CityBench
ESPON CityBench for benchmarking European Urban Zones

Interim Report II

Scientific Platform / Tools 2013/3/10

Interim Report II | Version 31/August/2013

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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.

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This basic report exists only in an electronic version.

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1. Abstract

This second CityBench interim report, Intermediate Deliverable II, reports on the on-going efforts in:

- compiling the final list of 1st tier LUZ areas to be included in the European Urban Benchmarking Webtool;
- creating the list of proposed indicators to be included in the European Urban Benchmarking Webtool;
- defining the initial list of functionality to be included in the CityBench tool;
- explaining in detail the prototype technical architecture. The CityBench tool is also open to discussion regarding adaptations of our server functionality and/or client functionality to accommodate needs of and cooperation with the parallel ESPON projects;
- setting up a draft version of the database, web services and client for first prototype;
- setting up a draft version of a platform for communication with users of the Webtool and other stakeholders;

The (draft) ESPON CU response document ('*CU Response Inception and Intermediate Deliverable 1*') is addressed in Chapter 3. Chapter 4 provides a short reporting of the activities, both planned and realised, the resolution of problems and the definition of delimitations. The European Urban Benchmarking Webtool prototype is described in Chapter 5, while Chapter 6 is dedicated to draft versions of the Webtool text sections (Home, About, How to Use, FAQ, etc.) in plain English. Chapter 7 details the proposed outline of the Final Report. Chapter 8 outlines the TPG work plan towards the Draft Final Report. Annex I lists all LUZ selected for 1st tier inclusion in the Webtool, and Annex II contains the Indicators Report, which elaborates on the rationale behind the proposed list of indicators to be included in the Webtool.

Following from the ESPON CU response document, several questions have arisen with the TPG that may be answered by either ESPON CU or ESPON SC. They are summarized below, supplemented with any other questions the TPG might have. Page numbers refer to the page containing the remark in document '*CU Response Inception and Intermediate Deliverable 1*'.

1. *Multi level* data (p.1): please elaborate on your understanding of Multi-level?
2. "…*which is a constraint of ESPON evidence*" (p.7): please elaborate.
3. TerrEvi data, especially TNC delineations and/or tables (p.7): will this be available to the TPG? and if yes, what is the timeline?
4. What is the official position of ESPON CU/MC regarding the usage of DG Regio Perceptions Survey?
5. 'Virtual machine' "…*solution appears feasible currently but needs to be investigated further*" (p.9): Please let us know if TPG input is needed for this investigation?
6. "*Meeting policy demand*" (p.9): could some concrete advice be provided on how to further incorporate aspects regarding European policy concepts, programmes, frameworks and activities, and processes concerning cities into the Webtool?
7. "*Useful to identify early "test-drivers" and "test-runs"…*" (p.11): the TPG appreciates support from CU and SC on identifying and contacting testers.
8. IPD data (p.12): additional information is needed (contacts, etc)?

9. Issue of aggregating NUTS 3 values for potential accessibility to MR level: there is uncertainty regarding the operationalization of this. A weighted average might be a possibility, but in that case the uncertainty concerns the weighting factor (NUTS 3 area, population, …?) the project expert has been contacting requesting advise on this issue.

2. Introduction

After the release of Intermediate Deliverable I, the TPG has continued to work on finalizing the conceptual architecture, wrapping up the selection of LUZ and indicators to be included in the Webtool, starting operationalization of the selected indicators, finalizing the design of the CityBench Webtool Data & Services Layer, creating a prototype of the Webtool and designing and setting up a functional server, database and applications. Furthermore, a functional analysis of the use cases has been performed, a demo has been prepared, and feedback from the stakeholders has been analysed. Finally, within the context of WP3: Dissemination, a draft version of a communication platform has been set up: a social network connected to an easy-presentation web page. First prototype to show project results has been developed and deployed. The priority is to disseminate it and get user feedback as soon as possible.

Over the previous period, the TPG has been in frequent contact with both Kieran Kearney and Sandra di Biaggio, former resp. current ESPON Project Expert, regarding various issues, which include but are not restricted to:

- the (nature of) correspondence between LUZ and MR;
- the reduction of the number of indicators to be included in Webtool;
- the usage of alternative data sources, e.g. DG Regio Perceptions Survey;
- 2011 Urban Audit data;
- typologies & TNC;
- a EuroGeographics license;
- the ESPON CU response to Inception Report and Intermediate Deliverable I.

3. Comments to ESPON CU response to Inception Report and Intermediate Deliverable I

ESPON CU has submitted a (draft version of a) document ('*CU Response Inception and Intermediate Deliverable 1*') to the TPG, detailing CU and EIB responses to both the CityBench Inception Report and the CityBench Intermediate Deliverable 1. The document contains several remarks, suggestions and recommendations regarding the setup, design and content of the webtool being developed by the TPG within the framework of the CityBench project. They will be addressed in this Chapter. For clarity reasons, text from the response document containing one or more remarks, suggestions and/or recommendations has been copied into this Chapter and complemented with TPG's comments.

1. General feedback

1.1 Overall appreciation

The following points should be considered by the TPG in the continuation of their work to further enrich the significance of the project results. The TPG is asked to:

- *Continue to positively cooperate with ESPON M4D and ETMS*
- *Continue to ensure that multi level and innovative data is included alongside ESPON and EUROSTAT data*

  TPG comment 01: it is unclear what is expected from the request on *multi-level* data. Please elaborate on the CU's understanding of this concept and what is meant on the context of CityBench.

  TPG comment 02: Inclusion of innovative data is ensured by harvesting VGI data (social media), using OpenFlights data to derive a 'connectivity by air' indicator and using European Environment Agency data to calculate land use / pollution values per LUZ.

- Consider a split of 5 ESPON, 5 innovatively derived and 5 EUROSTAT indicators as a guiding split in terms of the final indicators selected.

  TPG comment 03: This split has been taken into account when selecting the indicators for the proposed list.

- Tread carefully concerning LUZ and Metro and user-derived composite indicators.

  TPG comment 04: Each indicator will consist of values collected at one geographic level only.

  TPG comment 05: After feedback on the inception, the user-derived composite indicators approach has been abandoned.

- Continue to ensure the tool fits with and is clearly additional to other established (OECD MetroExplorer) and emerging (Urban Audit) webtools

TPG comment 06: The list of included LUZ contains all cities in the MetroExplorer.

TPG comment 07: The set of indicators is additional to the indicators included in the MetroExplorer.

- Set down the questions in the next deliverables that TPG would like answered by the steering group.

  TPG comment 08: See the Abstract for an overview of questions.

Intermediate deliverable 1
A list of indicators (according to themes emerging from the EIB and ESPON CU 'use cases') to be considered for integration is included. The list of indicators (37) is obviously too long but the TPG a) has reflected the varying demands from the 'use cases' b) is using this list as a basis to initially populate the tool to allow early testing and c) in discussions with the CU recognises the need to reduce the number to 15-20 indicators.

TPG comment 09: The number of indicators has been reduced to 19.

2.2 Internal coherence of the Inception Report and scientific quality

Uncertainty hangs over some points in the Inception Report and these are addressed here:

- Pre-selection of cities – ways for users to preselect cities are encouraged. From an ESPON perspective, allowing users to select cities by territorial co-operation programme areas (transnational and cross-border) would allow urban practitioners the opportunity to see benchmarking and networking potential. When benchmarking cities it also makes sense to compare performances in relation to the national capital city, as well as national and EU (averages), which is achievable in due course when the most appropriate indicators are agreed on.

  TPG comment 10: Options to select LUZ by territorial co-operation programme areas (transnational and cross-border) and to compare a LUZ performance to its capital city or to the national / EU average are now included as a requirement for the webtool. They will be developed in the second prototype stage.

  TPG comment 10b: it would be very helpful for this task to be provided with the definition (geographical or textual) of the transnational and cross-border areas needed to be taken into account.

- Scale classification – having 7-9 points seems too many and may be confusing to the end user. Ideally the user could have the option to manually create classes.

  TPG comment 11: the manual creation of classes is in conflict with the goal of the tool of being a quick scan and easy to use. We abandoned the classification method and are now proposing a similarity measurements for the benchmarking.

- Composite indicators – there is general wariness about implementing composite indicators as they present both methodological and presentation challenges (see more below).

  TPG comment 12: Composite indicators will not be included in the webtool.

- Integration of different geographical levels – several city delineations exist and overlap. The TPG propose a solution that the user be able to select the desired geographical level. It should be noted that many Metro Regions correspond to the 2012 LUZ delineations and information has been forwarded to the TPG in this regard. It is worth recalling that a stated wish that LUZ shall be the backbone of the tool.

  TPG comment 13: The webtool will show only one geographic level (LUZ), although several included indicators have been collected at other geographic levels. The lineage of the data and, if appropriate, the methodology to use data from other geographic levels will be available in the webtool.

  TPG comment 14: It is true that LUZ and MR delineations largely correspond – some cases excepted. This is elaborated in Annex II: ESPON CityBench – Indicators Report.

- Alternative private sources – The ESPON CU and EUROSTAT are investigating the usability of an existing EuroGeographics licence.

  TPG comment 15: The TPG has been informed by ESPON CU that EuroGeographics data will be available when needed – provided that not the actual data, but only derived indicators are shown in the webtool.

- The use of LUZ 2004 - The 2004 UA data contained much volunteered data, much of which (e.g. crime/cars) has changed in how it is collected. Therefore it must be approached with care. In addition, 2012 LUZ version will have data for French cities. The changes from the 2004 LUZ to the 2012 LUZ delineation were not that significant and there is congruency in most cases between the delineations. The 2004 LUZ corresponds with 2012 where there is a 1 in the city code. NUTS2010 can be corresponded to LUZ2012.

  TPG comment 16: Data collected during previous Urban Audits will not be included in the webtool.

  TPG comment 17: The correspondence between LUZ 2004 and LUZ 2012 delineations is addressed in Annex II: ESPON CityBench – Indicators Report.

  TPG comment 18: To our knowledge, a certain degree of correspondence between NUTS (3) 2010 and LUZ 2012 only exists when aggregating NUTS 3 regions to MR (being the NUTS 3 approximations of the major LUZ), as LUZ are related to LAU2 units.

  TPG comment 19: The webtool will use MR based on NUTS 3 version 2006, since all indicators collected at NUTS 3 level are still based upon version 2006 delineations.

Intermediate Deliverable 1

The TPG has largely addressed the above points in Intermediate Deliverables 1.

The need for multi-level/capital city comparisons is understood and the scale classification issue acknowledged. The TPG have tested the EUROGEOGRAPHICS data and have fed-back informally that this dataset presents some issues in terms of classifications that makes utilising the data in a meaningful way difficult.

TPG comment 20: in light of the fact that ESPON CU has access to EuroGeographics data license, it is still being considered to create indicators from at a later stage. The rationale for this is:

- **Each dataset has issues/errors – recognizing the limitations of this one is useful.**
- **Assuming that misclassifications or biases are consistent across all cities, they will average out when comparing LUZ.**
- **Expecting the underlying data to be improved in future editions, the methodology for deriving the indicators may be developed anyway.**
- **It is still an authoritative European dataset, derived from national mapping agencies.**

The TPG ask the ESPON CU for its opinion on whether disaggregation of Metro indicators is possible for multi-LUZ metro regions and if not then can a Metro region indicator be assigned to each of the LUZ. The preferred approach is that the LUZ and Metro data is kept separate as Metro data will provide different indicators anyway to what LUZ can provide. Nonetheless this matter should be visibly explained to the user as per the annexed feedback.

TPG comment 21: The issue of multi-LUZ MR proved to exist only in the Netherlands (MR Randstad North and MR Randstad South). This has been corrected in the current MR version by disaggregating both Randstad MR into smaller units that do correspond to one LUZ each.

The possibility of corresponding NUTS3 into Metro data to allow inclusion is being examined by the TPG. They are encouraged to pursue and elaborate on this so that ESPON data can be included. TB clarifications,...

TPG comment 22: The proposed list of indicators includes several (ESPON) indicators, collected at NUTS 3 level, which will be aggregated to MR level.

In terms of the indicators presented, these are derived logically from the 'use cases'. As already mentioned, the TPG are aware of the need to reduce these and will do so in an additional non-contractual delivery.

TPG comment 23: Non-contractual delivery: the Indicators Report, which indeed presents a reduced list of indicators.

It is understood that the selection is important in terms of populating the tool to allow testing and that indicator development is ongoing.

An important point to stress is that there are complementarities in the indicators. It is expected that some indicators are necessarily shared with these other tools but there is a clear need to have a unique selling point of the ESPON CityBench tool.

Some of the listed indicators will not be available including GDP of LUZ or PPS per inhabitant at Metro Region level (Double check with TB). Equally, it is clear in some cases that within the list, some thematic indicators can be reduced down easily, for example three of the transport indicators effectively deliver the same message and for others, the stakeholders have highlighted unsuitability (eg urban sprawl)

TPG comment 24: PPS per inhabitant at MR level: this is available, however not included in the proposed list of indicators.

TPG comment 25: The number of thematic indicators has been reduced to arrive at the proposed list of indicators.

TPG comment 26: Urban sprawl has been excluded from the proposed list of indicators.

The final list (c.15 indicators) consider not only end user needs but also the needs of the data suppliers for their data to be both included but also that there is value for them in supplying data. It is advantageous for ESPON and EUROSTAT that their data be presented alongside innovative unofficial datasets. The TPG may think it worthwhile to bring in a criteria (5 ESPON, 5 EUROSTAT and 5 unofficial or social media derived).

TPG comment 27: See TPG comment 03.

The radial view proposed is an interesting and innovative concept and is further elaboration is looked forward to.

Under 3.1 the TPG highlight the functionality of the tool and then further on in the Section highlight the app layer that will be implemented. There is some disagreement between the Sections that the TPG should rectify. For example, concerning ranking which is included in the app layer. The user should not be able to openly rank cities using the tool.

TPG comment 28: The webtool will be designed in such a way as to enable comparing via similarity measurements rather than ranking.

