economy, euro, financial, investment, market, money, price, rate, recession, sme, stock market
hu,Hungarian	szanálását, bank, business, bubble, capital, crash, korrupció, hitel, válság, adósság, defláció, csőd, gazdaság, euro, pénzügyi, befektetési, piac, pénz, ár, árfolyam, recesszió, kkv-k, stock market
ga,Irish	fhóirithint, banc, business, bubble, caipitil, crash, éilliú a, creidmheasa, ghéarchéime, fiach, díbhoilsciú, féimheachta, geilleagar, an euro, airgeadais, infheistíochta, mhargaidh, airgead, praghas, ráta, chúlú eacnamaíochta, sme, stoc mhargaidh
it,Italian	bailout, banca, bussines, bolla, capitale, crash, la corruzione, credito, crisi, debito, deflazione, fallimento, economia, euro, finanziario, investimento, mercato, denaro, prezzo, tasso, recessione, pmi, azioni
lv,Latvian	bailout, banka, business, bubble, capital, crash, korupciju, kredīts, krīze, parādu, deflācija, bankrotu, ekonomika, eiro, finanšu, investīciju, tirgus, nauda, cena, rate, recesijas, mvu, akciju tirgus
lt,Lithuanian	finansinės pagalbos, bankas, bussines, burbulas, kapitalas, avarijos, korupcija, kredito, krizė, skolos, defliacija, bankrotas, ekonomika, euras, finansai, investicijos, rinkos, pinigai, kaina, reitingas, recesija, mvį, vertybinių popierių rinka
mt,Maltese	kawzjoni, bank, business, bubble, capital, crash, korruzzjoni, kreditu, kriżi, dejn, deflazzjoni, falliment, ekonomija, euro, finanzjarja, investiment, market, money, price, rata, reċessjoni, sme, stock market
pl,Polish	bailout, bank, business, bubble, capital, crash, korupcja, kredyt, kryzys, dług, deflacja, upadłość, gospodarka, euro, finanse, inwestycje, market, money, cena, cena, recesja, sme, stock market
pt,Portuguese	ajuda, banco, bussines, bolha, capital, crash, corrupção, crédito, crise, dívida, deflação, falência, economia, euro, financeira, investimento, mercado, dinheiro, preço, rate, recessão, sme, stock market
ro,Romanian	bailout, bank, business, bubble, capital, crash, corupția, de credit, criza, datoriilor, deflația, falimentul, economy, euro, financiar, de investiții, market, money, pret, rate, recesiunea, pentru imm-uri, market stock
sk,Slovak	výpomoci, banka, business, bubble, kapitál, crash, korupcia, úver, kríza, zadlženie, deflácia, konkurz, ekonomika, euro, finančné, investičné, trh, peniaze, cena, rýchlosť, recesia, malých a stredných podnikov, stock market
sl,Slovene	bailout, banka, poslovni, bubble, capital, crash, korupcije, credit, kriza, dolg, deflacija, ste?aju, gospodarstvo, evro, finan?ne, naložbe, trg, denar, cena, cena, recesija, msp, stock market
es,Spanish	rescate financiero, banco, negocios, burbuja, capital, crash, corrupción, crédito, crisis, deuda, deflación, bancarrota, economía, euro, financiera, inversiones, mercado, dinero, precio, velocidad, recesión, pyme, mercado de valores
sv,Swedish	bailout, bank, business, bubble, huvudstad, krasch, korruption, kredit, kris, skuld, deflation, konkurs, ekonomi, euro, finansiell, investering, marknadsaktörer, pengar, pris, rate, recession, smf, stock market

is,Icelandic	bailout, bank, business, bubble, capital, crash, spillingu, credit, crisis, skuld, verðhjöðnun, gjaldþrot, economy, euro, financial, investment, market, money, price, rate, samdráttur, sme, stock market
tu,Turkish	kurtarma, banka, business, kabarcık, sermaye, crash, yolsuzluk, kredi, kriz, borç, deflasyon, iflas, ekonomi, euro, finans, yatırım, market, para, fiyat, fiyat, durgunluk, kobi, borsa
lu,Luxembourgish	
no,Norwegian	bailout, bank, business, bubble, capital, crash, korrupsjon, credit, krise, gjeld, deflasjon, konkurs, economy, euro, financial, investment, market, money, prisen, rate, tilbakeslag, sme, stock market

Unemployment:

Image 3. Unemployment concept 1.[6]

Image 4. Unemployment concept 2.[7]

- Query (UK001L2, en): service=Twitter&q= Demand, Employment, Increase, Job, Labour, Market, Productivity, Rate, Salary, Selfemployment, Underemployed, Unemployment, Vacanvy, Wages, Work, Worker, Young &bbox=&lat=3.212.622,546lon=3.635.630,281 &radius=70000&format=atom&end=26062013&start=26062013
- Projection: ETRS89_ETRS_LAEA
- Keywords (en): Demand, Employment, Increase, Job, Labour, Market, Productivity, Rate, Salary, Self-employment, Underemployed, Unemployment, Vacancy, Wages, Work, Worker, Young

