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CHARACTERIZATION OF CITIES AS STRATEGY FOR URBAN PLANNING: METHODOLOGY APPLIED IN THE REMOURBAN PROJECT

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ABSTRACT

This paper aims at describing the methodology deployed in the Project REMOURBAN for the characterization of European middle size cities which allows identifying their potential characteristics and adverse conditions as starting point for addressing their sustainable urban transformation. The methodology comprises a selection of suitable indicators for each application domain identified in the project (both technical - energy, mobility and ICTs- and non-technical –people, governance, finance), benchmarking of the data available at city level in the selected data sources and the employment of statistical methods for clustering cities with homogenous characteristic.

The approach has been applied in 41 European cities from 18 countries and different cluster methods were employed in order to determine which was the most appropriate for our analysis. In addition, for a better interpretation of the results and a more accurate classification of the cities, diverse analysis were performed in each domain for concluding with a global analysis which group all the indicators and domain.

Relevant information has been obtained for the cities analysed regarding the sector which has a better opportunity for the urban transformation (energy, mobility and ICT) as well as the most proper strategies around the Smart City enablers (people, governance and financing issues). Furthermore, the statistical analysis led to build 5 different typologies of cities in each one of the field analysed and other 5 groups of cities with homogenous features were defined

with the global analysis. The location of clusters in certain geographic areas (North, South, East and Centre of Europe) was only obtained in the global analysis, not obtaining a clear picture in the single analysis.

The replication strategy of REMOURBAN will continue with the evaluation of the replicability of interventions and innovative solutions performed in the three lighthouse cities of REMOURBAN through a model built on non-technological barriers, citizen engagement and financial innovative schemes. Some of the cities analysed in the characterization study will take part in the analysis.

1. INTRODUCTION: THE REMOURBAN PROJECT

REMOURBAN is a large scale demonstration project, whose purpose is to accelerate the urban transformation towards the smart city concept taking into account all aspects of sustainability. Several objectives will be achieved, being the most relevant the development of a holistic and replicable model for sustainable urban regeneration, with a jointly approach in the sectors of energy, mobility and ICTs.

This urban regeneration model will be developed and validated in three lighthouse cities (Valladolid-Spain, Nottingham-UK and Tepebasi/Eskisehir-Turkey) accelerating the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions.

Besides the lighthouse cities, two cities are involved in the project with the role of follower, Seraing in Belgium and Miskolc in Hungary. These cities allow increasing the European dimension of the project and its replication potential. In order to achieve this objective, a methodology for the replication of this urban regeneration model is being developed from the three main lighthouses to the follower cities and from there, to any other city in Europe, as a holistic strategy for city transformation and planning, integrating all the existing strategies for energy, mobility, ICTs and citizen engagement.

2. URBAN REGENERATION MODEL AND REPLICATION POTENTIAL

The main goal in REMOURBAN is to provide a Sustainable Urban Regeneration Model that defines a holistic process for urban transformation with a jointly approach in the fields of Sustainable Buildings and Districts, Sustainable Urban Mobility, and Integrated Infrastructures and Process. This model provides solutions in both technical and non-technical fields addressing the temporal goals, the main Smart City enablers within the transformation process –towards a more sustainable and smarter environment– and innovations in the priority actions of energy, mobility and ICTs.

This toolkit of solutions, integrated through the model, is able to be adapted and implemented in a wide range of European Cities, focusing on their specific goals and targets, and the boundary conditions that characterise their ecosystem.

The Urban Regeneration model covers the four main phases of the city transformation process, which are linked to the specific actions and the Smart City enablers. These main phases are:

- **City audit** is the first phase of this model, aiming at implementing a set of integrated existing methods and tools that can support the evaluation of the current conditions of the cities in which the Sustainable Urban Regeneration Model will be implemented.
- **Actions design**. The objective of this second phase is the definition of the specific interventions or actions that will be undertaken in the city. After the analysis of the information collected in the first phase, it will be proposed a solution according with the expectations about energy savings and costs. This is a decision-making process.
- **Implementation.** The actions designed in the second phase will be implemented and commissioned, covering all fields involved in this urban transformation. In this phase, the deployment of the monitoring program will be key to allow gather the necessary information for assessing the impact of the intervention in the following phase.
- **Assessment.** This last phase is in charge of assessing the impact of the interventions following evaluation protocols and using the information gathered during the implementation phase. For this evaluation, the most appropriate KPIs will be selected in order to assess the sustainability and the smartness and some specific parameters as the energy consumption, CO_2 emissions reduction, reduction of the journey delays, even the social acceptance of the final users and citizens.

