TEACHING MATERIAL GUIDANCE

1) Title of the material

Antolín, J.; de Torre, C.; García-Fuentes, M.Á.; Pérez, A.; Tomé, I.; Mirantes, M.L.; Hoyos, E. Development of an Evaluation Framework for Smartness and Sustainability in Cities. Sustainability 2020, 12, 5193. https://doi.org/10.3390/su12125193

https://www.mdpi.com/2071-1050/12/12/5193

2) Which section of the SUMP it is relevant to?

The authors presented an evaluation framework, methodology and Key Performance Indexes (KPIs) to assess smart and sustainable features within the urban development of cities. Therefore, the article can be linked to the 12th section of the SUMP circle related respectively to the review and lessons learned (in particular the analysis of successes and failures- **subsection 12.1**. and share results and lessons learnt- **subsection 12.2**

3) Which Mobility Manager knowledge this material is the most relevant to?

It is related to Transport and mobility planning (section 1 of the Mobility Manager competencies) especially 1e (evaluation of transport measures) as well as to Promotion and publicity (section 8).

4) Problem approached and content overview

Problem approach – general understanding of the role of evaluation framework to assess smart and sustainable features within the urban development of cities. Transforming cities into smarter and more sustainable environments is essential to achieving the goals of decarbonising the economy. In this sense, holistic strategies are needed to develop and implement urban regeneration strategies. The EU-funded REMOURBAN project has developed an urban regeneration model that provides mechanisms to implement these processes more effectively, integrating technologies, business models, governance procedures and evaluation mechanisms, where evaluation is seen as the main support mechanism in the different phases of the urban transformation process. The developed framework considers two levels of evaluation: the city level, to assess both sustainability and smartness of the city as a whole from a comprehensive and integrated perspective, and the project level, to provide clear identification of the impact of technology and solution implementation on three key priority areas (sustainable neighbourhoods and built environment, sustainable urban mobility, and integrated infrastructure and processes) aimed at achieving high-level city goals. This article presents the Urban Regeneration Model and describes the assessment framework and its implementation in the city of Valladolid (Spain).

The REMOURBAN assessment approach enables the assessment objectives assigned to the project to be met. As the main objective is to assess the sustainability of cities, a Sustainability Index (Su) is defined, but for a complementary assessment, a secondary

Co-funded by the Erasmus+ Programme of the European Union

index for cities is also proposed, the Smartness Index (Sm), which attempts to measure the technological sophistication of cities in the main areas of urban interest.

The framework is based on the definition of global indices as the calculation and aggregation of indicators grouped by priority categories and objectives. Given that the main objective for cities is to improve sustainability, a main index is defined at the city level to assess its sustainability, the Sustainability Index (Su). On the other hand, considering smart technologies and services as measures that can contribute to achieving sustainability goals, an additional index, the Smartness Index (Sm), is defined for cities.

The main purpose of developing the index is to create a single metric to measure the achievement of a specific goal, a model of effective communication.

The measurable objectives are related to the main objective of the index, but focus on more specific objectives that can be more easily assessed. They are usually related to global aspects or issues that can combine some basic categories used to organise the indicators accordingly, which are key variables that are measured from actual or calculated data. Indicators are used to assess a specific characteristic and are helpful in diagnosing problems and discovering patterns. This paper presents a general diagram showing the individual Measurable Objectives and Core Categories and their relationship to the indicators for the Sustainability Index (Su) at the city level. This scheme is analogous to that used for the Smartness Index (Sm), with both indicators having the same structure.

The first two measurable objectives defined for both indicators are Urban Organisation and Environment and Resources, with these two objectives being easier to measure and quantify than the third, Citizens and Society. This third measurable objective is arguably the most important element in making society smarter and more sustainable, but it is also the most difficult to measure. Many aspects related to it are usually subjective and therefore difficult to quantify.

Everything in cities is interconnected and decisions made in one area affect others. This is why measurement is so important, and establishing a clear and simple method of measurement helps to make the right decisions.

A valuable computer-based tool, named SmarTness and SustaInabiLity Evaluation Tool (STILE) has been developed as one of the core services that form part of the REMOURBAN ICT solutions. STILE allows for the following scenarios progress assessment comparing with baseline situation and progress assessment in two different timeframes, reinforcing decision-making by providing a clear report on whether interventions are performing as expected or, on the contrary, some improvements or corrective actions should be taken. STILE allows users to assess smart and sustainable development in cities in an objective and quantitative way, providing deep insight and understanding of a city's progress over time and the effectiveness of interventions undertaken to improve these factors. Divided into a granular and hierarchical tree of layers (categories, targets and indicators), the information contained in the index provides even more information to enhance effective

Co-funded by the Erasmus+ Programme of the European Union

decision-making when it comes to interventions that are actually linked to aspects identified as weaker or in need of improvement.