The issue of self-defined composite indicators is raised under functionality (p11). The TPG are asked to consider whether this is feasible or desirable given the comments above on keeping Metro and LUZ data separate and the implications that this might have in terms of MAUPs.

TPG comment 29: See TPG comment 12.

2.3 Coherence of the project with other ESPON projects and other research activities in the specific field of the project

The TPG gives an overview of the latest state of research affairs relating to data analysis and tool development. It is important that ESPON evidence is to the forefront of the tool and generally ESPON evidence is visible across the six domains though largely at NUTS2 and 3, which is a constraint of ESPON evidence. The ESPON data presented appears weak.

TPG comment 30: Please elaborate on what is meant by "…*which is a constraint of ESPON evidence*".

TPG comment 31: An overview of all consulted ESPON projects / project data is provided in Annex II: ESPON CityBench – Indicators Report.

TPG comment 32: Additional ESPON indicators have been included in the proposed list of indicators.

Basically we should try to push to used for more ESPON indicators that can complement Urban Audit data. This is particularly relevant in some topics such as climate change and accessibility, innovation.

A number of ESPON derived data NUTS level sources could be further considered:

- Climate change adaptability and aggregated impacts can be regarded as useful (vis a vis p32 given the role of the tool as highlighting opportunities and risks);
- Soil sealing per capita; and
- Ageing index, Old age dependency and gender imbalance.

TPG comment 33: Several of these suggested ESPON indicators have been included in the proposed list of indicators.

Intermediate deliverable 1

The TerrEvi project is ongoing and the CU will request TerrEvi data, including possible delineations of TNC/CBC. The ESPON CU will examine the issues with the SIESTA data.

Concerning the potential to use typologies based on Territorial Cooperation programmes, it is sensible to incorporate only the 13 Transnational Programme areas as introducing 53 or more cross border delineations may bring high complexity. The ESPON CU is trying to obtain the proposed delineations for 2014-2020 to allow easy incorporation into the tools and is in contact with both EC and the ESPON TerrEvi project.

TPG comment 34: Please indicate whether TerrEvi data, especially TNC delineations and/or tables, will be available for inclusion in the webtool, and timeline for delivery.

TPG comment 35: ESPON SIESTA data will not be needed (yet), as it has not been included in the proposed list of indicators.

The TPG should give consideration to including ESPON Climate results as well as Ageing/Dependency. It is an added value that the tool takes a longer term perspective in its indicator selection. Furthermore, some consideration should be further given to DG Regio's Perceptions Survey and the use of proxies (see stakeholder comments).

TPG comment 36: Both ESPON Climate and ESPON INTERCO (ageing and dependency) data have been included in the proposed list of indicators.

TPG comment 37: Following consultation with Kieran Kearney, former Project Expert at ESPON CU, and pending official feedback from ESPON CU/SC, it was proposed not to include DG Regio's Perceptions Survey data in the proposed list of indicators due to limited coverage (less than 40% of the selected LUZ).

2.4 Technical elaboration and clarification of the content

The Inception Report is well elaborated, presents a sufficient and relevant focus, operating at the right level of detail and geographical scales. Data interpolation will

be attempted (p33) to overcome data availability issues. The ESPON OLAP cube has been examined.

TPG comment 38: Note: ESPON OLAP cube data has not been included in the proposed list of indicators, since either most recent indicator values are from 2006, or calculations are based upon previous LUZ version.

A two tier approach will be used, based on the availability of data. The TPG should note that coverage across the ESPON space is required for this limited number of cities.

TPG comment 39: LUZ coverage across ESPON space has been ensured.

Significant gaps against an indicator 'wishlist' were highlighted in the 1st Project Paper due to unavailable data. In the Inception Report, the TPG ask to *note that in particular for economic and smartness indicators, the search is ongoing. Indicators on e.g. skills, innovation, enterprise births and deaths, competition and R&D expenditure might prove very useful in determining the economic and "smart" potential of an area.*

Against the original wishlist, most aspects are addressed or are being pursued though it is not so easy to draw a thread from this. Development/Investment demands, Energy and internal accessibility remain gaps. Bearing that in mind, more generally the use of alternative, multilevel and innovative data sources is fully encouraged such as unofficial indicators available at country-level (esp. regulatory/ease of doing business) and unofficial city data (TomTom, hotels databases, citations indexes, most liveable cities, UN habitat ranking) would also be additional for stakeholders. The providence of this data should always be honestly and transparently presented.

TPG comment 40: Indicators for development/investment demands/ease of doing business, energy and internal accessibility have been included in the proposed list of indicators.

TPG comment 41: Most suggested alternative data sources have been evaluated; the rationale for considering or not considering their usage is explained in Annex II: ESPON CityBench – Indicators Report. Additionally, the usage of e.g. OpenFlights and social media (VGI) as innovative data sources is proposed and elaborated in the Indicators Report (see also comment 02).

The following technical aspects were noted:

- Concerning standardisation of indicators, this will be a logical step once the indicator list is agreed.

  TPG comment 42: Some lines regarding standardization are included in the Annex to the Indicators Report.

- It is important to the investor group to be able to separate LUZ core and outer where appropriate.

  TPG comment 43: This is perceived to be a new functional requirement, and also one that is in contradiction to the stated wishes of using LUZ as webtool backbone and using only one geographic level in the webtool (easy to use/"quick scan"). Moreover, separate indicator values for LUZ core and outer are only available for some indicators, collected within the framework of an

Urban Audit. Derivation / calculation of (other) indicator values for LUZ core is not possible since LUZ core vector delineations are not available.

- UA 2012 data will be of varying coverage for each indicator. It will be difficult to increase indicator coverage quickly/significantly from a low % city coverage.

  TPG comment 44: The proposed list of indicators only contains UA 2012 indicators for which (selected) LUZ coverage exceeds 50%.

- The TPG state that the indicator list should not be limited to those themes, it should *allow for the flexible, custom and dynamic creation of composite indicators so that the users can create their own suitability analysis based on the vast existing data*. (p8) Combining indicators, either as a given or through user manipulation, into indices can present problems both in terms of understand-ability but also how missing indicators may skew indices.

  TPG comment 45: See TPG comment 12.

- The Urban Atlas and GEOSTAT require further examination.

  TPG comment 46: The usage of Urban Atlas and GEOSTAT as data sources has been evaluated; the rationale for considering or not considering their usage is explained in Annex II: ESPON CityBench – Indicators Report.

- The two tier model of city coverage is considered a good compromise approach between full usability and longer term coverage aspirations.
- Technical terms included the report (eg UxDesigner) are difficult for the reader to understand.

  TPG comment 47: The use of technical terms has been restricted in Intermediate Deliverable II.

<u>Intermediate Deliverable 1</u>

The technical elaboration of the paper has been strengthened vis a vis the Inception Report.

Energy and internal accessibility are addressed as indicators though development/Investment demands are not though it is recognised that this is very challenging to address. The indicators listed include some alternative and innovative data and the TPG are requested to ensure that these are fully integrated in the 5/5/5 logic outlined above.

TPG comment 47: see comment 40.

As outlined already, the TPG continue to pursue the issue of allowing users to combine indicators. Considering the issue of absent data and MAUP (LUZ and Metro) outlined under *Scientific Quality*, the desirability of this is questioned.

TPG comment 48: see comment 12.

The TPG should bear in mind that 2012 Urban Audit indicators that have low coverage (less than 50%) should not be included in the tool.

TPG comment 49: see comment 44.

The TPG are asked to continue to seek data for separate LUZ core and outer where appropriate. It is clear that this will be feasible for some Urban Audit indicators and cities but it is less clear if this is feasible for other delineations or indicators. The TPG should also address the issue of use of topographical datasets like GEOSTAT and Urban Atlas.

TPG comment 50: see comments 43 and 46.

The use of technical language is understood to be necessary but some further 'plain english' support to the reader in this regard would be helpful.

TPG comment 51: see comment 47.

It is understood that the TPG have two solutions for the CU to host the tool, including a version for a standalone machine and a 'virtual machine' which will allow the CU to host the tool on its existing servers. The latter solution appears feasible currently but needs to be investigated further.

TPG comment 52: Please indicate whether (and if so, what kind of) TPG input is needed for this investigation into a virtual machine solution.

It should be noted (see bottom p8) that the project is not Applied Research (Priority 1) but Scientific Platform and Tools (Priority 3).

TPG comment 53: This has been corrected in Intermediate Deliverable II.

Meeting policy demand

The TPG show a good understanding of European policy concepts and processes concerning cities with other initiatives such as the RFSC noted. The TPG could strengthen this aspect by keeping a close eye on developments in Cohesion Policy 2014-2020. The Common Strategic Framework provides an overarching framework to the activities of the ESPON Programme and also the activities of the EIB Municipal and Regional Unit, particularly in relation to JESSICA. The tool is envisaged to address long term risks and opportunities for cities but nonetheless an understanding of the medium term framework would be helpful.

TPG comment 54: Further discussion (and advise) is needed between TPG and SC on how to further incorporate aspects regarding European policy concepts, programmes, frameworks and activities, and processes concerning cities into the webtool.

<u>Intermediate Deliverable 1</u>

The TPG are to be praised for their strong focus on end users and their demands. Equally it is obvious that their perspective is focused on providing a tool that is complementary to other tools and brings add value fort the ESPON programme.

The TPG are asked to consider the interrogation paths into the tool and if these are sufficient given feedback from the stakeholders on their intended use.

TPG comment 55: Interrogation paths have been addressed in Intermediate Deliverable II.

Annex A – Feedback from the stakeholders on the Inception Report

<u>EUROSTAT</u>

Related to the question raised about metropolitan regions on page 21 I would add the following information: metropolitan regions are approximations of LUZ . Data on metropolitan regions should not be „assigned" to LUZ without clear explanations (preferably map based visualization) of the difference of the two concepts. Dropping the metropolitan region level would mean dropping some key indicators like GDP or detailed indicators on employemnt, unemployment and patents. (Most of these are not available at LUZ level.)

TPG comment 57: The difference between LUZ and MR could be visualized in the webtool by including both delineations. However, for easy of use and understandibility, it might be preferable to just use the LUZ outlines and tag each MR-based indicator as such.

TPG comment 58: Because of the absence of LUZ level data for some indicators, MR-based indicators have been included in the proposed list of indicators.

The perception survey includes 75 cities. The last survey was conducted by DG REGIO in December 2012 and the data will be released in July. It will also include approx. the same cities. In our experience this data gets a lot of attention from politicians and media.

TPG comment 59: see comment 37.

EIB 10 Urban Sprawl – In my opinion the land area of a city is not relevant in itself for measuring urban sprawl. OECD has calculated and included an urban sprawl index in its metropolitan database.

TPG comment 60: The Urban Sprawl indicator has not been included in the proposed list of indicators, since it is already part of the OECD MetroExplorer.

GDP of a city and PPS indicators included in Table 9 will be no longer published in the Urban Audit data set.

TPG comment 61:they are available at MR level.

EIB MRU

General:

- overall I found the report quite good and gave me the impression – as a non-specialist – that the consultants are technically capable of delivering a product with the required performance for the final user
- being ignorant of building blocks for geoportal IT architecture I would find useful to have a glossary covering many of the technical terms appearing on pages 12-14 (however this also depends on who the intended audience of the report is and whether this text will find its way Into the final report - which may have an audience wider than specialised readers like ESPON staff, software developers…)

  TPG comment 62: see comment 47.

- the two-phase approach to firming up the LUZ database is sensible and well-explained
- the potential use of NUTS3 level data to fill-up / proxy LUZ level data should be dealt with in some more detail

  TPG comment 63: This is addressed in Annex II: ESPON CityBench – Indicators Report.

- there are several points that require / would benefit from feedback / decisions from the SC - it would be useful that these are put together clearly either as part of the abstract or at the end of each Chapter

TPG comment 64: see comment 08.

- the current process should lead to produce a Beta version of CityBench ready to be test-driven – without risking proposing an immature prototype to testers but sooner rather than later
- useful to identify early "test-drivers" and "test-runs", e.g. EIB staff working on projects, consultants working on JESSICA studies, e.g. Poland, Spain, Italy etc.

TPG comment 65: that is agreed and welcome. A test run with practitioners is schedule in the context of the ESPON USESPON Seminar in Berlin, late september. Other contacts (in EIB) are also welcome. Can this be a task for CU?

Specific

- Section 2 good, but some specific functionalities could be better explained, i.e. "pre-selection by territorial cooperation programme" – examples coming to my mind could be URBACT II CSI Europe http://urbact.eu/en/projects/metropolitan-governance/csi-europe/homepage/ but there must be several in INTERREG / ESPON

TPG comment 66: As stated earlier in this document by ESPON CU, "…*it is sensible to incorporate only the 13 Transnational Programme areas as introducing 53 or more cross border delineations may bring high complexity*".

- contribution to policy processes should include link to the 2014-2020 strategy definition process i.e. urban / territorial agenda as component of partnership agreements, operational programmes – possibly (to be seen) a more direct discussion on how CityBench could refer to the 11 thematic objectives in cohesion policy

TPG comment 67: The CityBench webtool will be populated with a limited number of indicators, therefore coverage of all 11 cohesion policy themes is not possible. However, the webtool is designed in such a way as to enable a straightforward inclusion of additional indicators (customization and adaptation by the Admin ESPON CU).

- Section 3 rather technical, not clear to me whether / what indications are sought – or if this is essentially a "for information" Section
- Section 4 highlights gaps in availability and usefully mentions RFSC – for EIB MRU interesting to see how CityBench can complement the integrated approach under RFSC (does it work yet?) to capture investors' concerns and vulnerability / competitiveness analysis – so useful to see how users may play with the two tools and (possibly) use the flexibility of CityBench's architecture to explore further dimensions (and think about what practical applications could be e.g. for cities defining an integrated strategy) by :
    - incorporating dimensions / data collected / analysed in RFSC into CityBench;

      TPG comment 68: see comment 67.