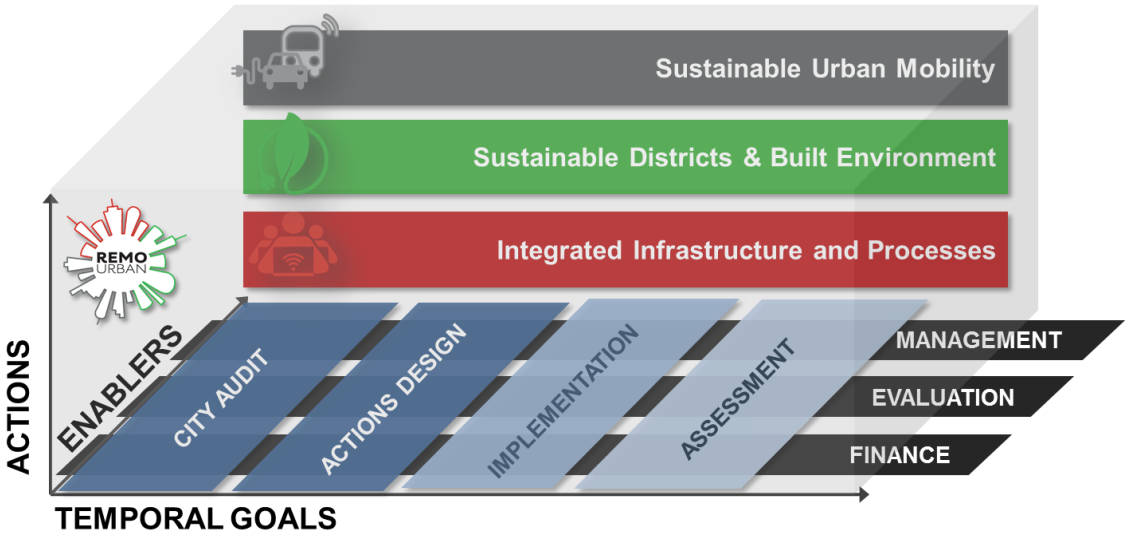

Figure 1. Sustainable urban regeneration model
Source: prepared by the authors

REMOURBAN aims at not only implementing this model in the three lighthouse cities where the main benefits and suitability of the model will be tested and demonstrate its replication potential and ability to be adapted to these different conditions. A first replication stage will be tested in the follower cities of Seraing (Belgium) and Miskolc (Hungary); but also a wider replicability plan to European Cities is being defined and will be validated.

This replicability plan is based on the characterisation of the European Cities, and grouping of them into specific target areas according to a set of indicators in the main fields of work of this model.

3. METHODOLOGY DEPLOYED FOR THE CITY CHARACTERIZATION

The methodology developed intends to categorize cities in five layers according to the REMOURBAN domains for a final generation of groups of cities which show same profile according to an aggregated scheme of indicators.

