How do we understand smart cities? An evolutionary perspective

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ABSTRACT

Smart city approaches in city planning have gained significant momentum in the recent past. While proponents argue that smart cities will bring positive social change by the adoption of ICTs, enriched governance and human capital among the citizenry, opponents point out about the negative effects and gaps exist in their planning and execution. Despite efforts to promote its practice, there has been wide criticism about the concept and the way it has been adopted and implemented. The roles of various players, especially the central role of the private sector, is often challenged in the academic literature. A variety of expectations from various stakeholders make the potential implementation strategies even more complex. The current paper reviews the research in the field to date to find that there are conflicting views in smart city planning, which limit our knowledge about the 'real' smart city and its implications for building creative and inclusive urban space. Such uncertainty at the conceptual level, and the heightened importance given by policy makers and markets to its adoption, highlights the need for proper scrutiny. The paper clusters the various views pertaining to the building of smart cities and, thereby, proposes a 3RC framework, consisting of Restrictive, Reflective, Rationalistic and Critical schools, which critically analyses various stages in the development of the field. The overall aim of the paper is to understand how smart cities differ in their meanings, intentions and 'offerings'.

1. Introduction

As the 'smart city' started to grow as an academic topic, scholars began to explore a variety of dimensions and practicalities related to its functioning (Letaifa, 2015). Although there are several arguments offered by proponents and opponents, the smart city, which consists —"utilization of networked infrastructures to improve economic and political efficiency and enable socio, cultural and urban development" (Hollands, 2008, p.307)—has been projected as a panacea to problems related to rapid urbanization and a way to achieve sustainable development (Datta, 2015a). Information and Communication Technologies (ICTs) are claimed to be at the core of the smart city discourse (Graham & Marvin, 2001), which emphasises "enhancing the socio-economic, ecological, logistic and competitive performance of cities" (Kourtit and Nijkamp, 2012 p.93). It is further articulated that such an aim could be achieved by tapping human capital, infrastructural capital, social capital and the entrepreneurial capital of the city.

In a nutshell, the intent of the smart city is to offer its citizens the highest possible quality of urban life (Bakici, Almirall, & Wareham, 2013). Cocchia (2014) notes that initiatives such as the Kyoto protocol,

IBM smart planet and the Europe 2020 strategy have advanced the smart city movement quite significantly. Proponents have projected smart technologies as vehicles to elevate cities to a new level, with the result that urban, national governments and supranational agencies such as the European Union and the African Union, have all advanced their metro areas as smart cities, and many have gone on to recognise themselves as smart cities and self-congratulate themselves with regard to each technology-related initiative they undertake (Hollands, 2008; Slavova & Okwechime, 2016; Luque-Ayala & Marvin, 2015).

There exist two overarching approaches to talking about smart cities—the technology driven method (TDM) and the human driven method (HDM).[1] The former argues that smart cities are networked places where deploying ICTs into each activity in the city would improve standards of life. It is further emphasised that the use of ICTs by communities will enable them to participate more fully in so-called knowledge societies (Eurocities, 2007). ICTs alone would not contribute to achieving the desired improvements in life standards, and there exists a need for enhancing human capital and other forms of skill development among the citizenry (Neirotti, Marco, Cagliano, Mangano, & Scorrano, 2014). Proponents of smart cities emphasise

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[1] Letaifa (2015) and Colldahl, Frey, and Kelemen (2013) argue that there are three components essential for smart cities which include technology, people and institutions. However, in the literature we reviewed, there is no significant reference to institutions, other than their effectiveness to administer or influence technology and people in order to build smart cities. Thus, we are more interested in the approaches these institutions adopt to achieve smart cities, i.e., technology-driven and human-driven.

the potential for promoting economic prosperity, ecological integrity and social equity which would advance the larger goal of urban sustainability (Gibbs, Krueger, & MacLeod, 2013).

However, opponents have so far raised serious criticisms, with some even questioning the basic rationale of the smart city, its functioning and actual contribution. Such critique has been fuelled by realities visible in cities self-identifying as smart. For example, Cugurullo (2013, p.34) describes Masdar in Abu Dhabi, a well-known smart city, as having "little space for the social aspects of sustainable development and for the basic social dimension of the city". Accordingly, smart cities have so far succeeded in hiding answers to the larger questions related to social justice and sustainability rather than illuminating them (Calzada & Cobo, 2015). Despite the growing interest among various stakeholders, there is no consensus about the real meaning of the smart city as a concept or its actual benefits.

