Chapter 25
A Unified Smart City Model (USCM) for Smart City Conceptualization and Benchmarking

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ABSTRACT

Smart cities have attracted an extensive and emerging interest from both science and industry with an increasing number of international examples emerging from all over the world. However, despite the significant role that smart cities can play to deal with recent urban challenges, the concept has been being criticized for not being able to realize its potential and for being a vendor hype. This paper reviews different conceptualization, benchmarks and evaluations of the smart city concept. Eight different classes of smart city conceptualization models have been discovered, which structure the unified conceptualization model and concern smart city facilities (i.e., energy, water, IoT etc.), services (i.e., health, education etc.), governance, planning and management, architecture, data and people. Benchmarking though is still ambiguous and different perspectives are followed by the researchers that measure -and recently monitor- various factors, which somehow exceed typical technological or urban characteristics. This can be attributed to the broadness of the smart city concept. This paper sheds light to parameters that can be measured and controlled in an attempt to improve smart city potential and leaves space for corresponding future research. More specifically, smart city progress, local capacity, vulnerabilities for resilience and policy impact are only some of the variants that scholars pay attention to measure and control.

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1. INTRODUCTION

Smart cities have been research for over a decade and there are many ways of looking at Smart Cities. Recently Smart Cities are viewed as ecosystems which are generally defined as communities of interacting organisms and their environments, and are typically described as complex networks formed because of resource interdependencies (Gretzel et al., 2015). Similarly, an ecosystem can be seen as "an interdependent social system of actors, organizations, material infrastructures, and symbolic resources" (Maheshwari and Janssen, 2014). Ecosystems, like other kinds of systems, are comprised of elements, interconnections and a function/purpose, but are special types of systems in that their elements are intelligent, autonomous, adaptive agents that often form communities and also because of the way they adapt to elements being added or removed. According to this definition, four critical elements exist in ecosystems: (1) interaction/engagement; (2) balance; (3) loosely coupled actors with shared goals; and, (4) self-organization (Gretzel et al., 2015). This term has been adopted by businesses, where an "ecosystem" describes the relationships between economic entities (i.e., producers, distributors, intermediaries, consumers etc.). Moreover, information and communication technologies (ICT) industry uses the term of digital ecosystems, which are focused on interactions among technological agents (devices, databases, programs, etc.) and respective information flows and form the infrastructure for digital business ecosystems.

Smart cities have been realized as intelligent digital ecosystems installed in the urban space (Neirotti et al., 2014; Piro et al., 2014; Desouza and Flanery, 2013; Wey and Hsu, 2014; Lee et al., 2014; Giffinger et al., 2007; Churabi et al., 2012). However, smart cities have not been limited to ICT and they shifted to '*smart people*' and their corresponding creativity. From this point of view, they are focused on enhancing urban life regarding six dimensions: people, government, economy, mobility, environment and living (Giffinger et al., 2007). Angelidou (2014) approached smart city using a civil engineering and urban architecture lens and classified smart cities as new versus existing cities, and corresponding smart city projects to "soft" versus "hard" implementations. More than 150 smart city cases can be observed around the world, which can be classified in (a) from-scratch city cases; (b) hard ICT infrastructure focused cases; and (c) soft ICT infrastructures in the urban space (Anthopoulos et al., 2016). Since there is no clear smart city approach yet, there have been several attempts by international organizations to standardize smart city solutions, such as for smart water, energy, transportation, buildings etc.

Recently, scholars have started criticizing the use of smart city concept and potential (see for example Söderström et al., 2014, Nam and Pardo, 2011; Brown, 2014). Some scholars argue that smart city is mostly the outcome of vendors' marketing campaigns (Söderström et al., 2014), others say that smart cities reflect little more than usual urban innovations (Nam and Pardo, 2011), while Brown (2014) criticizes the whole concept of smart city by questioning their effectiveness. Moreover, many scholars argue about technological adjectives to the "city". For instance, Allwinkle and Cruickshank (2011) argue about the "self-congratulating" efforts that city leaders follow when they claim to be "smart" and in this regard they differentiate "smart city" (the city that holds the computational power to perform tasks) from "intelligent city" (the city that utilizes the results from the application of innovation within the urban space). Churabi et al. (2012) compare the alternative technological adjectives to the smart city, while Anthopoulos and Fitsilis (2013) define a roadmapping tool for smart city technological adjective adoption.

To shed light on the smart cities concepts, various models for understanding and conceptualizing smart cities have been developed, which aim to define their scope, objectives and architectures. Also