Table AIII-3. Unemployment keywords for the EU27+4 official languages.

language, LUZ	Keywords
bg,Bulgarian	Търсенето, трудовата заетост, увеличаване, Job, труда, пазар, производителността, равнището на заплатата, Selfemployment, непълна заетост, безработица, Vacanvy, заплати, работа, Работник, младежи
hr,Croatian	Potražnja, zapošljavanje, Povećanje, posla, rada, tržišta, produktivnost, stopa, plaća, Selfemployment, nedovoljno, Nezaposlenost, Vacanvy, plaće, rad, radnik, mladih
cs,Czech	Poptávka, zaměstnání, zvýšení, práce, práce, trh, produktivita, rychlost, Plat, samostatná výdělečná činnost, Podzaměstnaní, nezaměstnanost, Vacanvy, Mzdy, práce, dělník, mládeže
da,Danish	Demand, beskæftigelse, øge, Job, Labour, Marked, produktivitet, Rate, Løn, selvansættelse, underbeskæftigede, arbejdsløshed, Vacanvy, Wages, Arbejde, Worker, Ungdom
nl,Dutch	Vraag, Werkgelegenheid, Verhoog, Job, Arbeid, Markt, Productiviteit, Rate, Salaris, Selfemployment, Underemployed, werkloosheid, Vacanvy, lonen, Work, Worker, Jeugd
et,Estonian	Nõudlus, tööhõive suurendamine, töö, töö, tootlusele, Rate, Palk, Selfemployment, Vaeghõivatuid, töötus Vacanvy, töötasu, töö-, töötaja-, noorsoo-

[6] http://www.123rf.com/photo_16445926_abstract-word-cloud-for-unemployment-with-related-tags-and-terms.html
[7] http://www.123rf.com/photo_12605002_unemployment-concept-in-word-tag-cloud-on-black-background.html