    - specifically on observed gaps, perhaps more effort in certain areas e.g.
        - availability of proxies at different levels – metro, core city… - also for variables below

TPG comment 69: see comment 43.

- credit rating of cities (see if Moody's / Fitch / Standard & Poor's coverage can be linked to LUZ database)

  TPG comment 70: This is dealt with in Annex II: ESPON CityBench – Indicators Report.

- real estate info (office / housing) – see IPD data (normally ludicrously expensive) http://www1.ipd.com/Pages/default.aspx - not sure what they have by city / region, other source is the real estate industry, we have some contact at ULI which we may use as well as academic contacts in the UK

  TPG comment 71: Kieran Kearney, former Project Expert at ESPON CU, undertook to inquire at ULI for further information regarding this.

- good idea to increase attention to smart indicators (table 11)

- communication on decisions made on Section 5.4 in order to progress to 5.5 critical – important to ensure timely communication & feedback between consultants and SG

  TPG comment 72: The TPG has ensured proper and timely communication with the SG regarding the progression from database design / setup phase to demo phase.

- Section 6 good as starting point should be discussed in some detail in next meeting – the "test-drive" should be based on appropriate visual interface & possibly using initial data employed in demos (point 5.5) –
  - in this context important to propose / discuss "interrogation paths" likely to be followed by users which may want to access the system from different perspectives, e.g. approaching by "project type" , for instance I want to know what locations are suitable – through a range of minimum requirements for instance proximity to international airport, high density of science graduates – and competitive / complementary candidate locations; it would be useful to be able to define a few typical "interrogation paths" and ensure that CityBench is structured so that it can address them
  - interrogation paths could also be useful to understand what type of integration needs may arise, i.e. how CityBench data can be enriched by / usefully combined with specific possibly proprietary data which may be available to the user (fDi for instance…)

    TPG comment 73: See comment 55.

4. 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.

4.1. Planned and/or realized activities

Creating a proposed list of indicators and a final list of 1st tier LUZ.

Based upon the ESPON CU response to both the Inception Report and Intermediate Deliverable 1, discussions by e-mail / telephone with Kieran Kearney and Sandra di Biaggio (former resp. current ESPON CU Project Expert), the use cases delivered by ESPON CU and EIB, and continued research by the TPG, a list of proposed indicators to be initially included in the Webtool has been created by Geodan. This list is presented in Section 7.3, as well as the final selection of 1st tier LUZ areas to be included in the Webtool.

Finalizing the European Urban Benchmarking Webtool prototype design.

Developers from both Geodan and UJI have been involved in finalizing the design for the prototype of the Webtool. Decisions have been made regarding the following layers: External Data Services, Data, Services and Application.

Building the European Urban Benchmarking Webtool prototype.

Based upon the finalized design of the Webtool, a prototype has been implemented by Geodan and UJI development team.

Setting up a (draft version of a) communication platform

Within the context of WP3: Dissemination and resulting from discussions by UJI regarding the optimal solution for communicating with users of the Webtool and other stakeholders, a social network connected to an easy-presentation web page was perceived to be the best option. A draft version is being set up accordingly. This communication platform will, among others, be used for the survey on stakeholder indicator needs.

4.2. Resolution of problems

Availability of LUZ data / indicators

One of the challenges faced by the TPG was the lacking availability of a sufficient amount of recent data and/or indicators at LUZ level, the designated backbone of the Webtool. The most recent edition (2011) of the Eurostat Urban Audit (UA) data collection, which is the main provider of indicators collected at LUZ level, has not been officially released yet. Instead, the TPG received a snapshot 'bulk extraction' of the database, which showed considerable data gaps for most indicators. (It is expected however that this will be remedied once the 2011 UA data collection is officially released, which is foreseen for Q3.) Therefore only a few UA indicators, for which LUZ coverage proved sufficient, could be used. This has been partially remedied by using data collected at Metropolitan Region (MR) level, which is the NUTS 3 approximation of LUZ. Also, indicator values collected at NUTS 3 level were aggregated to MR level using a NUTS 3 – MR correspondence table.

Alternative data sources: social media

Being encouraged to explore alternative data sources, the TPG has considered exploring social media. 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, enabling users to share information on these crowdsourcing platforms real-time and from anywhere, thereby augmenting this information with its location. Even when extracting useful information from this big volume of raw data is still difficult, but an approach to represent people's level of concern on a certain topic in the different LUZ areas has been tested. Further information on this is included in the Technical Report.

4.3. Definition of delimitations

Included indicators

The TPG will populate the Webtool with a limited amount (15-20) of indicators, which may or may not completely reflect the wishes of each stakeholder. To account for a stakeholder's wish to add or replace indicators, an 'admin tool' will be created that allows just that.

Stakeholders' wishes

As explained above, the TPG will populate the Webtool with a limited amount (15-20) of indicators, which may or may not completely reflect the wishes of each stakeholder. To account for a stakeholders' wishes to add or replace indicators, a communication platform is being created for administrators to evaluate and assess the need for modification into the Webtool's content through the previously described 'admin tool'.

5. Prototype of European Urban Benchmarking Webtool

A first prototype has been developed in order to give visibility to project work and get as soon as possible feedback from the user community. A technical report of the prototype has been also delivered.

6. Draft version of main web text sections

This Chapter presents a draft version of the textual content of the Webtool and Communication Platform. Attention will be directed primarily at key sections.

6.1. WebTool

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: Context, 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, OpenFlights 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*" (definitions from 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 NUTS2/3?

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 (one indicator in Webtool)
- NUTS3: small regions for specific diagnoses (several indicators in Webtool)

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 NUTS2/3 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:

1) Inclusion of all European cities that are part of another online city comparison tool, the OECD Metropolitan Explorer.
2) Inclusion of capitals of European countries not included in OECD to cover ESPON Space (i.e. EU27 plus Iceland, Liechtenstein, Norway and Switzerland).
3) Inclusion of all remaining LUZ with a population number of > 400,000.
4) 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 Context: 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 1^{st} (2^{nd}/3^{rd}/4^{th}) city'. Also, select one, two or three indicators on which the comparison will be based by clicking 'remove' and/or 'Select a 1^{st}/2^{nd}/3^{rd} 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** $((a_A - a_B)^2 + (b_A - b_B)^2 + (c_A - c_B)^2)$.
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?**

6.2. Communication Platform

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

The ESPON initiative
Sustainable development, economic and social progress, reinforced cohesion and environmental protection are fundamental principles of the European Union (EU) set out in the Treaty on European Union (EU, 2008).

Since the publication of the Brundtland Report (1987), where sustainable development was defined as “the needs of the present generation should be met without compromising the ability of future generations to meet their own needs”, that much attention is given to the implementation and monitoring of sustainable practices, including in cities. In fact, a core element of the European Cohesion Policy is the very promotion of sustainable urban development. The cohesion policy seeks to exploit Europe’s full economic, social and territorial potential, with an integrated approach involving cities across Europe (an approach already proven successful in the previous URBAN Community Initiative).

The European Union’s objectives for sustainable development have been actually taken up by the European ministers responsible for urban and spatial development, who translated them to concrete spatial and urban actions. In the Leipzig Charter on Sustainable European Cities and the Territorial Agenda of the European Union (EU Ministers, 2007), two key objectives are defined: integrated urban development should be applied throughout Europe

and deprived urban areas must receive more attention within an integrated urban development policy.

Therefore tools and methods that shed transparency to the status of urban areas throughout Europe are crucial to evaluate the integrated approach to urban development policies. The final goal is to achieve smarter, more sustainable and socially inclusive urban development. One such tool is the development of the Reference Framework of sustainable cities and tools for its implementation and monitoring targeting city governments.

But more stakeholders are involved in sustainable development and economic and social progress (such as citizens and private and public investors). Tools are needed that promote dialogue and transparent assessment and communication of opportunities and needs to implement integrated approaches to urban development.

The ESPON program is playing a crucial role in this implementation. Previous results have revealed that territorial capital and opportunities for development are inherent in the regional diversity that is a characteristic of Europe. Consequently, different types of territories are endowed with diverse combinations of resources, putting them into different positions for contributing to the Europe 2020 Strategy as well as to EU Cohesion Policy. This project intends to contribute to the illustration, analysis and assessment of this Territorial diversity.

As the European process moves towards a more integrated approach to policy making (taking into account territorial dimension), the work from the ESPON 2013 programme becomes crucial in extending and deepening the existing knowledge and contributing to the development of Cohesion Policy beyond 2013.

In this framework, this project intends to enable access and lower thresholds in understanding the vast body of knowledge gained in the ESPON programs.

(Link to ESPON website)

The Citybench project

The goal of this project is to provide a tool with information that can show patterns of risks and opportunities in European cities. The user group of this tool are practitioners, policymakers, as well as public and private investors. It should make best use of ESPON results, and combine these with other research results and relevant data. The goal is to make the ESPON knowledge base more available and useful to the identified target groups (which are engaged in managing investment in cities), therefore, it will be developed in close cooperation and active participation of the steering group that includes the ESPON Monitoring Committee, the Municipal and Regional Unit of the European Investment Bank (MRU-EIB) and Eurostat.

The tool, a ‘quickscan’ web application, allows a first understanding of risks and opportunities for cities, the potential aspects for investment and allows benchmarking of cities (comparing city characteristics/indicators side by side). It should make evident economic, social and environmental sustainability of cities in order to support investment decision making of policymakers, practitioners and public and private investors. Accordingly, the tool allows the benchmark of cities against other similar cities, around these themes.

Since this tool is led to a diverse group of users with different goals, skills and interests, we propose a methodology that allows users to select and combine indicators in order to perform custom multivariable analysis in an easy-to-use and straightforward method.

(Link to partners websites)

Project keywords
Responsive design
Data visualization
keywords_interior
Interaction design
Indicators (environmental, socio-economic, sustainability, life quality)
Web technology
Iterative & Incremental development
Multivariable analysis
Suitability queries

(Links to Wikipedia definition of the keywords)

Geographical level and Cities considered
Larger Urban Zones
City walls, even if they are preserved, no longer function as barriers between the people living inside and outside the city. Students, workers and people looking for healthcare or for cultural facilities regularly commute between the city and the surrounding area. Economic activity, transport flows and air pollution clearly cross the administrative boundaries of a city as well. Consequently, collecting data exclusively at core city level is insufficient. ESPON CU has stated that the (current version of the) Larger Urban Zone geographical level should be the backbone of the webtool, being eurostats the main provider for these data level.

NUTS3
The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of collecting, developing and harmonizing EU regional statistics and socio-economic analyses of the regions. Since not all indicators relevant to the webtool are available at LUZ level, NUTS 3 level data, of which ESPON is an important provider, is also considered.

Metropolitan region level
Metropolitan regions are NUTS3 regions or a combination of NUTS3 regions which represent all agglomerations of at least 250 000 inhabitants. These agglomerations were identified using the Urban Audit's Larger Urban Zones (LUZ), and therefore, are considered to be approximations for the corresponding LUZ and could be included in the webtool to constitute an additional set of indicators for selected LUZ.

Selection criteria
The solution proposed to previously exposed geographical level issue is to include two levels (LUZ, metropolitan region) in the webtool and treat them as separate datasets. This will allow the webtool user to select the desired geographical level (including the corresponding indicators) to be used for analysis.

The webtool will contain a subset of the available LUZ in a first proptotype. Selection of the LUZ for this subset is based on four criteria.

- Criterium 1: Include all European cities included in the OECD Metropolitan Areas database (MAdb)
- (http://www.oecd.org/statistics/datalab/metro-explorer.htm)
- Criterium 2: include all EU27+4 countries
- Criterium 3: Include all LUZ with a population number of > 400,000
- Criterium 4: Include additional LUZ in underrepresented countries

In order to ensure a proper representation of countries in the webtool, a second city (apart from the capital) should be included, provided that its population exceeds 200,000.

The actual number of first phase LUZ is 173. The number of LUZ for the second phase will correspond to the number of LUZ defined for the 2012 definition, and is expected to be over 695 cities. The list of cities can be consulted in the Interim Report 1 in the Docs section.

Indicators available

The indicators from the Reference Framework for European Sustainable Cities (RFSC) are being considered as a starting point. This point of view is reflected in the use case delivered by ESPON CU. Alternatively, the European Investment Bank (EIB) prepared a use case which lists an alternative requested set of indicators to be included in the webtool.

On the one hand using (proxies for) RFSC indicators is proposed by ESPON CU, whereas on the other hand EIB suggests that the "…indicators will be developed from existing ESPON and Eurostat data sources and take into account existing Urban Audit data". Therefore, an attempt was made to relate the RFSC indicators to data available from Eurostat, ESPON or other providers.

As can be derived from tables above, the ESPON use case contains a remark on the added value of "…presenting cities as parts of cross border and transnational functional areas". This is an interesting topic to be raised, and one which might be worth exploring in the course of the project.

The EIB use case stresses the importance of being able to update the selected indicators and in doing so, maintain a constant quality level. By relying mainly on Eurostat, ESPON and EEA data, all of high quality and updated once every couple of years, it should be possible to achieve this goal.

The list of the initial set of indicators can be consulted in the Interim Report 1 in the Docs section.

The indicators have been grouped into the following themes:

- Transport (accessibility, connectivity, modes)
- Economy
- Quality of Life (environment, air quality, climate)
- Knowledge / smartness
- Demography
- Social aspects (employment, poverty)
- LUZ morphology

Using these grouped indicators, the performance of one or more cities for each theme (or super indicator) can be calculated.

Further research and testing is needed to evaluate the idea to use crowd sourced information (harvested from the twitter and other social media APIs in order to calculate the so called city buzz), which includes number of twits within a city and/or twits about a city and or specific on some keywords (content analysis).

The Citybench Tool

The CityBench functional and technical requirements will be addressed by the implemented components deployed in the architecture. These requirements are:

Functionality

- Search cities based on given indicator values
- Search cities based on name
- Show indicator values of selected cities
- "Slide" through time to show the values of selected indicators from different years.
- Comparison of different cities (LUZ)
- Self-define composite indicators
- Standard map functionality to navigate through the map (zoom, pan)

Usability

- Must be easy to learn and understand
- Must be effective to use (able to answer the questions of the user). For example, which other cities are similar to LUZ X, for a pre-set of indicators.

