

TEACHING MATERIAL GUIDANCE

1) Title of the material

Tcholtchev, N.; Schieferdecker, I. Sustainable and Reliable Information and Communication Technology for Resilient Smart Cities. Smart Cities 2021, 4, 156-176. <https://doi.org/10.3390/smartcities4010009>.

<https://www.mdpi.com/2624-6511/4/1/9>

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

The authors presented the activities and developments necessary to achieve a resilient, standardized smart city, based on Open Urban Platforms (OUP) and the way these serve as a blueprint for each city/community towards the establishment of a sustainable and resilient ICT backbone. Therefore, the article can be linked to the third, fourth, fifth and sixth sections of the SUMP circle related respectively to the analysis of the infrastructure and available data situation (in particular identify information sources and cooperate with data owners- **subsection 3.1.**), scenario building and joint evaluation (development of scenarios of possible futures - **subsection 4.1.**), vision and strategy development (arguments for stakeholders – **subsection 5.1**) and setting targets and indicators (setting indicators for all targets - **subsection 6.1.**).

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 1b (employment of ITS/ICT and smart measures).

4) Problem approached and content overview

Problem approach - understanding the urgent need to optimise city/community processes and aiming to create new ecosystems that generate new business and operational models to enhance the quality of life of citizens, while reducing costs and streamlining city processes and operations. In this regard, ICTs (information and communication technologies) play an important role in the creation of such ecosystems, as they will be built around the notion of collecting data and information and sharing this data and information across multiple domains to connect and exploit synergies between different aspects of urban activities and daily life. A smart city naturally emerges around an urban data platform that consolidates various data sources across the urban ecosystem. Data sources can be diverse, including static data - e.g. government data, Open Data (e.g. from Intelligent Transportation Systems - ITS), and all kinds of urban data and information that are not constantly changing values/parameters - and dynamic data, e.g. continuous real-time data such as sensor (from ITS services)/Internet of Things (IoT) data, global positioning data, etc.

The approach presented in this paper is to use various aspects from the current theoretical framework of the smart city as inputs, including plans for ICT reference



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architectures and belonging standards, various views and dimensions of the sustainability topic, theoretical foundations from the field of reliable ICT systems, state-of-the-art and emerging technologies, as well as theoretical artefacts from the field of quality assurance and testing of communication-based systems. All these elements are combined in this paper to present an overall approach to a resilient and sustainable ICT-based smart city. This resilient and sustainable smart city should be based on three main pillars, namely: design principles for the development of sustainable and resilient ICT for smart cities, specific recommendations for next steps at the technological and organisational level, as well as the concept of continuous quality assurance and certification processes to establish high quality and secure critical IT and data communication infrastructures in the urban environment.

The key objective of the paper is to combine reasonable features from multiple approaches to ICT reference architectures and show how they can be used to define a sustainable and resilient ICT infrastructure in a city/community. The paper also presents the oupPLUS quality assurance approach and details how it can be used to provide interoperable, secure and resilient ICT. oupPLUS is a quality-oriented extension of open city platforms. Furthermore, the key technology pillars that should be included in any smart city development plan and for which oupPLUS provides the means for quality assurance, resilience and sustainability are presented.

5) Who could be interested in this material?

This article is addressed to students and those looking for a well-structured and concise introduction to information and communication technologies in the field of smart city development as a potential solution to help individuals overcome issues associated with sustainable and reliable ICT for resilient Smart Cities. The article contains many references to scientific literature in the smart mobility research area. The technologies and measures described can be helpful for those developing measures within SUMP.

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

The paper provides an overview of various related research and development activities, including long-term initiatives such as FI-WARE (FI-WARE stands for Future Internet-ware) or European projects such as Triangulum and Espresso. The paper presents basic definitions of sustainability, smart cities and sustainable smart cities. Furthermore, the concept of reliable ICT is presented and motivated by some historical definitions. An ICT framework for further discussion is established, presenting the concept of ICT reference architectures and open urban platforms, which provide a natural environment for smart city development and reliability enhancement. The importance of quality assurance in urban ICT frameworks is further presented and a specific ICT reference architecture is chronicled that provides the necessary constructs to systematically achieve a high degree of quality assessment and certification of smart city technologies. Key technological developments relevant for future smart cities and how to position them within the Open City Platform are also presented.



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The article contains many references to the scientific literature and standardisation documents on the new issues in the transport system in an urban environment. These references may be useful in the framework of projects and theses being developed.

7) Limitations

Most of the studies presented in the paper refer only to the theoretical aspects of sustainable and reliable Information and Communication Technology for resilient Smart Cities. The article is written at a fairly high level of generality.

Nevertheless, the approach to the topic as well as the references to scientific literature, are a valuable source of inspiration for preparing SUMP or for research on the impact of different factors and measures on mobility management with the use of sustainable and reliable ICT.