fi,Finnish	Kysyntä, Työllisyys, kasvu, Job, Labour, Market, tuottavuus, Rate, Palkka, Selfemployment, alityöllistettyjä, työttömyys, Vacanvy, palkat, työ, työntekijä-, nuoriso-
fr,French	Demande, emploi, augmentation, travail, marché, productivité, taux, salaire, travail autonome, sous-emploi, chômage Vacanvy, salaires, travail, travailleur, jeunesse
de,German	Die Nachfrage, Beschäftigung, Erhöhung, Job, Arbeit, Markt, Produktivität, Rate, Gehalt, Selbstständigkeit, unterbeschäftigt, Arbeitslosigkeit, Vacanvy, Lohn, Arbeit, Arbeiter, Jugend
el,Greek	Ζήτηση, την απασχόληση, την αύξηση, Εργασίας, Εργασίας, Αγορά, παραγωγικότητα, το ποσοστό, Μισθός, αυταπασχόληση, υποαπασχολούμενοι, ανεργία, Vacanvy, μισθοί, εργασία, εργάτης, Νεολαία
en,English	Demand, Employment, Increase, Job, Labour, Market, Productivity, Rate, Salary, Self-employment, Underemployed, Unemployment, Vacancy, Wages, Work, Worker, Young
hu,Hungarian	Kereslet, a foglalkoztatás, növekedés, munka, munka-, piac, termelékenység, Rate, Fizetés, Selfemployment, alulfoglalkoztatott, munkanélküliség, Vacanvy, bérek, munka, munkás, ifjúsági
ga,Irish	Éileamh, Fostaíocht, Méadú, Jabanna, an Lucht Oibre, an Mhargaidh, Táirgiúlacht, Ráta, Tuarastal, Selfemployment, underemployed, Dífhostaíocht, Vacanvy, Pá, Obair, Oibrí, Óige
it,Italian	La domanda, lavoro, aumentare, lavoro, lavoro, mercato, della produttività, di cambio, stipendio, lavoro autonomo, sottoccupati, Disoccupazione, Vacanvy, salari, lavoro, lavoratore, la gioventù
lv,Latvian	Pieprasījums, darba tirgū, palielināt, Darba, Darba, tirgus, ražīgums, Rate, alga, Selfemployment, nepietiekami, bezdarbs, Vacanvy, algas, darba, darbinieks, jaunatnes
lt,Lithuanian	Paklausa, Užimtumo, padidinimas, Darbas, Darbo, rinka, našumas, Reitingas, Atlyginimas Selfemployment, ne visu pajėgumu, Nedarbas, Vacanvy, Darbo užmokestis, darbas, darbuotojas, jaunimo
mt,Maltese	Demand Impjiegi, Żieda, Job, Labour, Market, Produttività, Rata, Salarju, Selfemployment, sottoimpjegati, qgħad, Vacanvy, Pagi, ix-Xogħol, Worker, Żgħażagħ
pl,Polish	Popyt, zatrudnienie, wzrost, praca, pracy, rynku, wydajność, szybkość, zalogi, samozatrudnienia, niepełne zatrudnienie, bezrobocie, Vacanvy, Płace, Praca, Pracownik, młodzież
pt,Portuguese	Demand, Emprego, Aumento, Job, Trabalho, mercado, produtividade, Rate, Salário, Selfemployment, subempregados, Desemprego, Vacanvy, Salário, Trabalho, Trabalhador, Juventude
ro,Romanian	Cerere, de muncă și creșterea, locuri de muncă, muncă, piață, a productivității, Rate, salariu, Selfemployment, sub-angajați, șomaj, Vacanvy, salarii, munca, munca, tineret
sk,Slovak	Dopyt, zamestnanie, zvýšenie, práca, práca, trh, produktivita, rýchlosť, Plat, samostatná zárobková činnosť, Podzaměstnaní, nezamestnanosť, Vacanvy, Mzdy, práca, robotník, mládeže
sl,Slovene	Povpraševanje, zaposlovanje, povečanje, Job, dela, trg, Produktivnost, Rate, plače, samozaposlitve, podzaposlenim, Brezposelnost, Vacanvy, plače, delo, delavec, mladina
es,Spanish	Demanda, empleo, Aumento, trabajo, trabajo, mercado, productividad, velocidad, Salario, autoempleo, subempleados, Desempleo, Vacanvy, salario, trabajo, trabajador, Juventud
sv,Swedish	Efterfrågan, arbetsmarknaden, öka, jobb, arbetsmarknad, marknad, produktivitet, Rate, Lön, egenföretagande, undersysselsatta Arbetslöshet, Vacanvy, löner, arbete, arbetare, ungdom
is	Eftirspurnar, atvinnu, Aukning Job, Vinnumálastofnun, Market, framleiðni, Rate, Laun, Selfemployment, Vinnulítill, Atvinnuleysi, Vacanvy, Laun, Vinna, Worker, Young
tu	Talep, İstihdam, Artış, İş, Çalışma, Market, Verimlilik, Hızı, Maaş, Selfemployment, Eksik İstihdam, İşsizlik, Vacanvy, Ücret, İş, İşçi, Genç
lu	
no	Etterspørsel, sysselsetting, øke, Job, arbeids-marked, produktivitet, Rate, Lønn, Selfemployment, undersysselsatte, Arbeidsledighet, Vacanvy, Lønn, Arbeid, Worker, Young

Other possible topics:

- Economy: Crisis, Bank, Money, Credit, SME, Financial, Euro, Debt, Investment, Unemployment, Employment, Job, Market, ECB, OECD, Labor Union, Trade Union, Stock Market
- Politics: Parliament, Europe, European Commission, Politics, Corruption, Right Wing, Left Wing, Union, Labor Union, Trade Union, Legislation, Law

Tourism

It is of interest of the project to provide social media information about mobility in Europe. Both short term displacement for tourism or long term mobility (emigration/immigration) provide interesting information about cities. Such as its economy based on tourism, or its capacity to absorb immigration. This also could provide useful information to support decision making to local government or a potential investor. These indicators are calculated per capita inside a LUZ delimitation. The idea, not yet implemented in the prototype, is to calculate the items posted in social media networks by foreign users in a city.

Table AIII-4. Tourism indicators.

Source	Indicator	Spatial level (+ version)	Year	Unit / format	Remarks
Twitter/Flickr/ YouTube	**# items posted in a city whose user is a foreigner**	**LUZ (2012)**	**2013**	**Items / per capita**	
Twitter	# of tweets whose user is a foreigner	LUZ (2012)	2013	Tweets / per capita	Data is stored daily.
Flickr	# of pics whose user is a foreigner	LUZ (2012)	2013	Pictures / per capita	Data is stored daily
YouTube	# of videos whose user is a foreigner	LUZ (2012)	2013	Videos / per capita	Data is stored daily

Calculation procedure:

- Create a batch process to send this query Twitter/Flikckr/YouTube and store the number of items posted in a city whose user is a foreigner. This is done for every city, on a daily basis.
- Indicator can be calculated in different temporal resolution: daily/weekly/monthly/yearly.

Annex IV. Admin Tool Workflow

Uploading a new Indicator

The Table

This is the table that the ESPON administrator must have local in order to upload it into the database.

Table AIV-1. Excel file (.csv) expected by the Database.

