International Journal of Urban Planning and Smart Cities
Volume 2 • Issue 2 • July-December 2021

Business Models for Smart City Solutions:
An Overview of Main Archetypes

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ABSTRACT

Smart city business models identify the mechanisms through which a smart city solution or a combination of integrated solutions are able to create, deliver, and capture private and public value for society. This paper aims to identify the main archetypes of smart city business models in three sectors (energy, mobility, ICT) through an in-depth analysis of three city case studies: Valencia, Dresden, and Antalya (involved in the Horizon 2020 project "MAtchUP"). Cities' business models are analysed through a questionnaire-based survey, targeted to city government representatives and their technical partners. The paper develops a set of smart city business model archetypes, based on the roles and involvement of public and private actors in 1) funding, 2) asset ownership, and 3) operations of smart city solutions. These archetypes range from a model where the city government plays a prevalent role in all three dimensions to a model where private actors are more prevalent with several intermediate models.

KEYWORDS

Archetypes, Business Models, Smart City Solutions

INTRODUCTION

Urban areas spatially aggregate people, buildings, infrastructures, capital and economic activities, which generate a high pressure on resources and imply relevant social, environmental and economic challenges. The concept of "smart cities" has emerged over time to identify urban areas where digital technologies are deployed on a wide scale in order to manage urban infrastructures. Several definitions of "smart cities" are available in literature (Neirotti et al., 2014). While many of them attribute to Information and Communication Technologies (ICT) the capacity to increase the efficiency of several city services, others emphasize the role of human, social and institutional capital (Lim et al., 2019). The concept has evolved over time from a "digital", to an "entrepreneurial" and more recently to a "sustainable" city vision (Martin et al., 2018). Compared to a technological-oriented vision, the sustainability-oriented perspective adopts a broader meaning of smart city, where integration between environmental, economic and social aspects on one side and digital innovation on the other side are key elements. Many authors highlight the potential contribution of smart cities to solve urban

DOI: 10.4018/IJUPSC.2021070106

sustainability challenges, and call upon the need to consider all the relevant dimensions in defining and analysing smart cities (Caragliu et al., 2009). While most literature emphasizes the positive impacts of a smart transition, a few studies also report the negative impacts associated, such as those related to polarization, digital divide, inequality, privacy and democracy issues (Lim et al., 2019).

The availability of adequate resources to invest in smart city solutions conditions local governments' policies and measures. A substantial part of smart city projects is supported by public funding, while private investors' role is still limited. This is due to many factors. The most innovative smart solutions are perceived as too risky by investors. Smart solutions often require large investments. Also, many smart solutions have a low profitability but are able to deliver high socio-economic value, which is difficult to monetize (European Commission, 2013).

The concept of "smart city business model" is increasingly used to describe the funding, revenue and value creation model of smart city solutions. However, there is no agreed definition of what a smart city business model is and also a comprehensive categorization of such models is currently lacking. Scientific literature has identified "archetypes" of business models oriented towards sustainability mainly in the corporate world. An archetype can be intended as a general model which is representative of a set of mechanisms that enable innovation, generating benefits to society and the environment (Bocken et al., 2014). Developing a common understanding and categorization of the main business models oriented to smart and sustainable development can be useful to different stakeholders, including urban policy makers, city managers, business developers, practitioners and researchers. It can provide a set of possible models to be replicated and adapted to a specific context.

This paper aims to identify the main archetypes of smart city business models in three sectors (energy, mobility, ICT), through an in-depth analysis of three city case studies: Valencia, Dresden and Antalya, involved as lighthouse cities in the Horizon 2020 EU-project "MAtchUP"[1]. MAtchUP is an EU-funded Smart City project where partner cities are testing smart solutions and urban planning approaches to reshape their social, economic and environmental models, with the goal to promote social inclusion, liveability and prosperity for their citizens. Smart solutions analysed in the paper include individual technologies and bundles of integrated technologies, which together are able to generate different types of private and public value.

This paper also aims to investigate the factors and barriers that facilitate or hinder the implementation of smart city business models. There are many factors that affect the design of a smart city business model. These include political-administrative, economic-financial, social-behavioural and technological factors.

The paper is structured in the following sections beyond the introduction: the second section defines the business model concept and applies it to the smart city context, describing the current evaluation approaches to analyse smart city business models; the third section describes the methodology adopted to i) define the unit of analysis for smart city business models; ii) collect data on the smart city business models of MAtchUP lighthouse cities through a survey; iii) define new archetypes for smart city business models, taking into account the results of a literature analysis on business model archetypes; the fourth section presents the survey results and the defined archetypes. These archetypes are based on public and private actors' involvement in different building blocks of a business model. The last section draws the paper conclusions.

Background

The concept of "business model" was developed in the '60s and it has been increasingly used in the '90s in different domains (Diaz-Diaz et al., 2017). Several definitions of business models are available. One of the most widely used definitions states that "business models describe the rationale of how an organization creates, delivers and captures value" (Osterwalder & Pigneur, 2010). In the corporate world, "value" is generally conceived in economic terms and referred to economic/financial performances (Tokoro, 2016). The concept of value has however evolved over time including "creating shared value" (Porter & Kramer, 2011), as companies are increasingly required to contribute to the

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