Data

- The system must use data from the ESPON Database
- The system should use data from external sources to include indicators not available or not fully covered in the ESPON database
- The system should try to scale data to the LUZ regions.

Open Source

- The CityBench project will preferably use Open Source Software components to implement required functionality
- Source code and configuration file developed for the CityBench project specifically will be made available as Open Source.

Open standards

- The project should use Open Standards to give access to the CityBench data
- The project must be able to use relevant Open Standards to use data from other sources (e.g. INSPIRE data from NMCA's, data from EIB and EuroStat).

Deployment

- The system must be deployable at the ESPON CU
- The system must be maintainable by employees or contractors of ESPON CU

The conceptual architecture of the CityBench project, following the INSPIRE architecture, adapts it to include the required functionality in the form of Network services and the client applications in the form of a Web Portal, and follows a classical 3-layer style. Each layer has

distinct characteristics and its components implement a distinct role in the CityBench system.

- CityBench data layer: This layer contains data copied from the ESPON database or other available datasets, and data derived from these and external datasets. The data is stored in components specifically designed and implemented for the CityBench project.
- CityBench service layer: it specifies the interfaces available to manage search and use the data in the CityBench data layer. Based on these interfaces the CityBench tool will be implemented, but also other clients could access the data in the CityBench datalayer through this service layer.
- CityBench app layer: This layer implements the client application to access the functionality provided by the CityBench system.

(Screenshots of the web tool linked to a bigger image and its explanation, see *http://lsivirtual27.dlsi.uji.es/web/?p=18*)

Documents to download
ESPON Project Overview December 2012
Inception Report
Interim Report 1

(Links to the pdf documents. This list will be updated)

News
(News feed from major and social media and blog - TBD)

Community
(*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)

(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)

7. Proposed outline of Final Report

This Chapter describes the proposed outline of the CityBench Final Report, which will document both the scientific and practical work undertaken in developing and delivering the European Urban Benchmarking Webtool.

7.1. Methodologies, models and concepts developed and used

This Section will describe the methodologies, models and concepts underlying the CityBench Webtool.

7.2. Overview of 1st tier LUZ areas

Intermediate Deliverable I proposed a selection of 1st tier LUZ, which has been used as a basis for the final list of 1st tier LUZ to be included in the Webtool. Compared to the list in Intermediate Deliverable I, some minor changes were made.

- The LUZ Bern had been erroneously omitted from the list presented in Intermediate Deliverable I but is now included;
- The current (2012) LUZ areas of Caserta, Kalisz and Salerno were found to be much smaller than their previous (2004) LUZ area on which the initial LUZ selection was based. Consequently, population numbers for these now smaller LUZ are also (much) lower, i.e. well below 400,000. They were therefore removed from the 1st tier LUZ list.

The Final Report will include the final list of LUZ areas selected for the 1st tier, including their corresponding MR. (Please note that it is also included, as Annex 1, in the current report.) In addition, the Final Report will propose a time path for including 2nd tier LUZ in the Webtool, i.e. all additional LUZ as defined by UA 2011. However, if, because of (continued) lack of available data for these additional LUZ, inclusion of them in the Webtool is considered to provide only limited added value, the Final Report will elaborate on this instead.

7.3. Overview of proposed indicators

Following from a discussion with, and at the direction of, Kieran Kearney (former ESPON CU Project Expert), it was decided to limit the number of indicators to start populating the Webtool with to 15/20. In addition, the decision was made to select these indicators from 3 sources in approximately equal proportions: 5/7 from ESPON, 5/7 from Eurostat and 5/7 from 'other' sources, e.g. Social Media. Please note however that the Webtool will be designed in such a way as to enable the addition of other indicators as required.
The 19 indicators selected for initial inclusion in the Webtool are shown in Table 7-1. The column 'Source (code)' may contain either a '1' (ESPON data), a '2' (Eurostat data) or a '3' ('other' sources).

Table 7-1. Proposed indicators.

	Indicator	Source (code)	Source (name)	Most recent year	Geographic level (version)
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?)
04	# of in- / outbound flights	3	OpenFlights	Real-time	LUZ (2012)
05	Potential accessibility, road / rail, standardised ESPON	1	ESPON TRACC	2006	NUTS 3 (2006)
06	Ageing index	1	ESPON INTERCO	2008	NUTS 3 (2006)
07	Old age dependency	1	ESPON INTERCO	2008	NUTS 3 (2006)

08	# of items being posted about 'Crisis'/per inhabitant	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
09	# of items being posted about 'Unemployment'/per inhabitant	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
10	# of items being posted by tourists/(per inhabitant?)	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
11	Ease of doing business	3	IFC / World Bank	2013	Country
12	Gas / Electricity prices for industrial consumers	2	Eurostat	2012	Country
13	% of LUZ consisting of green urban areas	3	EEA Corine	2006	LUZ (2012)
14	Residential PM10	3	EEA	2008	LUZ (2012)
15	Combined adaptive capacity to climate change	1	ESPON Climate	2011	NUTS 3 (2006)
16	High-Tech (total) patent applications to the EPO per million of inhabitants	2	Eurostat	2009	MR (NUTS 3 2006?)
17	IP Addresses	1	ESPON TEL Update	2009	NUTS 3 (2006)
18	Share of renewable energy in gross final energy consumption	2	Eurostat	2011	Country
19	Photovoltaic energy potential	1	ESPON ReRisk	2005	NUTS 2 (2006)

Annex 2 contains the full Indicators Report, which explains the rationale behind the list presented in Table 7-1. It also includes an Appendix providing a factsheet that outlines the steps needed to calculate each indicator. The list proposed is a reflection of the various wishes as expressed by both ESPON and EIB, combined with research performed by the TPG. However, to ensure that the proposed indicators are indeed, to all stakeholders involved, the best set to start populating the Webtool with, a survey on indicator needs is to be conducted among the stakeholders. This survey will list all potential indicators as presented in Annex 2 and will enable the stakeholders to select the ones most interesting to them. The results of the survey will lead to the final list of indicators for the Webtool, which will be presented in the Final Report.

7.4. Future research avenues to consider

The Indicators report (see Annex 2) describes in detail the search for available data (sources) to be potentially included in the Webtool. Several points may need to be considered in this respect, which will be further elaborated in the Final Report.

- **Further data requirements**
  - It is foreseen that ever more Volunteered Geographic Information (VGI) will become available, as the usage of social media using location-aware devices keeps increasing. This source of potentially relevant data should be continuously monitored and explored, to possibly extract new, innovative indicators from it.
  - The proposed list of indicators constitutes only a fraction of all data/indicators available (from ESPON, Eurostat, other sources). ESPON admins may add indicators as required, as the Webtool is designed in such a way as to easily facilitate this.

- **Building time series**
  The geographic delimitations currently used by ESPON and Eurostat UA to collect data are different from the ones used previously. ESPON is moving from (the various levels of) the 2006 version of the NUTS nomenclature to the 2010 version. Since NUTS 3 units are the building blocks for the Metropolitan Regions (MR), the effect of using different NUTS versions will propagate to MR level as well. Similarly, the most recent Eurostat UA data collection is based upon the 2012 LUZ version, as opposed to previous Urban Audits that were based upon earlier LUZ delimitation versions. In both cases, acreage differences between the previous and current nomenclature versions may exist to a greater or lesser extent. This may (and probably will) lead to inconsistencies when building time series from data collected for different nomenclature versions. Therefore, if time series from ESPON and/or Eurostat data

are to be built, it is important to ensure that data for different years was collected for the same nomenclature version.

- **Improving weak aspects in the selected set of indicators**
  - Several indicators currently selected for the Webtool have been collected at MR level or NUTS 3 level, the 2006 version. The rationale for using the 2006 version is that the ESPON database as yet contains very little data collected for the 2010 version of NUTS 3. It is expected that future data collections will be based upon the 2010 NUTS nomenclature. Once enough new NUTS 2010 based data for the selected indicators will be available, this should replace the current data.
  - One selected indicator has been collected at NUTS 2, and three others at country level. Although these geographic levels differ from the LUZ level (the designated backbone of the Webtool), these indicators have been included because they were requested by the SC. Furthermore, these higher geographic levels are considered justifiable in case of these particular indicators: e.g. energy prices and (the legal setting for) ease of doing business are the same within a particular country, independently of the geographic level. However, the search for LUZ / MR level data for one or more of these indicators, or proxies for them, should preferably continue.

- **Further developments linked to the Webtool**
  A potentially important development with respect to the CityBench project is the emergence of 'linked data', which "…*refers to a set of best practices for publishing and connecting structured data on the Web*".[1] More comprehensively,

  > "…*Linked Data is simply about using the Web to create typed links between data from different sources. These may be as diverse as databases maintained by two organisations in different geographical locations, or simply heterogeneous systems within one organisation that, historically, have not easily interoperated at the data level. Technically, Linked Data refers to data published on the Web in such a way that it is machine-readable, its meaning is explicitly defined, it is linked to other external data sets, and can in turn be linked to from external data sets.*" [1]

  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 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.

7.5. Steps for updating the European Urban Benchmarking webtool

The practical steps required by the ESPON CU to update the European Urban Benchmarking webtool on an annual basis, described in a logical and user friendly manner. This will be

[1] Bizer, C., Heath, T. and Berners-Lee, T. (unknown date) **Linked Data - The Story So Far** [Internet]. Available from: <http://eprints.soton.ac.uk/271285/1/bizer-heath-berners-lee-ijswis-linked-data.pdf> [Accessed 22 August 2013].

further described in the final European Urban Benchmarking Webtool Demonstration Report.

7.6. Proposed outline of a 'European Urban Benchmarking Webtool Demonstration Report'

It is proposed to produce high quality video tutorials instead of a descriptive report. Still, a detailed technical report (explaining the system function and design) will be delivered.

8. Work plan until the Draft Final Report

The work plan for the period between the release of this Deliverable and of the Draft Final report is outlined below.

Continued development of Webtool prototype

A first version of the Webtool prototype will be available by August 31. After its presentation and following feedback from ESPON, EIB and other potential stakeholders, prototype development will continue, aimed at progressing from the demo / prototype phase to a draft final version of the Webtool. One of the focus points will be the inclusion 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.

Survey on indicator needs 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 indicators to be initially included, as presented in Section 8.2.2 and Annex II. However, this selection by the TPG may not necessarily reflect the optimal indicator set according to one or more of the stakeholders. Therefore a survey on indicator needs amongst the stakeholders is proposed. The TPG will provide the stakeholders with a comprehensive list of potential indicators, on which the need for inclusion of each indicator can be expressed by assigning a value from 1 (no need) to 10 (highest need) to them. The outcome of this survey may lead to a set of indicators differing from the one currently proposed by the TPG.

Expanding the harvesting of social media data

Social media data (VGI) has as yet been harvested for only a small selection of LUZ, mainly because of the proof-of-concept phase of the harvesting process and because of the large data volumes generated by harvesting VGI. The next phase of VGI harvesting will involve 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, a table with (relevant) typologies will be prepared and linked in the database to the LUZ table. Furthermore, the TNC delineations , once received, will be added to the Webtool as well.

Operationalization of indicators and including them in Webtool

The operationalization of the proposed indicators is elaborated in the Appendix to Annex II – Indicators Report. Several indicators have already been operationalized, to enable inclusion in the Webtool prototype. Operationalization of the remaining selected indicators will be performed shortly.

Communication and interaction with stakeholders

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

Annex 1. 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	N/A (no corresponding MR)	
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

Annex 2. Indicators Report

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1 Introduction

Having a relevant ánd up-to-date indicator set is of crucial importance to both acceptance and usage of the CityBench Webtool. Thus since the beginning of the project, a considerable amount of time has been allocated to searching for potential data sources and selecting the most usable data / indicators from these sources. A first list of indicators was presented in the Inception report. Based upon the response from ESPON CU to this report and upon use cases completed by ESPON CU and the European Investment Bank (EIB), a revised indicator list was included in Intermediate Deliverable I. However, this was still considered to be a provisional list, as the search for suitable data sources continued and there were still several uncertainties regarding: data availability (esp. the new Eurostat Urban Audit dataset), (comparability of) geographic levels and social media indicators (VGI). Now that these issues have been addressed, the proposed list of indicators to be used in the CityBench Webtool will be presented in this report. ESPON CU response to the Inception report as well as to Intermediate Deliverable I have also been taken into account.

The report will explain the rationale behind the selection of both data sources and indicators and will provide an overview of the issues encountered when considering the different geographic levels at which data is being collected.

Compared to the Chapter on indicators in Intermediate Deliverable I, special attention will be paid to information collected by 'the public', i.e. indicators based upon geo-located data harvested from social media (VGI). The reason for this is that when evaluating existing information for analysing and comparing cities, new trends in digital information and social media should be taken into account as well. Nowadays, bottom-up initiatives complement the ecosystem of information available online. Regular citizens are sharing information about their surroundings 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 on places and on events that may have an impact upon society. In this respect, one might even argue that the location analytics industry is moving from a paradigm of lower volume, higher accuracy data to one of higher volume and lower accuracy. Thus, the CityBench project aims to generate indicators not only from official data but also from data shared by citizens through social networks, providing a 'social view'.

2 Potential data / indicator sources

When the search for suitable data sources and indicators had just commenced, attention was focused upon the ESPON and Eurostat databases, as they were considered the main sources of data, and thus indicators, for populating the Webtool. However, it soon became apparent that both data providers are in the process of reviewing and updating their databases. A direct consequence of this is that for several relevant indicators, recent data is not yet available. Moreover, the ESPON and Eurostat databases do not cover all indicators potentially relevant to the CityBench project. Therefore, an assessment was performed of a range of potential data and/or indicator sources (including several ESPON projects), some of which were proposed by ESPON CU and/or EIB. Table 2-1 presents an overview of them, including the rationale for (not) considering them for integration into the Webtool.