ID	LUZ_ID	VALUE	YEAR
1	AT001L1	28,54	2009
2	AT002L1	43,26	2009
3	AT003L1	12,00	2009
…	…	…	…

To be able to account for multiple indicators upload, admin can prepare a workbook with multiple sheets containing a different indicator on each sheet.

Most spreadsheets from Espon have a different structure, with the different year values in different columns.

Table AIV-2. Excel file usually used by ESPON projects.

LUZ_ID	1999_2002	2003_2006	2007_2009
AT001L1	5,497	5,633	6,174
…	…	…	…

We propose a check for this on the form Wizard, if yes, the upload tool will be able to read for each city the different years and create the table/s as expected by the database (Table AIV-1).

If the value given is collected for a period and not a specific year (as in Table AIV-2), the tool will choose the latest year from the header to put it in the year field.

Indicator metadata should be prepared on individual rows above the actual indicator data, as shown in Table AIV-3. Later, in the Admin Tool, an admin only needs to fill the cell code corresponding with each metadata (eg. B2 or E5).

Table AIV-3. Indicator metadata.

Source of Data	Eurostat		
Short Description	Short Description…		
Name	EU nationals …		
Unit	Value		
ID	LUZ_ID	VALUE	YEAR
	AT001L1	5,497	2002
	AT003L1	12,00	2002

Admin will WRITE fields like data source or theme, and can make writing errors making the tool add new themes or data sources in the database that are not really new (eg: conectivity and connectivity). Because of that, the tool will warn about similarities in the words used.

The Webtool

A button linking with the Admin Tool button is needed in the client.

A pop-up asking for a user and password log-in will be launched. An admin user and password will be needed to proceed.

The AdminTool

Form to insert a new indicator

[Form to INSERT data into the INDICATORS table]

Next is described the pop-up that will help the ESPON administrator to insert his new table in the database. He will need to fill in the cells code from the Excel file for all the fields, which correspond with the INDICATORS table fields.

Name: character varying(20) [this will be the new table's name, for example, POP_DENSITY]

Description: character varying(255) [text describing more in detail the indicator meaning, for example, Population density values for 2012 based on Eurostat data at metropolitan region level]

Unit: character varying(10)

Data source:

Urban Audit	[1 in the DATASOURCE field]
Eurostats	[2 in the DATASOURCE field]
ESPON DB	[3 in the DATASOURCE field]
EEA	[4 in the DATASOURCE field]
Social Networks	[5 in the DATASOURCE field]
Other	[character varying(20), will INSERT a new row into the DATASOURCE table, and the corresponding number in the INDICATORS table DATASOURCE field]

Indicator ID: character varying(20) (data sources 1 and 2 have codes like the LUZ ones). [If the new indicator does not have an official code, thus the ESPON admin does not fill in this field, an automatic code will be given with the next pattern: starts with CB, then datasource code, then theme code, then two digits serial, then V for absolute number (look into the UNIT field) or I for a relation (when unit field has the symbol /).]

Geographical level of data capture:

LUZ Bounding box	[BBOX in the DATASOURCE field]
Country	[C in the DATASOURCE field]
Large Urban Zones	[LUZ in the DATASOURCE field]
Metropolitan Regions	[MR in the DATASOURCE field]
Nomenclature of Territorial Units for Statistics - Level 3	[NUTS3 in the DATASOURCE field]
Other…	[code: character varying(10); description: character varying(255), will INSERT a new row into the GEOLEVELS

table and the corresponding code in the INDICATORS table GEOLEVEL field]

Theme: Context [1 in the DATASOURCE field]
Connectivity [2 in the DATASOURCE field]
Demography [3 in the DATASOURCE field]
Social media [4 in the DATASOURCE field]
Investment climate [5 in the DATASOURCE field]
Environment [6 in the DATASOURCE field]
Smartness [7 in the DATASOURCE field]
Other… [character varying(50), will INSERT a new row into the THEMES table and the corresponding number in the INDICATORS table THEME field]

Creation Date [time stamp, transparent to user]

Modifying Date [time stamp, transparent to user]

Multiple years check: Dropdown list containing:

No [if Excel file is like Table AIV-1, nothing happens]

Yes [if Excel file is like Table AIV-2, the tool will be able to read for each city the different years and create the table/s expected by the database (Table AIV-1). If the header is a period of years, the tool will choose the latest year to put it in the YEAR field]

Upload button [saves previous data in the INDICATORS table if uploading the csv file into the database succeeds]

Uploading the file

[Transparent to user]

After populating the INDICATORS table through the previous Wizard, the ESPON administrator pushes the UPLOAD button and selects his CSV file. ETL tool will execute next steps, transparent to the user.