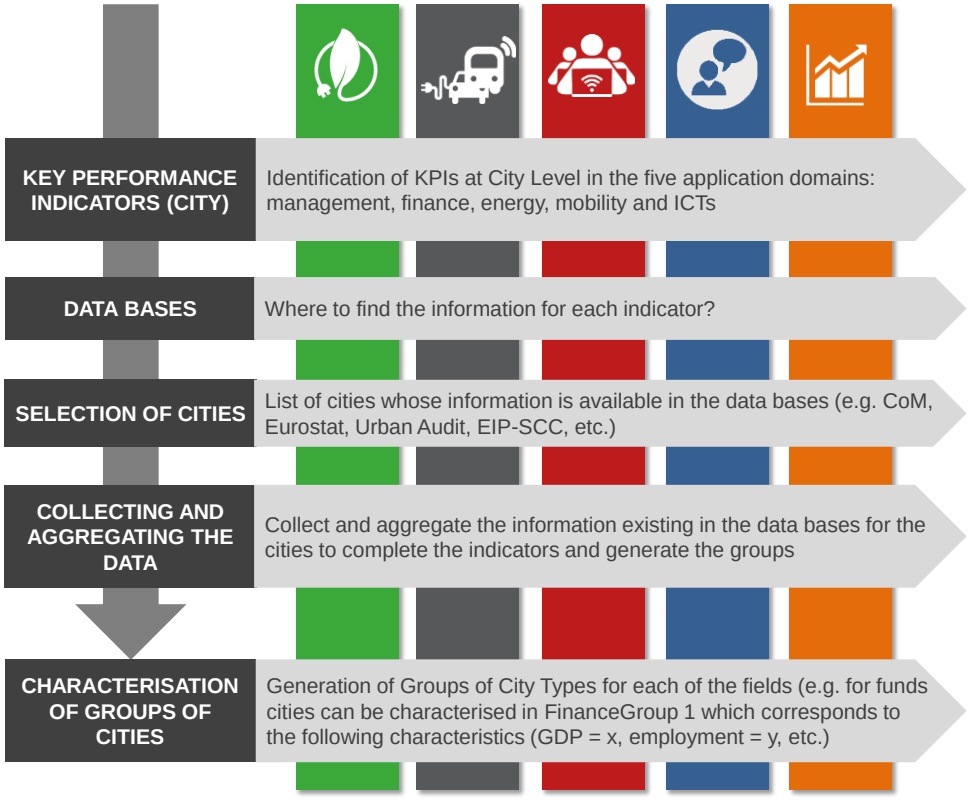

Figure 2. Overall scheme of the methodology
Source: prepared by the authors

The methodology comprises 5 steps which are briefly explained below:

- Selection of indicators for each REMOURBAN domain (management, finance, energy, mobility and ICTs) at city level. The choice will be based on their representativeness and availability in the existing sources.
- Exploration of database where find information for each indicator.
- Selection of cities which count with information for all the indicators in the databases.
- Collection of data for each city to complete indicators and generate groups of cities with similar features.
- Characterization of groups of cities in basis on range of values for each analysed field.

Therefore, the scope of the replicability is delimited to those cities with detailed information in databases (boundary condition).

4. RESULTS AND DISCUSION

With the application of the methodology, it is contemplated to narrow the study to 41 European cities of a certain size and establish groups of cities with homogenous characteristics in each domain. Within each of these groups of cities, the representative value will be calculated for each indicator in order to have the most representative values for a city within that cluster.

In a second interaction, the relationship among the different layers is analysed, leading to a cross-field characterisation at a higher level than the detailed classification by layer. The combination of both analyses allows different levels of detail in the clustering, which will deal to the identification of how the urban regeneration model can be adapted to the specific city characteristics of each group, ensuring therefore its replicability.

The radar graph below show some of the results obtained with the analysis:

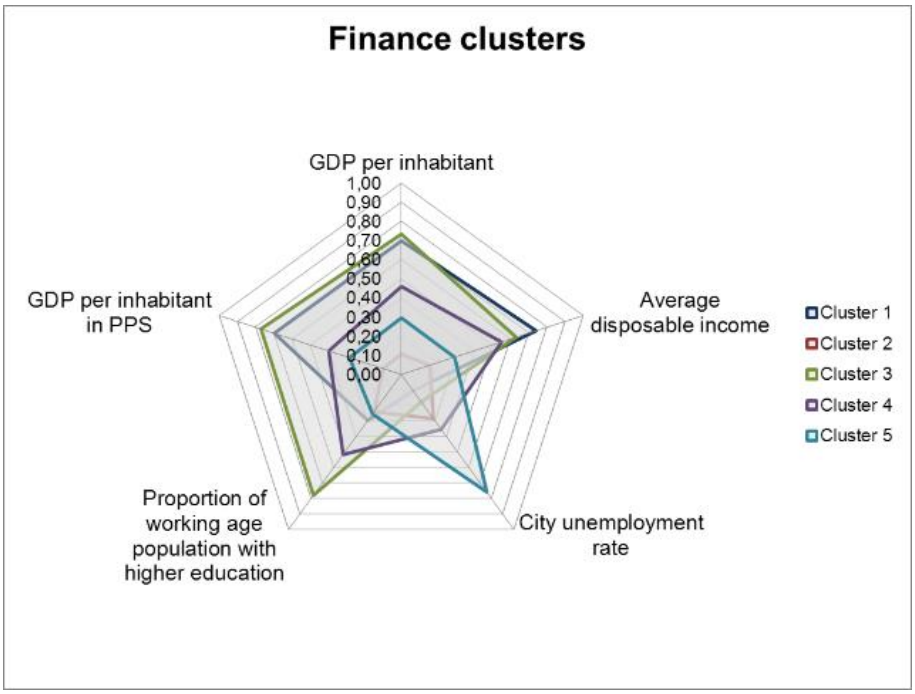

Figure 3. Results of the finance clustering
Source: prepared by the authors

The characterization of the cities revealed for each city the sectors which have a better opportunity for the urban transformation (energy, mobility and ICT) as well as the most proper strategies around the Smart City enablers (people, governance and financing issues).

Some interesting conclusions related to the urban planning have been obtained:

- Strategies based on citizen engagement can work in those cities which have a high rate of recycling and a high level participation in elections. However it can be assumed that these strategies should not be applied for an immediate result in each cities far of this scenario.

- Cities with a modal split based on private vehicle and a high number of cars probably present problems of traffic. If policy makers know the exact figure of the city in this issue could overcome better the problem.

However, it is required to make a joint analysis which includes all the indicators and domains in order to take into account the influence of all the factors. For example, it is not sure that cities with good position in financial issues present a higher potential for implementing efficient energy solutions than others.

The result obtained with the global analysis is represented in table below where the minimum and maximum values for each indicator have been identified in each cluster with the objective of finding the potential and failures of the cities analysed.

	People	Governance	Finance	Mobility	Energy	Infrastructures
Cluster 1						
Cluster 2						
Cluster 3						
Cluster 4						
Cluster 5						

Most positive values
Intermediate values
Less positive values

As it can be observed, any city analysed have totally secured the implementation of energy efficiency solutions. In some cases, the financial schemes are the main restrain (cities belong to cluster 1 and cluster 3) whereas the people profile can be the main responsible for other cities.

On the other hand, it has been detected a connection of the clusters with certain geographical areas as it is shown in the picture below.