Table 2-1. Overview of consulted data / indicator sources.

Data / indicator source	Data provided	Proposed by ESPON CU / EIB?	Considered for integration?	Reason(s) for considering / not considering integration of data source
Cambridge Econometrics	Sectoral data for output, employment, hours-worked / demographic data	No	No	License fees apply
ESPON AMCER	Analysis and monitoring of the impact of	Yes	No	Data available for 9 NUTS 2 regions only

	EU R&D policies at regional level for 9 NUTS 2 regions			
ESPON Climate	Many indicators on (expected) climate change for 1961-2100 or 2071-2100 + Mitigative / adaptive capacity to climate change for 2005-2011	Yes	Yes	On specific request of ESPON CU
ESPON INTERCO	Soil sealing per inhabitant (NUTS 3)	Yes	No	Aggregating values to MR level (too) laborious => Alternative: gridded EEA soil sealing data: ((avg. % of soil sealing of LUZ) x (total LUZ area)) / (# of LUZ inhabitants)
ESPON INTERCO	Ageing index / Old age dependency / gender imbalance (NUTS 3)	Yes	Yes	On specific request of ESPON CU
ESPON OLAP Cube	Disaggregation of socioeconomic and 1990-2011 population data into regular grid and combination with other types of data	Yes	Yes	Data structure allowing manipulation of data from multiple dimensions (spatial, thematic and temporal)
ESPON SIESTA	Indicators on "a strategy for smart, sustainable and inclusive growth"	Yes	Maybe	Data availability unknown; "*The ESPON CU will examine the issues with the SIESTA data*" [1]
ESPON TERCO	Indicators on territorial cooperation in transnational areas and across internal/external borders (NUTS 2)	Yes	No	Geographic level incompatible with LUZ or MR
ESPON TerrEvi	Methodological conceptual framework for delivery of relevant territorial benchmarking and analytical components in ESPON Territorial Evidence Packs relevant for Structural Funds Programmes	Yes	No	No data available as yet; ESPON CU states that "…*the CU will request TerrEvi data*…" [1]
ESPON TRACC	Indicators on (potential) accessibility per modality (NUTS 3)	Yes	Yes	Provide an insight into accessibility
Eurochambers	Economic reports at country level	Yes	No	No dataset(s) found
EUROCITIES	Main topics: climate / inclusion / recovery	Yes	No	No dataset(s) found
Eurofound	Areas of expertise: Business and society, Diversity, Employment status, Gender, Health, Human capital, Industrial change, Industrial relations, Labour market, Participation at work, Population and society, Quality of life, Quality of work, Social cohesion, Social protection, Time, Work-life balance, Work organization (NUTS 2)	Yes	No	Geographic level incompatible with LUZ or MR
EuroGeographics	EuroRegionalMap: roads and (high speed) railroads / land use / amenities	No	Yes	License fees apply, however ESPON CU will accommodate for this
European Environment Agency (EEA)	Environmental & land use (CLC) data	Yes	Yes	May be used to derive quality of life and/or air pollution indicators
European Patent Office	European patent information	No	No	License fees apply
European Urban Knowledge Network (EUKN)	Knowledge and experience on tackling urban issues	Yes	No	No dataset(s) found

Eurostat / DG REGIO	Perception survey results	Yes	No	Only 65 of 171 1st tier LUZ are covered
fDi Benchmark (Financial Times Business)	Indicators on competitiveness and attractiveness of cities	Yes	No	Response (by e-mail) from FT: "*This sounds like a replication of our fDi Benchmark system and in principle we would not be in favour of this.*"
GEOSTAT	Various population characteristics of the 2011 population Census in 1 km² grid datasets	Yes	No	Currently available for 2006 Census data only; unknown when 2011 Census grids will be published => Alternative: 2011 pop. data from Urban Audit 2011
IFC / World Bank	Country level indicators on ease of doing business	Yes	Yes	Useful to investors; Integration into Webtool
International Labour Organization (ILO)	Over 100 indicators on (un)employment, income, poverty, prices etc. for 165 economies.	No	No	Provides data on country level only => alternatives: ESPON and Eurostat db
ISI Web of Knowledge	Information on (geographic origin of) citations and citation counts	No	Yes	May be used to derive indicator on knowledge level
Moody's / Fitch / Standard & Poor's	Credit rating of cities	Yes	No	No city rankings available and/or license fees apply
Most liveable cities (e.g. Economist Intelligence Unit / Mercer / Monocle)	List of cities as they rank on annual surveys of living conditions	Yes	No	Worldwide city rankings: only some European cities included; Results are subject to criticism
OAG Aviation	Statistics on global air transport	No	No	License fees apply
OpenFlights	Airport, airline and route data	No	Yes	May be used to derive "connectivity by air" indicator(s)
OpenStreetMap (OSM)	Many geo-located variables (e.g. transport, amenities such as universities)	Yes	Yes	Rich source of geo-located information
Publish or perish	Academic citation metrics	No	No	No information on geographic origin of citations
ReRisk	Climate, economic & energy statistics (NUTS 2)	Yes	Yes	Climate data may be used to derive QoL indicator(s)
ResearchGate	Scientific collaboration platform, providing access to a large number of publications	No	No	Does not provide information on geographic origin of publications
RRG GIS Database	Large number of variables for 38 European countries; focus is on transportation networks and transport facilities	No	No	Yearly license fees apply
TomTom	Avg. speed on major roads and/or freeways	Yes	Maybe	Data is being assessed, license fees as yet unclear
UN-HABITAT	Urban indicators	Yes	No	Indicators focus on basic amenities (e.g. Access to improved sanitation), which are more applicable to developing countries
University rankings	Various rankings for universities worldwide	No	No	Depending on ranking, only 24 – 33 universities in EU27+4 area are listed
Urban Atlas	Highly detailed land use coverage data for 305 European LUZ	Yes	No	Very laborious: each LUZ dataset to be downloaded and converted to raster separately; Based on previous LUZ delineations => Alternative: CORINE Land Cover data

[1]: CU Response Inception and Intermediate Deliverable 1.docx, p.7

3 Geographic levels

3.1 LUZ level

ESPON CU has stated that the (current version of the) Larger Urban Zone geographical level should be the backbone of the Webtool. Therefore, when searching for indicators attention has been focused on indicators collected at LUZ level. The main provider of these LUZ based indicators is Eurostat. One of the issues encountered was that, until now, all LUZ indicators had been collected for a previous version (2004) of LUZ delineations (delineations available from Eurostat). This version not only differs in size and shape of the LUZ, but also in number from the current LUZ version (2012). Please note that, as yet, the LUZ 2012 delineations are not available from any official geographic delineations repository; instead, they have been retrieved from the link provided in this EC Call for tenders document. According to ESPON CU, despite these differences in shape and size the data collected for the previous LUZ represent a reasonable approximation for the corresponding current LUZ and can therefore be used in the Webtool. When considering the 171 1st tier LUZ, 160 of the current LUZ have a correspondence to a previous LUZ. However, in some cases the areal differences are considerable, as may be derived from Figure 3-1 and Figure 3-2. A specification of the outliers is available upon request.

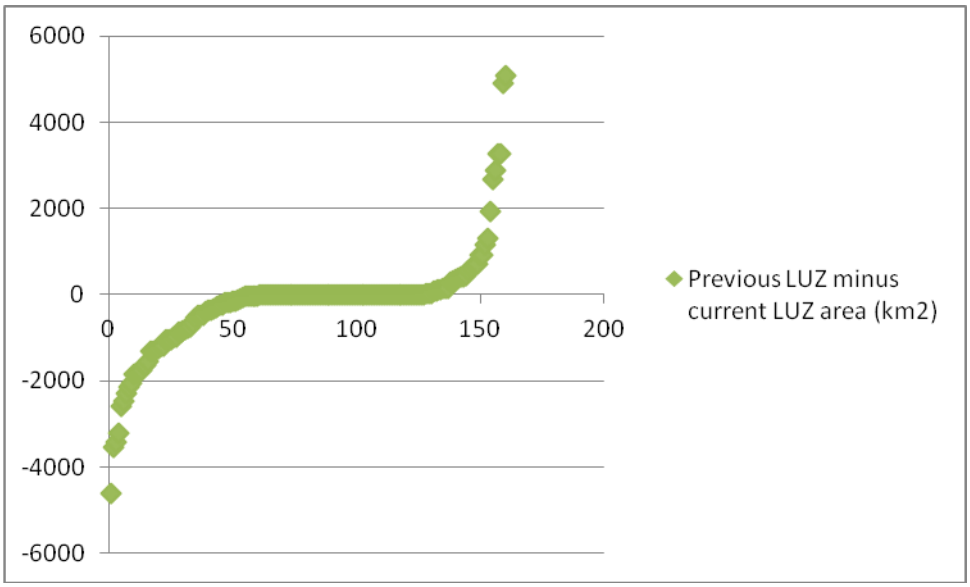

Figure 3-1. Areal difference (km2) between previous and current LUZ pairs (n=160).

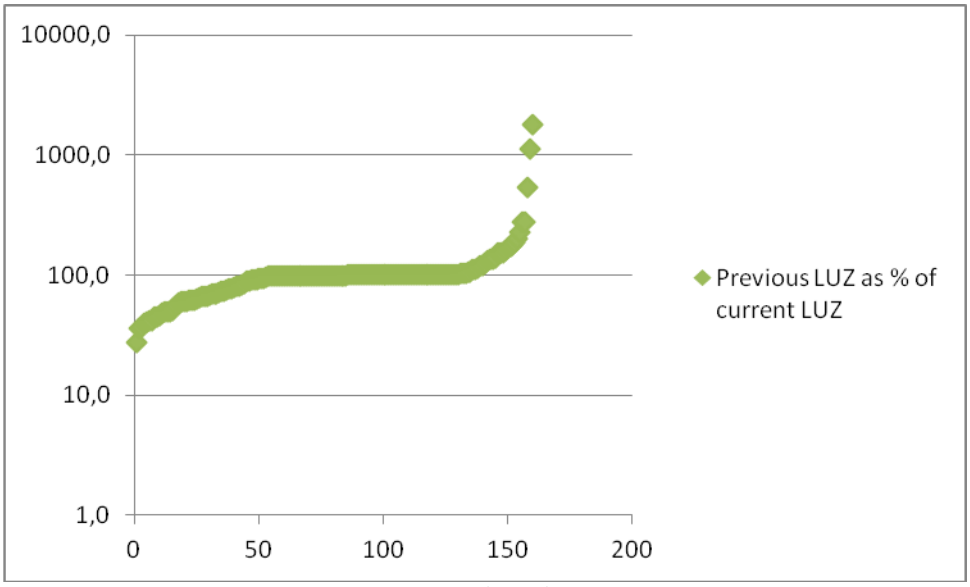

Figure 3-2. Previous LUZ area as % of current LUZ area (n=160).

Figure 3-3 shows the previous and current LUZ delineations for Bratislava and Wien, as examples of both a good and a poor correspondence.

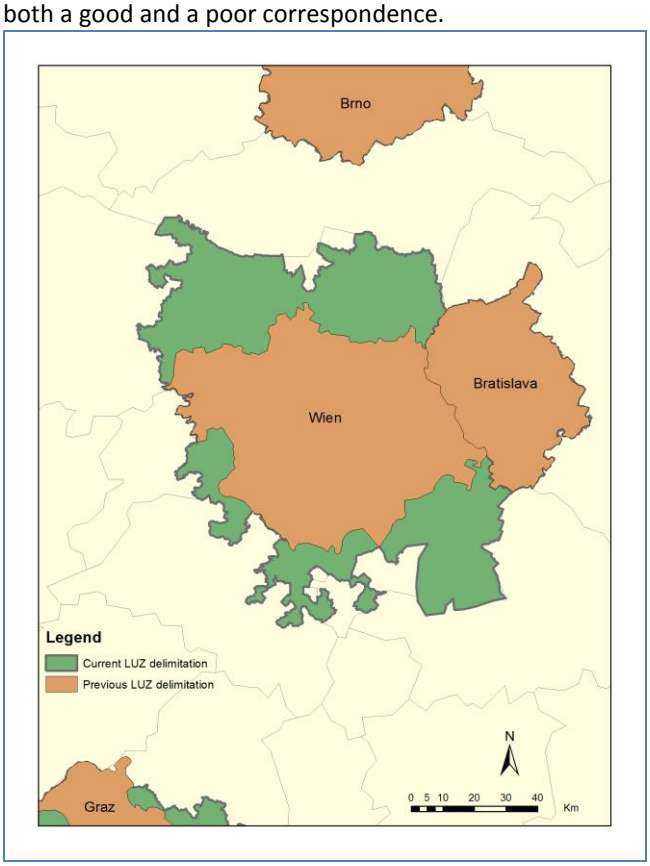

Figure 3-3. Examples of a good (Bratislava) and a poor (Wien) correspondence between previous and current LUZ delineations.

This discrepancy between previous and current LUZ delineations may lead to data inconsistencies in case of a time series for a LUZ-based indicator, thus the use of time series is not recommended at this stage. However, as more and more data will be collected for the current LUZ version, creation of time series may become possible in the (near) future.

3.2 NUTS 3 level

Since not all indicators relevant to the Webtool are available at LUZ level, NUTS 3 level data, of which ESPON is an important provider, has also been scanned. A lot of relevant and recent data is available at this regional level; NUTS 3 delineations are available from Eurostat. It was assumed that this data could be used because of the existence of a correspondence table between the previous LUZ and NUTS 3 versions. This table specifies which NUTS 3 regions are part of a particular LUZ. As such, it seemed possible to convert NUTS 3 level data to LUZ level and thus use it in the Webtool. However, the current LUZ version is based on LAU2, therefore this correspondence with NUTS 3 does not exist anymore. This would make it very difficult to integrate data collected at NUTS 3 level into the Webtool. Luckily, this issue has been solved by the creation of so-called 'Metropolitan Regions'.