Check if all LUZ_ID exist in the LUZ and LUZ_CENTROIDS tables

CREATE table NEW_INDICATOR [name taken from the NAME filed given in the previus Wizard, thus, corresponding with the NAME field of the INDICATORS table, for example POP_DENSITY]

```
CREATE TABLE CityBench.NEW_INDICATOR (
ID serial NOT NULL,
LUZ_ID varchar(10),
VALUE float,
YEAR int,
CONSTRAINT pk_NEW_INDICATOR PRIMARY KEY(ID),
CONSTRAINT fk_LUZ_ID FOREIGN KEY(LUZ_ID) REFERENCES
CityBench.LUZ(LUZ_ID)
);
```

Import data into the new table NEW_INDICATOR

INSERT new rows into LUZ_INDICATORS table

```
INSERT INTO CityBench.luz_indicators (luz_id, ind_id)
SELECT DISTINCT CityBench.NEW_INDICATOR.luz_id,
CityBench.indicators.id
FROM CityBench.NEW_INDICATOR, CityBench.indicators
WHERE CityBench.indicators.id = 'NEW_INDICATOR.id';
```

Closing pop-up

When all the steps are successfully executed, we will have:

```
1 new row in the INDICATORS table
1 new row in the DATASOURCE table (eventually)
1 new row in the GEOLEVELS table (eventually)
1 new row in the THEMES table (eventually)
1 new table named NEW_INDICATOR (for example POP_DENSTY)
with X rows
Y new rows in the LUZ_INDICATORS table
```

Then, the Admin Tool will execute next steps:

Check that this has indeed taken place.

If so, **save** changes.

A **pop-up** window will be launched so ESPON administrator knows everything was OK, with a Finish button. When he clicks on the button, Wizard closes.

Deleting an Existing Indicator

To be developed

Updating an Existing Indicator

To be developed

Annex V. Services

Cities

getAllCities Service

This service will return the list of all LUZ from the database.

Takes: -
Returns: [LUZ_ID, LUZ_Name, long, lat]

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/objects/cities

getAllCities Country filter Service

This service is a query parameter from the previous service and will return the list of all LUZ from the database belonging to a given country

Takes: countryID
Returns: [LUZ_ID, LUZ_Name, long, lat]

Query:

```
SELECT cen.*
FROM CityBench.luz luz, CityBench.countries c,
CityBench.luz_centroids cen
WHERE luz.country = 'AT'
AND c.acronym = 'AT'
AND luz.luz_id = cen.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/objects/cities?country=AT

getAllCities Typology filter Service

This service is a query parameter from the previous service and will return the list of all LUZ from the database belonging to a given typology.

Takes: typeID
Returns: [LUZ_ID, LUZ_Name, long, lat]

Query:

```
SELECT cen.*
FROM CityBench.mr, CityBench.luz_centroids cen
WHERE CityBench.mr.mr_id in (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id in (
            SELECT CityBench.nuts3_types.nuts_id
            FROM CityBench.nuts3_types, CityBench.types
            WHERE CityBench.nuts3_types.type = 'CAP'
            AND CityBench.types.type = 'CAP'
            ORDER BY CityBench.nuts3_types.nuts_id))
AND cen.luz_id = CityBench.mr.luz_id
```

```
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/objects/cities?typology=CAP

getAllCities Trans National Cooperation Programs filter Service

This service is a query parameter from the previous service and will return the list of all LUZ from the database belonging to a given transborder/crossborder area.

Takes: `tnc_code or tnc_name`
Returns: `[LUZ_ID, LUZ_Name, long, lat]`

Query:

```
SELECT cen.*
FROM CityBench.mr, CityBench.luz_centroids cen
WHERE CityBench.mr.mr_id in (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id in (
            SELECT CityBench.nuts3_tnc.nuts3
            FROM CityBench.nuts3_tnc, CityBench.tnc
            WHERE CityBench.nuts3_tnc.tnc_code = 7
            AND CityBench.tnc.tnc_code = 7
            ORDER BY CityBench.nuts3_tnc.nuts3))
AND cen.luz_id = CityBench.mr.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/objects/cities?tnc_code=7

```
--or
SELECT cen.*
FROM CityBench.mr, CityBench.luz_centroids cen
WHERE CityBench.mr.mr_id in (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id in (
            SELECT CityBench.nuts3_tnc.nuts3
            FROM CityBench.nuts3_tnc, CityBench.tnc
            WHERE CityBench.nuts3_tnc.tnc_code = (
                  SELECT CityBench.tnc.tnc_code
                  FROM CityBench.tnc
                  WHERE CityBench.tnc.tnc_name = 'Macronesia')
            ORDER BY CityBench.nuts3_tnc.nuts3))
AND cen.luz_id = CityBench.mr.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/objects/cities?tnc_name=Macronesia

getAllCities Language filter Service

This service is a query parameter from the previous service and will return the list of all LUZ from the database having as official language a given language.