The assessment process is based on key performance indicators (KPIs), which are normalised, weighted and aggregated to calculate global Su and Sm indices. The city-level evaluation aims to support the development and assess the impact of the city's high-level integrated urban plan strategy. The methodology defined by the evaluation is applied to calculate the indices of each city-lighthouse before and after the implementation of the intervention. Applying the methodology to calculate the indices requires the following steps:

- Scope Definition
- Baseline Definition for the Lighthouse Cities
- Reporting Period for the Lighthouse Cities
- Data Collection and Analysis
- Calculation of the Indices
- Normalization Process
- Weighting Process
- Aggregation Process
- Evaluation of the Results

The article presents a catalogue of KPIs, key from the point of view of evaluation. The results of the Sustainability and Smartness evaluation in Valladolid in the reporting periods 2018 and 2019 were presented in the paper as an example of the proposed framework.

5) Who could be interested in this material?

The article is aimed at students and those looking for inspiration in evaluation and monitoring the changes coused by measures are applied in SUMP.

6) What is worth mentioning as an innovative factor for the reader?

The Urban Regeneration Model (URM) can be considered as one of the main results of the REMOURBAN project. The development of this methodology was essential for the proper alignment of the project tasks and the understanding of all the links.

Urban transformation assessment is one of the three frameworks defined in the Urban Regeneration Model, as assessment is sought as the main support mechanism in the different phases of the urban transformation process. The framework considers two levels of assessment: the city level, to assess both the sustainability and smartness of the city as a whole from a comprehensive and integrated perspective, and the project level, to provide a clear identification of the impact of technology and solution implementation on three key priority areas (sustainable neighbourhoods and built environment, sustainable urban mobility, and integrated infrastructure and processes) to achieve high-level city goals.

Co-funded by the Erasmus+ Programme of the European Union

This article focuses on the REMOURBAN assessment framework at the city level, with the main objective of describing the application of this framework in the assessment of the sustainability and smartness of the Lighthouse City of Valladolid before and after the project intervention, and showing the main results achieved by REMOURBAN activities from a sustainability and smartness perspective. The assessment of the city's progress covers two reporting years - 2018 and 2019 - showing progress in different periods.

To make the URM more useful and easily replicable, some supporting tools have been developed, one of which is STILE, which focuses on applying the evaluation framework at both the city and project level.

The values calculated by STILE for the city of Valladolid and comparisons between the three periods analysed (base period and reporting period 2018 and 2019) are included in this article and their results analysed. As can be seen, when the values of the indicators calculated for each period are compared, their variability during the development of REMOURBAN has not been very significant, although as a general comment a slight improvement can be appreciated.

The reason why the changes over the duration of the project are not very significant in the indicators is mainly because these are city-level indicators, and in the case of REMOURBAN, activities that have a large impact in a specific area of the city have less impact when their impact on the city as a whole is analysed. It should also be taken into account that some actions have a long-term impact and it is not possible to appreciate large changes during the project period. It should be taken into account that both indicators (Su and Sm) have improved due to actions such as retrofitting a single neighbourhood or changing a small percentage of vehicles to electric vehicles. If the same actions were carried out in more city districts or if there was a further increase in the number of electric vehicles, these indicators would change more. The analysis of the indicators, including their measurable targets and main categories, allows us to know the impact of each measure on the city as a whole and can be used to extrapolate the results to plan future interventions in the city.

7) Limitations

The STILE tool requires a large amount of data that REMOURBAN cities had to collect and provide in order to calculate the indicators defined in each category of the assessment framework. Data collection was one of the most difficult tasks, given the need for a large amount of data of sufficient quality to produce accurate results. Most of the data needed to calculate the indicators at the city level were collected from official statistics of governments, international organisations or municipal databases. governments, international organisations or municipal databases.

The tool developed here can be further explored and improved by integrating more information on aspects that can contribute to better management of other urban resources such as water or waste. In addition, new solutions that are currently being explored consider the integration of georeferenced data sources in order to extract the

Co-funded by the Erasmus+ Programme of the European Union

data required to model certain aspects of the city and present the results offered by the tool.

The proposed framework can be further explored and developed to meet the need to assess urban resilience to unexpected events such as COVID-19 or climate change induced disasters. It should be noted that the framework presented in this document has been designed to support the processes considered within the Urban Regeneration Model presented, and therefore to support the assessment of the areas covered. However, consideration should be given to the possibility of extending and adapting the system to take account of these aspects.

Co-funded by the Erasmus+ Programme of the European Union