Accordingly, we review existing research to determine the novelty, practices and prospects for the smart city, and analyse how cities could better fulfil the aspirations they foster. While doing so, we take note of the claims that the smart city movement is largely a strategic vision to reach sustainable futures, rather than a description of reality in a current context (Angelidou, 2015, Komninos, Pallot, & Schaffers, 2013, Wolfram, 2012).[2] Based on a systemic analysis of the literature, we divide the evaluation of smart cities into four schools of thought and articulate them under a 3RC framework. The 3RC framework includes: (a) Restrictive, (b) Reflective, (c) Rationalistic or pragmatic, and (d) Critical schools of thought. Each school elaborates the concept and the practice of smart cities, and thereby extends the overall understanding of the subject. We explain our rationale for articulating the 3RC framework, and the various schools proposed as part of it, below.

The remainder of the paper is divided into three sections. While the first section details the methodology we adopted to conduct this research, the second section aims to further probe the four schools as part of the 3RC framework. The third section concludes the discussion and opens up avenues for future research.

2. Methodology

We adopted content analysis to derive our understandings of smart cities, offer policy suggestions and draw conclusions in this study. Berelson (1952) defines content analysis as "a research technique for objective, systematic and quantitative description of the manifest content of communication" (p.18). The 'content' of communication, in general, refers to book chapters, articles, books, reports, formal and informal discussions and historical documents (Lukenbill, 2012). However, in this research we omitted editor notes, chapters and popular essays on smart cities from our data while relying explicitly on non-invited and peer-reviewed articles from scientific journals.[3] Content analysis delivers valid inferences and analytical constructs from existing texts. It further offers new insights and enhances the understanding of the phenomenon being studied. Analytical constructs have been derived from: (i) understanding various theories and practices; (ii) the experience or knowledge of experts; and (iii) previous research on the subjects being studied (Krippendorff, 2012).

In order to analyse the meanings of 'smart city' and various perspectives drawn from a variety of scholars, we turned to EBSCO and ABI/Inform databases to find the existing literature on smart cities. We used terms such as 'smart city', 'smart city research', 'smart city management' and 'smart city planning' to identify relevant articles for review. In order to crosscheck whether we missed any article in the selected database, we then searched through popular platforms such as

the Wiley online library, the Oxford Journals database, Taylor and Francis, Springer Link, Scopus, Sage and Elsevier's ScienceDirect manually in order to cover all relevant articles. We reviewed all the scientific articles on smart cities available from these sources up until May 2016. We found a total of 211 articles which met our basic search criteria.[4] A total of 50 articles were omitted after an initial analysis which showed little promise in terms of offering relevant information with regard to the concept or meanings of smart city. As a result, the final dataset was restricted to 161 articles.

Both authors of this paper reviewed all the articles independently and categorised them based on their content and the perspectives the authors of each article offered. Thus, the articles were initially coded based on their relevance for smart city research and their broad stance on defining smart cities. We coded the literature based on a variety of indicators such as their relevance for TDM and HDM. The analysis helped us to draw up a framework for understanding existing research and perspectives from an array of researchers working in the field. We found an evolutionary perspective which we named the '3RC' framework with a variety of schools of thought, for and against, present in it. We then attempted to understand whether the schools of thought identified in the framework are sequential in nature, i.e., whether the timeframes of each of these schools follow one another. A categorisation of articles by year confirmed that they were all published across a similar time period, leaving no scope to analyse such evolution on the basis of time of publication. As a result, various identities, meanings and intentions expressed for smart cities have been segregated based on associating them with the various schools of thought, the combination of which resulted in the 3RC framework.

We found two trends in the articles, i.e., (a) those which support the construction of smart cities, and (b) those which question the basic concept of smart cities and their very existence. We first separated the articles based on this criteria and then analysed the two groups independently. The first set of articles offered a variety of perspectives in support of smart cities. We identified that there are at least three different thought processes behind that support: (i) restrictive school, (ii) reflective school, and (iii) rationalistic or pragmatic school. We then looked into the critical literature to assess whether there was similar scope for drawing out multiple perspectives, but found that all the papers largely offered a similar pessimistic note and questioned the basic existence of smart cities, leaving us to place all of them under the (iv) critical school. Thus, we were left with four schools of thought, which we termed the 3RC framework, based on the first letter of each school. Fig. 1 below indicates the number of publications under each category by year of publication.

As can be seen, the first two papers on smart cities we identified surprisingly came from the rationalistic school, published way back in 1999 and 2006. The critical school first appears in 2008 and the reflective school is next to appear, in 2010. Although the restrictive school only got going in 2012, it has been quite effective in terms of articulating the technology driven approach. We used the number of articles published by each broadly pro-smart school from low to high as a scheme for arranging their presence in the framework sequence: restrictive first with 28 articles in total, reflective with 31 and then rationalistic with a total of 78 articles. This left the set of anti-smart articles representing the critical school, to be placed at the end of the framework.

3. 3RC Framework

The current section divides the literature about smart cities into the

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