Takes: languageID
Returns: [LUZ_ID, LUZ_Name, long, lat]

Query:

```
SELECT cen.*
FROM CityBench.luz, CityBench.luz_language,
CityBench.luz_centroids cen
WHERE CityBench.luz_language.luz_language = (
      SELECT CityBench.languages.acronym
      FROM CityBench.languages
      WHERE CityBench.languages.name = 'Dutch')
AND CityBench.luz_language.luz_id = CityBench.luz.luz_id
AND cen.luz_id = luz.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/objects/cities?city_lang=Dutch

Indicators

getAllIndicators Service

This service will return the list of all indicators from the database.

Takes: -
Returns: [all Indicators' data]

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators

getAllIndicators Theme filter Service

This service is a query parameter from the previous service and will return the list of all indicators from the database belonging to a given theme.

Takes: themeName or themeID
Returns: [all Indicators' data]

Query:

```
SELECT CityBench.indicators.*
FROM CityBench.indicators
WHERE CityBench.indicators.theme = (
      SELECT CityBench.themes.id
      FROM CityBench.themes
      WHERE CityBench.themes.name = 'Context')
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators?theme=Context

```
-- or
SELECT CityBench.indicators.*
```

```
FROM CityBench.indicators
WHERE CityBench.indicators.theme = 1
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators?theme_id=1

getAllIndicators Data Source filter Service

This service is a query parameter from the previous service and will return the list of all indicators from the database whose data proceed from a given data source.

Takes: dSourceName or dSourceID
Returns: [all Indicators' data]

Query:

```
SELECT CityBench.indicators.*
FROM CityBench.indicators
WHERE CityBench.indicators.source_id = (
      SELECT CityBench.datasource.id
      FROM CityBench.datasource
      WHERE CityBench.datasource.name = 'Eurostat')
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators?source=Eurostat

```
-- or
SELECT CityBench.indicators.*
FROM CityBench.indicators
WHERE CityBench.indicators.source_id = 2
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators?source_id=2

getAllIndicators Geographical Level of data capture filter Service

This service is a query parameter from the previous service and will return the list of all indicators from the database whose data has been captured on a given geographical level basis.

Takes: geolevelName or geolevelID
Returns: [all Indicators' data]

Query:

```
SELECT CityBench.indicators.*
FROM CityBench.indicators
WHERE CityBench.indicators.geolevel = (
      SELECT CityBench.geolevels.code
      FROM CityBench.geolevels
      WHERE CityBench.geolevels.description = 'Country')
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators?geolevel=Country

```
-- or
SELECT CityBench.indicators.*
FROM CityBench.indicators
WHERE CityBench.indicators.geolevel = 'C'
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicators?geolevel_id=C

Completeness Service

This service will return the number of cities having data for a given indicator or for a given indicator and year.

Takes: `indicatorName or (indicatorName, year)`
Returns: `count`

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/completeness?name=con_air

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/completeness?name=con_air&year=2001

Indicators Theme Service

This service will return the theme from a given indicator.

Takes: `indicatorID or indicatorName`
Returns: `themeID`

Query:

```
SELECT CityBench.indicators.theme
FROM CityBench.indicators
WHERE CityBench.indicators.id = 'EC2031V'
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatortheme?indicator_id= EC2031V

```
-- or
SELECT CityBench.indicators.theme
FROM CityBench.indicators
WHERE CityBench.indicators.name = 'GDP'
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatortheme?indicator=GDP

Values

getIndicator Service

This service will return a list of all cities with the correspondent value for a given indicator or for a given indicator in a given year.

Takes: `indicatorName or (indicatorName, year)`
Returns: `([LUZ_ID], [Value])`

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatordata?name=con_air

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatordata?name=con_air&year=2001

getIndicatorPerMR Service

This service will return the list of LUZ together with the value and year of the given indicator, when the indicator table is defined at MR geographic level, for all the MRs in the table or for a given set of MRs.

Takes: `indicatorName or (indicatorName, [MR_ID])`
Returns: `([LUZ_ID], [value], [year])`

Query:

```
SELECT CityBench.MR.luz_id, CityBench.MR_INDICATOR_TEST.value,
CityBench.MR_INDICATOR_TEST.year
FROM CityBench.MR, CityBench.MR_INDICATOR_TEST
WHERE CityBench.MR.mr_id = CityBench.MR_INDICATOR_TEST.mr_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/mrtoluz?ind=MR_INDICATOR_TEST

```
-- or
SELECT CityBench.MR.luz_id, CityBench.MR_INDICATOR_TEST.value,
CityBench.MR_INDICATOR_TEST.year
FROM CityBench.MR, CityBench.MR_INDICATOR_TEST
WHERE CityBench.MR.mr_id = CityBench.MR_INDICATOR_TEST.mr_id
AND CityBench.MR.mr_id IN ('DE003M', 'DE002M', 'DE001M')
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/mrtoluz?ind=MR_INDICATOR_TEST&ids=DE003M,DE002M,DE001M

getIndicatorPerNUTS3-AVG Service

This service will return the list of LUZ together with the aggregated AVERAGE value and LATEST year of the given indicator, when the indicator table is defined at NUTS3 geographic level, for all the NUTS3s in the table or for a given set of NUTS3s.

Takes: `indicatorName or (indicatorName, [NUTS3_ID])`
Returns: `([LUZ_ID], [value], [year])`

Query:

```
SELECT CityBench.MR.luz_id,
AVG(CityBench.NUTS3_INDICATOR_TEST.value),
MAX(CityBench.NUTS3_INDICATOR_TEST.year)
FROM CityBench.MR, CityBench.NUTS3_INDICATOR_TEST
WHERE CityBench.MR.mr_id = (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id =
      CityBench.NUTS3_INDICATOR_TEST.nuts3_id)
GROUP BY CityBench.MR.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/ind_luz_from_mr_summary?ind_name=nuts3_indicator_test&agg_fn=av_my

```
-- or
SELECT CityBench.MR.luz_id,
AVG(CityBench.NUTS3_INDICATOR_TEST.value),
MAX(CityBench.NUTS3_INDICATOR_TEST.year)
FROM CityBench.MR, CityBench.NUTS3_INDICATOR_TEST
WHERE CityBench.MR.mr_id = (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id =
      CityBench.NUTS3_INDICATOR_TEST.nuts3_id
      AND CityBench.nuts3_mr.nuts3_id in ('AT112', 'AT125',
      'AT126', 'AT127', 'AT130', 'AT221', 'AT225', 'AT312',
      'AT313'))
GROUP BY CityBench.MR.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/ind_luz_from_mr_summary?ind_name=nuts3_indicator_test&nuts_ids=AT112,AT125,AT126,AT127,AT130,AT221,AT225,AT312,AT313&agg_fn=av_my

getIndicatorPerNUTS3-SUM Service

This service will return the list of LUZ together with the aggregated ADDED value and LATEST year of the given indicator, when the indicator table is defined at NUTS3 geographic level, for all the NUTS3s in the table or for a given set of NUTS3s.

Takes: `indicatorName` or (`indicatorName`, `[NUTS3_ID]`)
Returns: (`[LUZ_ID]`, `[value]`, `[year]`)

Query:

```
SELECT CityBench.MR.luz_id,
SUM(CityBench.NUTS3_INDICATOR_TEST.value),
MAX(CityBench.NUTS3_INDICATOR_TEST.year)
FROM CityBench.MR, CityBench.NUTS3_INDICATOR_TEST
```

```
WHERE CityBench.MR.mr_id = (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id =
      CityBench.NUTS3_INDICATOR_TEST.nuts3_id)
GROUP BY CityBench.MR.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/ind_luz_from_mr_summary?ind_name=nuts3_indicator_test&agg_fn=sv_my

```
-- or
SELECT CityBench.MR.luz_id,
SUM(CityBench.NUTS3_INDICATOR_TEST.value),
MAX(CityBench.NUTS3_INDICATOR_TEST.year)
FROM CityBench.MR, CityBench.NUTS3_INDICATOR_TEST
WHERE CityBench.MR.mr_id = (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id =
      CityBench.NUTS3_INDICATOR_TEST.nuts3_id
      AND CityBench.nuts3_mr.nuts3_id in ('AT112', 'AT125',
      'AT126', 'AT127', 'AT130', 'AT221', 'AT225', 'AT312',
      'AT313'))
GROUP BY CityBench.MR.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/ind_luz_from_mr_summary?ind_name=nuts3_indicator_test&nuts_ids=AT112,AT125,AT126,AT127,AT130,AT221,AT225,AT312,AT313&agg_fn=sv_my

getIndicatorPerNUTS3-MAX Service

This service will return the list of LUZ together with the aggregated MAXIMUM value and LATEST year of the given indicator, when the indicator table is defined at NUTS3 geographic level, for all the NUTS3s in the table or for a given set of NUTS3s.

Takes: `indicatorName or (indicatorName, [NUTS3_ID])`
Returns: `([LUZ_ID], [value], [year])`

Query:

```
SELECT CityBench.MR.luz_id,
MAX(CityBench.NUTS3_INDICATOR_TEST.value),
MAX(CityBench.NUTS3_INDICATOR_TEST.year)
FROM CityBench.MR, CityBench.NUTS3_INDICATOR_TEST
WHERE CityBench.MR.mr_id = (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id =
      CityBench.NUTS3_INDICATOR_TEST.nuts3_id)
GROUP BY CityBench.MR.luz_id
```