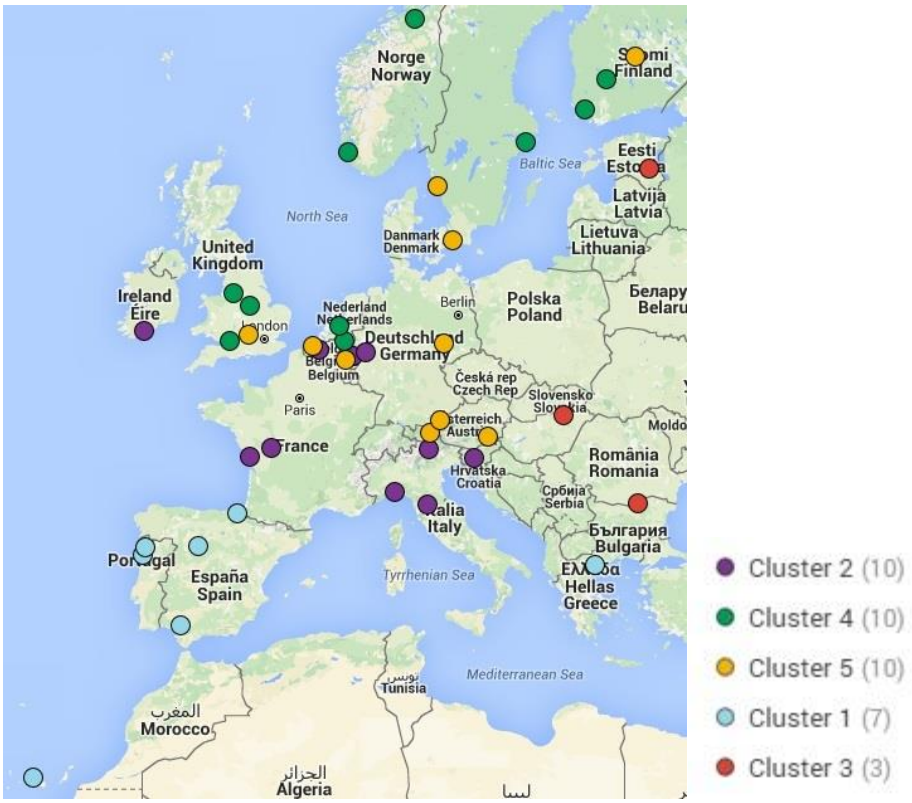

Figure 4. Map of cities characterised and their related cluster
Source: prepared by the authors

- Cluster 1 corresponds with cities located in countries of the South of Europe (Greece, Portugal and Spain).
- Cluster 2 corresponds with cities located mainly in countries of the Centre of Europe (France, Italy, Slovenia, and Belgium). This cluster also involves other countries such as Germany and Ireland.
- Cluster 3 corresponds with cities located in countries of the East of Europe (Bulgaria, Estonia and Hungary).
- Cluster 4 corresponds with cities located in Scandinavian countries (Finland, Norway, Sweden), UK and Netherlands.
- Cluster 5 corresponds with cities located in diverse geographic zones. North countries (Austria, Germany), Scandinavian area (Sweden, Finland), Belgium and UK.

5. FUTURE DIRECTIONS

The first step of the replicability strategy of REMOURBAN project has been the characterization of the European cities following the methodology described above. This characterisation provides the basis for supporting the development and facilitating the replication of the urban regeneration model developed in REMOURBAN project in order to improve the sustainability and smartness of European cities.

Taking advantage of this characterization and considering the innovative technologies and methodologies that are being analysed and deployed within REMOURBAN, the second phase of this strategy is the development of a model for replication potential that will be evaluated at the follower cities, taking into account the stakeholders involved in the process, the technical and non-technical barriers and the needed business models and financial schemes for the application of the urban regeneration model in the European cities.

This model will include necessary adaptations in order to make the REMOURBAN model applicable for each group of cities identified within the characterization of cities.

6. CONCLUSIONS

REMOURBAN will take account of this characterisation of the EU cities, as one complimentary tool for better understanding the urban dynamics and creating a replication framework for its findings. This characterization provides the overview of which cities have adverse conditions in meeting their energy, transport and climate change targets.

The 41 selected European cities have been characterised obtaining different typologies of cities for each layer analysed in the application domain of the REMOURBAN regeneration model: management, finance, mobility, energy and ICTs.
As a result, it is possible to identify which are the adverse conditions and potential features of these cities by each domain (energy, mobility, ICT) and enablers (people, governance and finance).

Further to the layer-by-layer analysis, a second analysis has been performed where five geographic areas have been detected in Europe as a result of applying a clustering approach for characterising the cities in a global analysis in which all the indicators are considered: North, Centre, South, East and Scandinavian countries (UK and Ireland are not included in these identified areas). Contrary to the outcomes obtained in the analysis by layers, in the global evaluation cities have been grouped into regions with a clear correlation with their location.

As a result of crossing both analyses, it can be easily identified the correlation among the global cluster and the layer-by-layer evaluation, where it is clearly shown how although cities belong to the same global cluster (which is mostly distributed in clear geographical areas), they usually have different conditions for some of the layers, which makes more precise the layer-by-layer evaluation in order to define how the urban regeneration model can be adapted to these existing conditions.

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