3.3 Metropolitan Region level

277 Metropolitan Regions (MR) in 30 countries have been defined. These regions are aggregations of NUTS 3 areas and are considered by ESPON CU to be reasonable (and acceptable) approximations for the corresponding LUZ. This would mean that data collected at MR level could be included in the Webtool to constitute an additional set of indicators for selected LUZ (i.e. only those with a corresponding MR). Of the 1st tier LUZ to be included in the Webtool (see Chapter 7), only two do not have a corresponding MR: Metz (France) and Reykjavík (Island).

As with the two LUZ versions however, the areal difference between a LUZ and its corresponding MR is in some cases considerable (with most MR being larger than their corresponding LUZ), see Figure 3-4 and Figure 3-5. A specification of the outliers is available upon request.

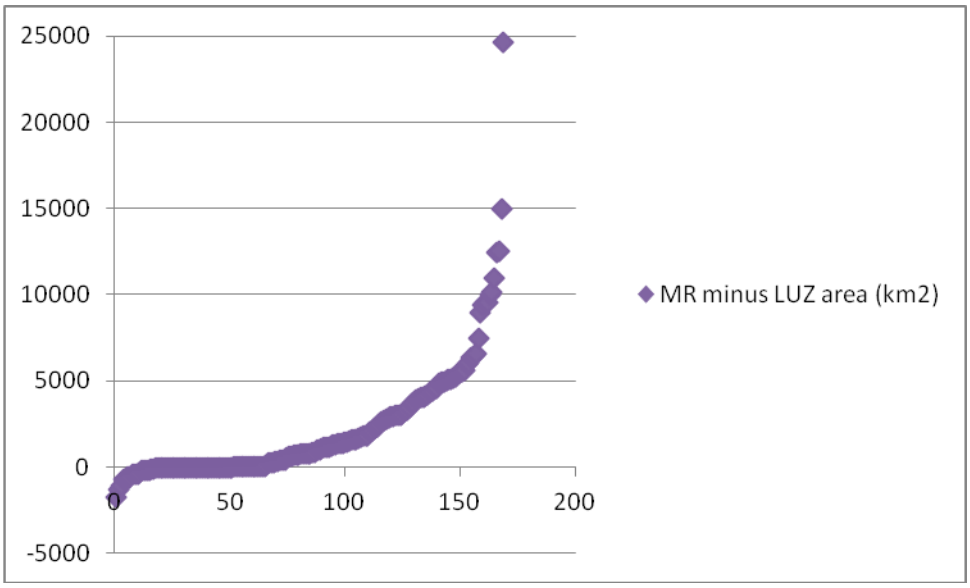

Figure 3-4. Areal difference (km2) between current LUZ and corresponding MR pairs (n=169).

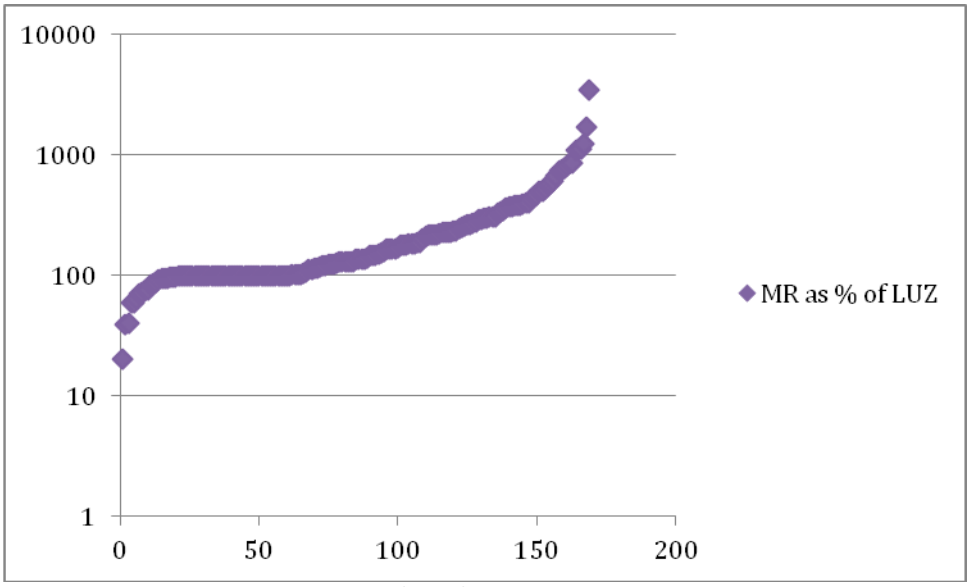

Figure 3-5. MR area as % of current LUZ area (n=169).

Another aspect to consider is that virtually all data currently available for NUTS 3 level (e.g. in the ESPON database) has been collected for the 2006 version of the NUTS 3 nomenclature. There are some minor differences between NUTS 3 version 2006 and NUTS 3 version 2010, which naturally propagate to the MR level as well. Figure 3-6 and Figure 3-7 present the differences between MR based on NUTS 3 version 2006 and MR based on NUTS 3 version 2010.

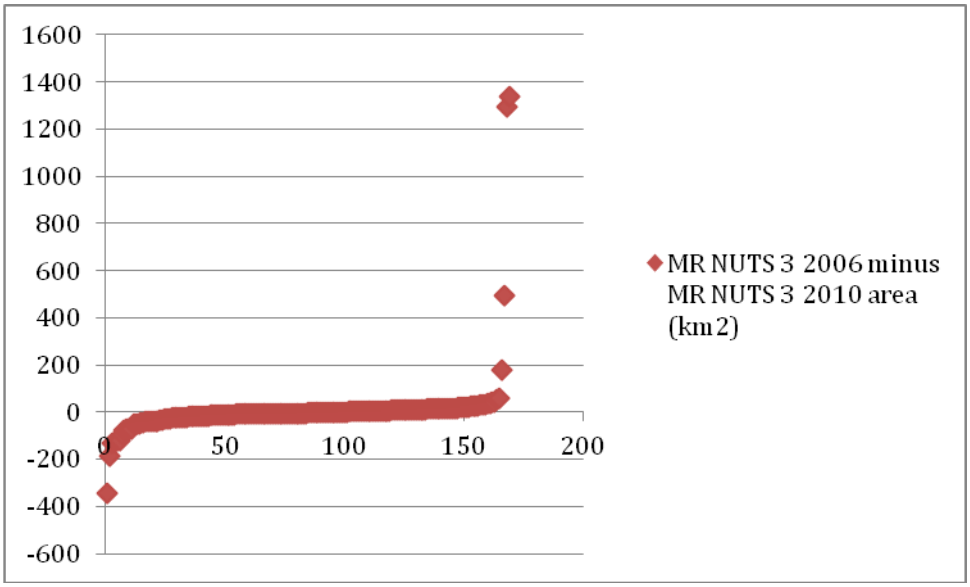

Figure 3-6. Areal difference (km2) between MR NUTS 3 2006 and corresponding MR NUTS 3 2010 (n=169).

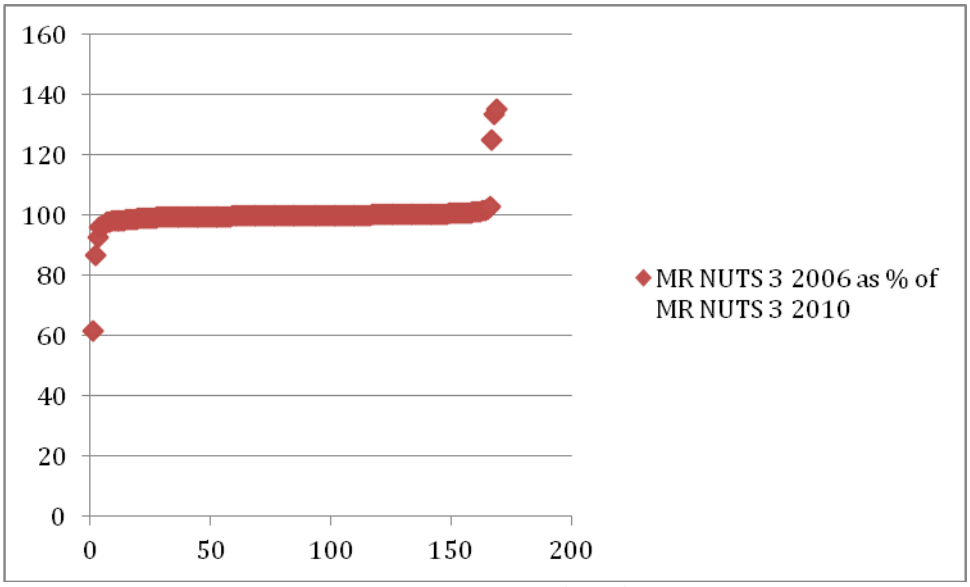

Figure 3-7. MR NUTS 3 2006 area as % of MR NUTS 3 2010 area (n=169).

Because of the abundance of data collected for NUTS 3 version 2006, the MR delineations used in the Webtool will be based on this version.

In consultation with ESPON CU, it was decided to refrain from using two geographic levels (LUZ, MR) in the Webtool and treat them as separate datasets. Instead, indicators collected at MR level will be marked as such and integrated with the LUZ derived indicators. Since each indicator is collected at either LUZ or MR level, this is the same for each LUZ; therefore, when comparing two or more LUZ on a certain indicator this will be based on the same geographic delineations.

3.4 Core City level

Some Eurostat indicators, especially those collected within the framework of an Urban Audit (UA), are collected at both LUZ and Core City level. The latter, according to Eurostat, is "…*the city as defined by its administrative and/or political boundaries*". As such, a Core City is always part of, and contained within, the LUZ to which it belongs. However, except for UA derived indicators, other data sources do not provide data for this geographic level. Also, no correspondence exists between NUTS 3 / MR and Core City. And as the Webtool should be based upon LUZ delineations, it was decided disregard this geographic level.

3.5 NUTS 2 level

The NUTS 2 geographic level generally corresponds to provinces, states, regions, or similar. There is no official correspondence between NUTS 2 on the one hand and LUZ / MR on the other hand. Integrating data collected at this level into the Webtool is therefore difficult. But there are exceptions: for example climate data collected at NUTS 2 level may still prove to be useful. In this case, it may be safely assumed that climate values collected for a province also apply to the one or more LUZ / MR it contains.

3.6 Country level

Some data is only collected at country level, often because it is related to country policies, regulations, economy, etc. An example of this is the set of 'Ease of Doing Business' indicators developed by IFC and World Bank. Using this kind of country level indicators implies that each LUZ within a specific country is assigned the same (country) value for a certain indicator. This might still be interesting to the CityBench project, because it highlights differences between LUZ in different countries.

4 Potential indicators

Intermediate Deliverable I presented an overview of potential indicators, grouped into themes. Additional research, ESPON CU responses to both the Inception report and Interim report, and exploration of Volunteered Geographic Information (VGI) derived from social media (Twitter, Flickr and YouTube) have led to a revision of the potential indicator list. This Section therefore presents a comprehensive overview of the revised list of indicators, all of which are potentially interesting for usage in the Webtool. VGI derived indicators are explored in more detail in Chapter 6.

Please note that data availability for the new Urban Audit (2011) indicators included is currently still (very) low but is expected to increase in the course of 2013.

The potential indicators have been grouped into the following themes:

1. Transport (accessibility, connectivity).
2. Economy.
3. Quality of Life (environment, air quality, climate).
4. Knowledge / smartness.
5. Demography.
6. Social aspects (employment, poverty).
7. LUZ morphology.

Below are several Tables, each covering a single theme. Please note that:

- a K or EIB code in the 'Indicator' column relates to the RFSC resp. EIB indicators as proposed in the use cases (see Interim report);
- the number in the 'Year' column indicates the most recent year for which data has been or is being collected.

Table 4-1. Transport (accessibility, connectivity).

Data source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
ESPON	EIB 2: Air, Multimodal, Road and Rail Accessibility	NUTS 3 (2006)	2006	Potential accessibility, standardised ESPON	Yes	Existing accessibility data, no need to create new indicator from alternative source; however, aggregating values from NUTS 3 to MR not straightforward
Eurogeographics	# of railway / freeway links leading to/from city	N/A	2010	Absolute (#)	No	Existing ESPON accessibility data is used instead; Might be added at a later stage
Eurostat UA 2011	K 7: Percentage of journeys to work by car or motor cycle	LUZ (2012)	2011	%	No	Data virtually absent (except for German L/C 2009)
OpenFlights	# of in- / outbound flights	N/A	Real-time	Absolute (#)	Yes	Open data; Relatively easy to extract and process
OpenStreetMap	Road and (high speed) rail connections	N/A	Real-time	Absolute (#)	No	Data difficult to extract; Of varying quality level

TomTom	Avg. speed on major roads and/or freeways	N/A	2013	Km/h	No	Data is being assessed, license fees as yet unclear; Might be added at a later stage

Table 4-2. Economy.

Source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
Eurostat	Gross Domestic Product (GDP) per inhabitant	MR (based on NUTS 3 2006?)	2009	Absolute (€)	Yes	Context indicator
Eurostat	Euro / Purchasing power standard per inhabitant	MR (based on NUTS 3 2006?)	2009	Absolute (€) / % of the EU average	No	More or less similar to GDP per inhabitant
Eurostat	EIB 3: Gas / Electricity prices for industrial consumers	NUTS 0	2012	€ per kWh	Yes	Useful to investors
Eurostat UA 2011	K 6: (Employment (jobs) in various sectors) /) / (Employment (jobs) – employees + Employment (jobs) – self-employed) x 100	LUZ (2012)	2011	%	No	Current data availability in UA 2011 < 50% Only some LUZ data for DE / NL / NO (2009 – 2011); for other countries only some City data (2009)
Eurostat UA 2011	EIB 1: data on number of residents with ISCED level 0,1,2 / 3,4 / 5,6 / economically active population	LUZ (2012)	2011	Absolute #	No	Current data availability in UA 2011 < 50% Available data mainly for City level
Eurostat, Eurostat UA 2011	EIB 8: Employment (jobs) in various sectors / GDP 1999-2011	LUZ (2004) / LUZ (2012)	2011	Absolute (#)	No	MAUP issue: use of values for previous and current LUZ (might be prevented by using shorter time series, e.g. 2005-2011)
IFC / World Bank	Ease of doing business	NUTS 0	2013	Overall country ranking	Yes	Useful to investors; At request of ESPON CU

Table 4-3. Quality of Life (environment, air quality, climate).