```
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/ind_luz_from_mr_summary?ind_name=nuts3_indicator_test&agg_fn=mv_my

```
-- or
SELECT CityBench.MR.luz_id,
MAX(CityBench.NUTS3_INDICATOR_TEST.value),
MAX(CityBench.NUTS3_INDICATOR_TEST.year)
FROM CityBench.MR, CityBench.NUTS3_INDICATOR_TEST
WHERE CityBench.MR.mr_id = (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id =
      CityBench.NUTS3_INDICATOR_TEST.nuts3_id
      AND CityBench.nuts3_mr.nuts3_id in ('AT112', 'AT125',
      'AT126', 'AT127', 'AT130', 'AT221', 'AT225', 'AT312',
      'AT313'))
GROUP BY CityBench.MR.luz_id
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/ind_luz_from_mr_summary?ind_name=nuts3_indicator_test&nuts_ids=AT112,AT125,AT126,AT127,AT130,AT221,AT225,AT312,AT313&agg_fn=mv_my

getIndicatorsPerYear Service

This service will return a list of all cities with the correspondent value for a given set of indicators in a given year.

Takes: `([indicatorName], year)`
Returns: `([LUZ_ID], [indicator1Value],…, [indicatorNValue])`

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatorsdata?names=con_air,con_road,con_rail&year=2006

getIndicatorsPerYears Service

This service will return a list of all cities with the correspondent value for a given set of indicators in a given set of years.

Takes: `([indicatorName], [year])`
Returns: `([year], [LUZ_ID], [indicator1Value],…, [indicatorNValue])`

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatorsyearsdata?names=con_air,con_road&years=2001,2006

getIndicatorsPerCities Service

This service will return an indicators matrix of available years matrixes with the list of cities and values for each year and indicator from a given set of indicators and cities.

Takes: ([indicatorName], [LUZ_ID])
Returns: {indicators: [IndicatorName1: {years: {y1: ([LUZ_ID], [value]), …, yn: ([LUZ_ID], [value])}},…, IndicatorNamen: {…}}

Query:

```
        SELECT indicators.id, con_air.year, con_air.luz_id,
        con_air.value
        FROM CityBench.indicators, CityBench.luz,
        CityBench.con_air
        WHERE CityBench.indicators.name = 'con_air'
        AND con_air.luz_id IN ('AT001L2', 'AT002L2', 'BE001L2',
        'BE002L2')
UNION
        SELECT indicators.id, population.year, population.luz_id,
        population.value
        FROM CityBench.indicators, CityBench.luz,
        CityBench.population
        WHERE CityBench.indicators.name = 'population'
        AND population.luz_id IN ('AT001L2', 'AT002L2',
        'BE001L2', 'BE002L2')
UNION
        SELECT indicators.id, unemployment_rat.year,
        unemployment_rat.luz_id, unemployment_rat.value
        FROM CityBench.indicators, CityBench.luz,
        CityBench.unemployment_rat
        WHERE CityBench.indicators.name = 'unemployment_rat'
        AND unemployment_rat.luz_id IN ('AT001L2', 'AT002L2',
        'BE001L2', 'BE002L2')
ORDER BY id, year, luz_id
;
```

geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/indicatorscities?names=unemployment_rat,population,con_air&cities=AT001L2,AT002L2

getAllIndicatorsPerCity Service

This service will return a list of indicators with the correspondent value and year for a given city.

Takes: LUZ_ID
Returns: ([indicatorName], [Value], [Year])

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/manager/cityindicators?luzid=AT001L2

Transformers

MR2LUZ Service

This service will return the LUZ list from a given set of MRs.

Takes: `[MR_ID]`
Returns: `[LUZ_ID]`

Query:

```
SELECT CityBench.MR.luz_id
FROM CityBench.MR
WHERE CityBench.MR.mr_id IN ('DE003M', 'DE002M', 'DE001M')
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/mrtoluz?ids=DE003M,DE002M,DE001M

NUTS32LUZ Service

This service will return the LUZ list from a given set of NUTS3s.

Takes: `[NUTS3_ID]`
Returns: `[LUZ_ID]`

Query:

```
SELECT CityBench.MR.luz_id
FROM CityBench.MR
WHERE CityBench.MR.mr_id in (
      SELECT CityBench.nuts3_mr.mr_id
      FROM CityBench.nuts3_mr
      WHERE CityBench.nuts3_mr.nuts3_id in ('AT112', 'AT125',
      'AT126', 'AT127', 'AT130', 'AT221', 'AT225', 'AT312',
      'AT313'))
;
```

http://geo4.dlsi.uji.es/CityBenchservices1/webresources/v1/extras/nuts3toluz?nuts_ids=AT112,AT125,AT126,AT127,AT130,AT221,AT225,AT312,AT313

www.espon.eu

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