Source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
EEA: CORINE	K 17: (Green urban areas) / (other land use)	100x100 m	2006	% green vs built up	Yes	EEA data: official and free
ESPON ReRisk	Climate: Mean	NUTS 2	2010	Deg. Celsius	No	Not relevant enough

	minimum January / maximum July temperature	(2006)				
European Climate assessment	Climate: temperature / rainfall / sunshine	0.25x0.25 deg.	2012	Various	No	Not relevant enough
European Environment Agency	K 15 / K18 / EIB 11: Residential PM10	5x5km	2008	# of tons PM10 per grid	Yes	EEA data: official and free

Table 4-4. Knowledge / smartness.

Source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
ESPON	Photovoltaic energy potential (Photovoltaic output for 1 kWp system mounted at optimum angle)	NUTS2 (2006)	2005	kWh	Yes	Indicator of potential usage of solar energy => 'Smartness'
Eurostat -or- ESPON TEL Update	K 3: Households with broadband access by NUTS 2 regions -or- K 3: IP addresses	NUTS 2 (2010) -or- NUTS 3 (2006)	2012 -or- 2009	% -or- Absolute (#)	No Yes	Geographic level inadequate (but updated every year) Either this one… … or this one Easy to extract, aggregate to MR and use (but most recent data from 2009)
Eurostat	K 2: High-Tech (total) patent applications to the EPO per million of inhabitants	MR	2009	# per million of inhabitants	Yes	Indicator for MR knowledge level
Eurostat	K 16: Share of renewable energy in gross final energy consumption	NUTS 0	2011	%	Yes	Fairly recent indicator of sustainability => 'Smartness'
Eurostat UA 2011	K 10: (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	LUZ (2012)	2011	%	No	Current data availability in UA 2011 < 50%; Available data mainly for City level
Eurostat, Eurostat UA 2011	EIB 5: (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)	LUZ (2004) / LUZ (2012)	2011	Absolute #	No	Current data availability in UA 2011 < 50%; Available data mainly for City level; MAUP issue: use of values for previous and current LUZ (might be prevented by using shorter time series, e.g. 2005)

OpenStreetMap	EIB 4: no of universities in 50 km radius	50km radius around LUZ center	Real-time	Absolute #	No	Might be very difficult to extract actual # of universities, since each separate university building is of amenity 'university'
Publication repositories, e.g. ISI Web of Knowledge	# of high-impact publications	N/A	Real-time	Absolute (#) per LUZ	No	Calculation of indicator(s) from source data complicated; Might be added at a later stage

Table 4-5. Demography.

Source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
Eurostat	K 11: Life expectancy at birth by sex and NUTS 2 regions	NUTS 2 (2010)	2010 / 2011	# of years	No	Geographic level inadequate
Eurostat UA 2011	Resident population / Population density	LUZ (2012)	2011	Absolute # / #/km^2	Yes	Context indicator
Eurostat UA 2011	EIB 7: Ageing (Tot Res Pop >65) / (Tot Res Pop) x 100 for 2005 & 2011	LUZ (2012)	2011	%	No	Might be added at a later stage
Eurostat UA 2011	K 1: Pop in/-decrease (Tot Res Pop 2012 / Tot Res Pop 2005) x 100	LUZ (2012)	2011	%	No	Might be added at a later stage

Table 4-6. Social aspects (employment, poverty).

Source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
ESPON OLAP Cube	Employment	LUZ (2004)	2006	Absolute #	No	Most recent data from 2006; Previous LUZ version
ESPON OLAP CUBE	Unemployment	LUZ (2004)	2006	Absolute #	No	Most recent data from 2006; Previous LUZ version
Eurostat	K 13: People at risk of poverty or social exclusion by NUTS 2 regions	NUTS 2 (2010) / NUTS 0	2010 / 2011	%	No	Geographic level inadequate
Eurostat UA 2011	K 5: (Persons employed, 20-64, female / male) / (Female / Male Resident Population 20-64) x 100	LUZ (2012)	2011	%	No	Similar to Persons unemployed (see below)
Eurostat UA 2011	EIB 9: e.g. 1) Persons unemployed 2) Individuals reliant on	LUZ (2012)	2011	%	1): Yes 2) and 3): No	1): Context indicator 2) and 3):

	social security benefits (>50%) 3) Number of jobless households with / without children					Current data availability in UA 2011 < 50% (only some DE L/C data for 2009)
Eurostat UA 2011	K 9: (Students leaving compulsory education without having a diploma) / (Total students registered for final year of compulsory education) x 100	LUZ (2012)	2011	%	No	Current data availability in UA 2011 < 50% (only some De L/C data for 2009 / only some CZ/DE/RO L/C data for 2009)
Eurostat UA 2011	K 12: Number of overcrowded households (>1 persons/room)	LUZ (2012)	2011	Absolute #	No	Current data availability in UA 2011 < 50% (only some DE L/C data for 2009)

Table 4-7. LUZ morphology.

Source	Indicator	Spatial level (version)	Year	Unit / format	Included in proposed list of indicators for Webtool	Reason(s) for using / not using
European Environment Agency	K 19: mosaic_100m_sealing_v2.tif	100x100 m	2006	% of continuous soil sealing	No	Alternative: % of green urban area
LUZ 2012 shapefile	EIB 10: Total land area (km2)	LUZ 2012	2011	Absolute # (km^2)	No	But might be used to calculate other indicators, e.g. population density

5 Social Media Indicators

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.

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 Twitter2 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

[2] https://twitter.com/

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.

5.1 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 of citizens and therefore it could influence in vulnerable fields such as financial markets. This also could provide useful information to support decision making to local government or a potential investor. These indicators are related to a topic per capita inside a LUZ delimitation.

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

Table 8.- Attitude/information about current circumstances indicators

Calculation procedure:

- Generate two lists of keywords (in every language) that illustrate the Crisis and the Unemployment fields 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.

Crisis topic

Image 1.- Recession concept[3]

Image 2.- Crisis concept[4]

- Query (UK001L2, en): service=Twitter&q= Assets, Bailout, Bank, Bussines, Bubble, Capital, Capitalist, Crash, Corruption, Credit, Crisis, Debt, Deflation, Bankruptcy, Economy, Euro, Europe, Financial, Investment, Investors, 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): assets, Bailout, Bank, Bussines, Bubble, Capital, Capitalist, Crash, Corruption, Credit, Crisis, Debt, Deflation, Bankruptcy, Economy, Euro, Europe, Financial, Investment, Investors, Market, Money, Price, Rate, Recession, SME, Stock Market

language, LUZ	Keywords
bg,Bulgarian	Закупените активи, Bailout, банка, Bussines, Bubble, Capital, капиталист, Crash, корупцията, кредит, криза, дълг, Дефлация, несъстоятелност икономиката, Euro, Европа, финансови, инвестиционни, Инвеститори, пазар, пари, Цена, Rate, рецесия, МСП, Stock Market
hr,Croatian	Assests, Bailout, banka, Bussines, Bubble, kapital, kapitalistički, Crash, korupcija, kreditne, kriza, dug, ispuhavanja, stečaj, ekonomija, Euro, Europa, financijska, investicijska, investitori, tržište, novac, cijena, stopa, Recesija, malog i srednjeg poduzetništva, Burza
cs,Czech	Assests, výpomoci, banka, Bussines, Bubble, kapitál, kapitalista, Crash, korupce, úvěr, krize, zadlužení, deflace, konkurs, ekonomika, euro, Evropa, finanční, investiční, investoři, trh, peníze, cena, rychlost, recese, malých a středních podniků, Stock Market
da,Danish	Assests, redningen, Bank, Bussines, Bubble, Capital, kapitalistiske, crash, korruption, Credit, Krise, Gæld, Deflation, Konkurs, Economy, Euro, Europa, Finansielle, Investment, investorer, markedsaktører, Money, Pris, Rate, Recession, SME, Stock Market
nl,Dutch	Assests, Bailout, Bank, Bussines, Bubble, Hoofdstad, kapitalistische, Crash, corruptie, Krediet, Crisis, Schuld, Deflatie, faillissement, Economie, Euro, Europa, financieel, investering, beleggers, markt, geld, prijs, tarief, Recessie, KMO, Stock Market
et,Estonian	Assests, kautsjoni Bank, Bussines, Bubble, Capital, kapitalistlikku Crash, korruptsiooni-, krediidi kriisi, võlakirjad, Deflatsioon, pankrot, majandus, euro, Euroopa, finants-, investeeringute, investorid, turg, raha, Hind, Rate, Allakäik, VKEde, Stock Market
fi,Finnish	Hyödykkeet, bailout, Bank, Bussines, Bubble, Capital, kapitalistinen, Crash, Korruptio, luotto, kriisi, velka, Deflaatio, konkurssi, talous, euro, Eurooppa, rahoitus-, sijoitus, Sijoittajat, Market, Money, Hinta, Rate, lama, pk-yritysten, Stock Market
fr,French	Assests, renflouement, banques, Bussines, Bulle, Capital, capitaliste, crash, la corruption, crédit, crise, dette, la déflation, la faillite, économie, Euro, Europe, financiers, d'investissement, les investisseurs, le marché, l'argent, le prix, taux, récession, PME, Stock Market
de,German	Assests, Bailout, Bank Bussines, Blase, Capital, Capitalist, Unfall, Korruption, Kredit, Krise, Schulden, Deflation, Bankrott, Wirtschaft, Euro, Europa, Finanzen, Investitionen, Investoren, Markt, Geld, Preis, Preise, Rezession, KMU, Stock Market

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

el,Greek	Assests, διάσωσης, Τράπεζα Επαγγελματικός, φυσαλίδας, Capital, καπιταλιστική, Crash, διαφθορά, Credit, Κρίση, Χρέος, αποπληθωρισμός, την πτώχευση, οικονομία, ευρώ, Ευρώπη, χρηματιστηριακές, επενδυτικές, οι επενδυτές, αγορά, χρήματα, Τιμή, Τιμή, ύφεση, ΜΜΕ, Χρηματιστήριο
en,English	Assets, Bailout, Bank, Bussines, Bubble, Capital, Capitalist, Crash, Corruption, Credit, Crisis, Debt, Deflation, Bankruptcy, Economy, Euro, Europe, Financial, Investment, Investors, Market, Money, Price, Rate, Recession, SME, Stock Market
hu,Hungarian	Assests, szanálását, Bank, Bussines, Bubble, Capital, kapitalista, Crash, korrupció, Hitel, válság, adósság, defláció, csőd, gazdaság, Euro, Európa, pénzügyi, befektetési, befektetők, piac, pénz, ár, árfolyam, recesszió, KKV-k, Stock Market
ga,Irish	Assests, fhóirithint, Banc, Bussines, Bubble, Caipitil, caipitlí, Crash, Éilliú a, Creidmheasa, Ghéarchéime, Fiach, Díbhoilsciú, Féimheachta, Geilleagar, an Euro, an Eoraip, Airgeadais, Infheistíochta, Infheisteoirí, Mhargaidh, Airgead, Praghas, Ráta, Chúlú Eacnamaíochta, SME, Stoc Mhargaidh
it,Italian	Valore di attività, Bailout, Banca, Bussines, Bolla, capitale, capitalismo, crash, la corruzione, credito, crisi, debito, deflazione, fallimento, economia, euro, Europa, finanziario, investimento, gli investitori, mercato, denaro, prezzo, tasso, Recessione, PMI, Azioni
lv,Latvian	Assests, bailout, banka, Bussines, Bubble, Capital, kapitālistam, Crash, korupciju, Kredīts, krīze, parādu, deflācija, bankrotu, Ekonomika, eiro, Eiropa, finanšu, investīciju, Investors, tirgus, nauda, Cena, Rate, recesijas, MVU, akciju tirgus
lt,Lithuanian	Assests, Finansinės pagalbos, bankas, bussines, burbulas, Kapitalas, Kapitalizmo, avarijos, Korupcija, kredito, krizė, skolos, Defliacija, Bankrotas, ekonomika, euras, Europa, finansai, investicijos, investuotojai, rinkos, Pinigai, Kaina, Reitingas, Recesija, MVĮ, vertybinių popierių rinka
mt,Maltese	Assests, Kawzjoni, Bank, Bussines, Bubble, Capital, Capitalist, Crash, Korruzzjoni, Kreditu, Kriżi, Dejn, deflazzjoni, Falliment, Ekonomija, Euro, l-Ewropa, finanzjarja, investiment, Investituri, Market, Money, Price, Rata, reċessjoni, SME, Stock Market
pl,Polish	Assests, Bailout, Bank, Bussines, Bubble, Capital, kapitalistyczna, Crash, Korupcja, Kredyt, Kryzys, dług, Deflacja, Upadłość, gospodarka, Euro, Europa, Finanse, Inwestycje, Inwestorzy, Market, Money, Cena, Cena, Recesja, SME, Stock Market
pt,Portuguese	Recursos, ajuda, banco, negocios, Bolha, Capital, capitalista, Crash, Corrupção, Crédito, Crise, Dívida, deflação, Falência, Economia, Euro, Europa, financeira, investimento, investidores, mercado, dinheiro, Preço, Recessão, PME, Bolsa
ro,Romanian	Assests, Bailout, Bank, Bussines, Bubble, Capital, Capitalist, Crash, Corupția, de credit, Criza, datoriilor, Deflația, Falimentul, Economy, Euro, Europa, Financiar, de Investiții, Investitorii, Market, Money, Pret, Rate, Recesiunea, pentru IMM-uri, Market Stock
sk,Slovak	Assests, výpomoci, banka, Bussines, Bubble, kapitál, kapitalista, Crash, korupcia, úver, kríza, zadlženie, deflácia, konkurz, ekonomika, euro, Európa, finančné, investičné, investori, trh, peniaze, cena, rýchlosť, recesia, malých a stredných podnikov, Stock Market
sl,Slovene	Assests, Bailout, banka, Poslovni, Bubble, Capital, Kapitalizem, Crash, korupcije, Credit, kriza, dolg, deflacija, stečaju, Gospodarstvo, evro, Evropa, finančne naložbe, vlagatelji, trg, denar, cena, cena, recesija, MSP, Stock Market
es,Spanish	Patrimonio, Rescate financiero, Banco, Negocios, Burbuja, Capital, capitalista, Crash, corrupción, crédito, crisis, deuda, deflación, Bancarrota, Economía, Euro, Europa, Financiera, Inversiones, Inversores, Mercado, dinero, precio, velocidad, Recesión, PYME, Mercado de Valores
sv,Swedish	Gångar, Bailout, Bank, Bussines, Bubble, huvudstad, kapitalist, krasch, korruption, Kredit, Kris, Skuld, Deflation, konkurs, ekonomi, Euro, Europa, finansiell, investering, investerare, marknadsaktörer, Pengar, Pris, Rate, Recession, SMF, Stock Market
is,Icelandic	Assests, Bailout, Bank, Bussines, Bubble, Capital, capitalist, Crash, spillingu, Credit, Crisis, Skuld, verðhjöðnun, Gjaldþrot, Economy, Euro, Evrópu, Financial, Investment, Investors, Market, Money, Price, Rate, Samdráttur, SME, Stock Market
tu,Turkish	Varlıklarını, Kurtarma, Banka, Bussines, Kabarcık, Sermaye, Kapitalist, Crash, Yolsuzluk, Kredi, Kriz, Borç, Deflasyon, İflas, Ekonomi, Euro, Avrupa, Finans, Yatırım, Yatırımcılar, Market, Para, Fiyat, fiyat, Durgunluk, KOBİ, Borsa
lu,Luxembourgish	
no,Norwegian	Assests, Bailout, Bank, Bussines, Bubble, Capital, kapitalistiske, Crash, Korrupsjon, Credit, Krise, gjeld, Deflasjon, Konkurs, Economy, Euro, Europa, Financial, Investment, investorer, Market, Money, Prisen, Rate, Tilbakeslag, SME, Stock Market

Table 9.- Crisis keywords for the EU27+4 official languages

Unemployment topic

Image 3.- Unemployment concept 1[5]

Image 4.- Unemployment concept 2[6]

- 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, Selfemployment, Underemployed, Unemployment, Vacanvy, Wages, Work, Worker, Young

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-
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, Selfemployment, Underemployed, Unemployment, Vacanvy, 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

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

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	Procura de Emprego, Aumento, Trabalho, mercado, produtividade, Salário, empregado por conta propria, subempregados, Desemprego, vaga, Trabalhador, Juvens
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

Table 10.- Unemployment keywords for the EU27+4 official languages

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: Parlament, Europe, European Comission, Politics, Corruption, Rigth Wing, Left Wing, Union, Labor Union, Trade Union, Legislation, Law,

5.2 Tourism

It is of interest of the project to provide social media information about movility in Europe. Both short term displacement for turism or long term movility (emigration/inmigration) provide interesting information about cities. Such as its economy based on turism, or its capacity to absorv inmigration. 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 is to calculate the items posted in social media networks by foreign users in a city.

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	LUZ (2012)	2013	Pictures / per	Data is stored

	foreigner			capita	daily
YouTube	# of videos whose user is a foreigner	LUZ (2012)	2013	Videos / per capita	Data is stored daily

Table 11.- Tourism indicators

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.

6 List of proposed indicators

Following from a discussion with, and at the direction of, Kieran Kearney (former ESPON CU Project Expert), it was decided to limit the number of indicators to start populating the Webtool with to 15/20. In addition, the decision was made to select these indicators from 3 sources in approximately equal proportions: 5/7 from ESPON, 5/7 from Eurostat and 5/7 from 'other' sources, e.g. Social Media. Please note however that the Webtool will be designed in such a way as to enable the addition of other indicators as required.

From the tables presented in Chapter 5, 19 indicators have been selected for initial inclusion in the Webtool. They are shown in Table 7-1. The column 'Source (code)' may contain either a '1' (ESPON data), a '2' (Eurostat data) or a '3' ('other' sources).

Table 6-1. Proposed indicators.

	Indicator	Source (code)	Source (name)	Most recent year	Geographic level (version)
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?)
04	# of in- / outbound flights	3	OpenFlights	Real-time	LUZ (2012)
05	Potential accessibility, road / rail, standardised ESPON	1	ESPON TRACC	2006	NUTS 3 (2006)
06	Ageing index	1	ESPON INTERCO	2008	NUTS 3 (2006)
07	Old age dependency	1	ESPON INTERCO	2008	NUTS 3 (2006)
08	# of items being posted about 'Crisis'/per inhabitant	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
09	# of items being posted about 'Unemployment'/per inhabitant	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
10	# of items being posted by tourists/(per inhabitant?)	3	Twitter/YouTube/Flickr	Real-time	LUZ (2012)
11	Ease of doing business	3	IFC / World Bank	2013	Country
12	Gas / Electricity prices for industrial consumers	2	Eurostat	2012	Country
13	% of LUZ consisting of green urban areas	3	EEA Corine	2006	LUZ (2012)
14	Residential PM10	3	EEA	2008	LUZ (2012)
15	Combined adaptive capacity to climate change	1	ESPON Climate	2011	NUTS 3 (2006)
16	High-Tech (total) patent applications to the EPO per million of inhabitants	2	Eurostat	2009	MR (NUTS 3 2006?)
17	IP Addresses	1	ESPON TEL Update	2009	NUTS 3 (2006)
18	Share of renewable energy in gross final energy consumption	2	Eurostat	2011	Country
19	Photovoltaic energy potential	1	ESPON ReRisk	2005	NUTS 2 (2006)

The Appendix to this report provides a factsheet outlining the steps needed to calculate each indicator.

Appendix: calculation of indicators

Indicator	Source (name), Geographic level (version)	Calculation of indicator
Theme: Context		
Resident population / Population density	Eurostat, LUZ (2012)	Resident population: 1. Download tabular data from Urban Audit 2011 db (*not available online yet*) 2. Extract values for Resident population in 2011 Population density: 1. Calculate LUZ 2012 areas from LUZ 2012 outlines vector file (using Lambert azimuthal equal-area projection) 2. Divide Resident population numbers by LUZ 2012 areas
GDP per inhabitant	Eurostat, MR (NUTS 3 2006?)	1. Download table **met_e3gdp** from Eurostat db 2. Extract values for GDP per inhabitant in 2010 3. Correct some MR codes (remove 'C' at end of code) to prevent inconsistencies with MR – LUZ correspondence table
% of persons unemployed	Eurostat, MR (NUTS 3 2006?)	1. Download table **met_lfu3rt** from Eurostat db (*currently not available online*) 2. Extract values for Total unemployment – 15 years or over in 2009 3. Correct some MR codes (remove 'C' at end of code) to prevent inconsistencies with MR – LUZ correspondence table
Theme: Connectivity		
# of in- / outbound flights	OpenFlights, LUZ (2012)	1. Download airport & route data from OpenFlights 2. Import downloaded data in Excel (make sure lat/long coordinates are in correct format after importing by using dot as decimal separator) 3. Route table: • for outgoing flights, create pivot tables using Src_airpID as row label and Dest_airpID as Σ value and copy columns (2) to new sheet (outgoing) • for incoming flights, create pivot tables using Dest_airpID as row label and Src_airpID as Σ value and copy columns (2) to new sheet (incoming) 4. [ArcMap] Open airports data and join it to outgoing / incoming sheet (keep only matching records) 5. [ArcMap] Export joined table as .dbf 6. [ArcMap] Add new .dbf to ToC 7. [ArcMap] Display XY Data, using Longitude for X Field and Latitude for Y Field and GCS_WGS_1984 as Coordinate System 8. [ArcMap] Select all European airports on map 9. [ArcMap] Choose Data => Export Data... to export selected features to new vector layers (outgoing / incoming) 10. [ArcMap] Reproject new vector layers to ETRS 1989 LAEA 11. [ArcMap] Optionally: create buffer around LUZ to account for airports just outside a LUZ 12. [ArcMap] Use Spatial Join to merge outgoing / incoming values to (optionally: buffered) LUZ (Merge Rule: Sum)
Potential accessibility, road / rail, standardised ESPON	ESPON TRACC, NUTS 3 (2006)	1. Download tables from ESPON db2 => Project: ACC Update 2. Extract values for Potential accessibility, road / rail, standardised ESPON in 2006 3. Calculate average value for each MR from values for its included NUTS 3 regions, using an MR – NUTS 3 (2006) correspondence table (*not available online*) and assigning a weight to each NUTS 3 (2006) => ESPON CU has been asked for advice regarding the best manner of aggregation / the weighting factor to be used
Theme: Demography		
Ageing index	ESPON INTERCO, NUTS 3 (2006)	1. Download tables from ESPON db2 => Project: INTERCO 2. Extract values for Ageing index / Old age dependency in 2008 3. Calculate average value for each MR from values for its included NUTS 3 regions, using an MR – NUTS 3 (2006) correspondence table (*not available online*) and assigning a weight to each NUTS 3 (2006) region according to its population number in 2008
Old age dependency	ESPON INTERCO, NUTS 3 (2006)	

		(M4D_poptot19902011_20120522_POP_T_1990-01-01_2011-01-01.xls, available from ESPON db2)
Theme: Social media		
# of items being posted about 'Crisis'/per inhabitant	Twitter/YouTube/Flickr, LUZ (2012)	1. Generate 2 lists with 'Crisis' resp. 'Unemployment' keywords, for each official language within selected LUZ 2. Create query and batch process to send this query to Twitter/Flickr/YouTube 3. Store number of items posted daily/weekly/monthly/yearly within each LUZ 4. For values per inhabitant: divide stored numbers by Resident population values
# of items being posted about 'Unemployment'/per inhabitant	Twitter/YouTube/Flickr, LUZ (2012)	
# of items being posted by tourists/(per inhabitant?)	Twitter/YouTube/Flickr, LUZ (2012)	1. Create query and batch process to send this query to Twitter/Flickr/YouTube 2. Store number of items posted daily/weekly/monthly/yearly by foreigners within each LUZ 3. For values per inhabitant: divide stored numbers by Resident population values
Theme: Investment climate		
Ease of doing business	IFC / World Bank, Country	1. Download rankings data from Doing Business 2. Extract EU27+4 countries 3. Assign country rankings for Ease of Doing Business to each LUZ it contains
Gas / Electricity prices for industrial consumers	Eurostat, Country	1. Download tables **nrg_pc_203** and **nrg_pc_205** from Eurostat db 2. Extract Gas / Electricity prices (€ per kWh, ex. taxes) for industrial consumers for period 2012S2 (Gas: Band I3; Electricity: Band IC) 3. Assign values for Gas / Electricity prices for industrial consumers per country to each LUZ it contains
Theme: Environment		
% of LUZ consisting of green urban areas	EEA Corine, LUZ (2012)	1. Download CLC 2006 – 100m raster data from European Environment Agency 2. [ArcMap] Perform Tabulate Area calculations on CLC 2006 classes for LUZ 2012 areas 3. [ArcMap] Add new field to table created by Tabulate Area operation and use Field Calculator to sum all areas per LUZ 4. Copy table to Excel; convert absolute values to % 5. Combine CLC classes 141 (Green urban areas) and 142 (Sport and leisure facilities) to obtain total % of green area inside LUZ 6. Join table with CLC class percentages to LUZ 2012 vector layer
Residential PM10 => Max. value (=class) in LUZ for 5 x 5 km area	EEA, LUZ (2012)	1. Download European Pollutant Release and Transfer Register (E-PRTR) diffuse air emission datasets from European Environment Agency 2. [ArcMap] Calculate statistics for raster 3. [ArcMap] Reclassify raster into 7 classes (Jenks Natural Breaks) 4. [ArcMap] Perform Tabulate Area calculations on reclassified raster for LUZ 2012 areas 5. Manually derive maximum pollution class (in 5 x 5 km area) for each LUZ
Combined adaptive capacity to climate change	ESPON Climate, NUTS 3 (2006)	1. Download tables from ESPON db2 => Project: ESPON Climate (*no public access*) 2. Calculate average value for each MR from values for its included NUTS 3 regions, using an MR – NUTS 3 (2006) correspondence table (*not available online*)
Theme: Smartness		
High-Tech (total) patent applications to the EPO per million of inhabitants	Eurostat, MR (NUTS 3 2006?)	1. Download table **pat_ep_mtec** from Eurostat db 2. Extract values for High-Tech (total) patent applications to the EPO per million of inhabitants in 2009 3. Correct some MR codes (remove 'C' at end of code) to prevent inconsistencies with MR – LUZ correspondence table
IP Addresses	ESPON TEL Update, NUTS 3 (2006)	1. Download table from ESPON db2 => Project: TEL Update 2. Extract values for 2009 3. Calculate value for each MR by aggregating values for its included NUTS 3 regions, using an MR – NUTS 3 (2006) correspondence table (*not available online*)
Share of renewable energy in gross final energy consumption	Eurostat, Country	1. Download table **tsdcc110** from Eurostat db 2. Extract values for 2011 3. Assign values for Share of renewable energy in gross final energy consumption per country to each LUZ it contains
Photovoltaic energy potential	ESPON ReRisk, NUTS 2 (2006)	1. Download table from ESPON db2 => Project: ReRisk 2. Assign values for Photovoltaic energy potential per NUTS 2 area

		to each LUZ it contains

In addition to the particular calculation steps described above, each indicator (except for Residential PM10) is standardized as follows:

1. Normalize values on 0 to 1 scale;

Classify into 5 / 7 classes using Jenks Natural Breaks.

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