Knowledge Management in Smart City Development: A Systematic Review

Abstract: The notion of 'smart cities' has gained the attention of policymakers, urban developers and government authorities around the world and is emerging as a major response to urbanization, economic regeneration and other environmental challenges faced by cities globally. Smart cities depend not only on a city's endowment of hard infrastructure (physical capital), but also and increasingly so, on the availability and quality of knowledge communication and social infrastructure (human and social capital). This emerging role of cities as information hubs and knowledge repositories is particularly decisive for urban competitiveness. Arguably, many smart city projects die after the pilot stage and the lessons learned from previous projects never scale up to inform subsequent implementations. This is a major impediment in the future development of smart cities, particularly around facilitating successful technological and procedural replication. In line with recent calls for a cautious rethink of the very rationale and relevance of the smart cities debate pointing to new avenues of research into interdisciplinary aspects, this paper reviews the extant smart city literature in an attempt to identify current theoretical streams and provide further insight into the role of Knowledge Management in smart city development. It also explores how cities can realise the full benefits of tacit knowledge, learning and collaboration. A review of forty-eight peer-reviewed articles is conducted. The findings suggest the lack of Knowledge Management models for smart city replication and reveal how socio-technical approaches can help to support collaboration and knowledge sharing. Policy recommendations for local and national governments on how cities can benefit from a shift towards collaborative knowledge-making are also provided.

Keywords: knowledge management, smart city, knowledge sharing, learning, literature review

1. Background

Cities are complex ecosystems facing many economic, social and political challenges. These challenges also have significant impact on basic amenities such as housing, transportation and healthcare, leading to inadequate transport infrastructure and lack of affordable housing and safe sanitation facilities (Bulkeley, 2013). In view of these observations, the need to create holistic, scalable and human-centred 'smart city development' approaches has become imperative.

Sustainable smart city development encompasses all dimensions of sustainability including the environment, economic and social well-being of the people. It emerges as a concept focused on mitigating issues arising from rapid urbanization and population growth. The term smart city embraces several definitions depending on the meanings of the word 'smart' (Cocchia, 2014). Scholars have used the terms intelligent city, knowledge city, ubiquitous city, sustainable city, green city, eco city, resilient city and digital city to broadly represent the area and discuss different aspects of smart city development – underpinning sustainability curricula in transportation, energy use and the development of ICT systems. Despite various definitions and explanations, 'smart city' is still a fuzzy concept and there is absence of a commonly accepted definition that encapsulates the complexity and multi-layered interconnectedness of new emerging technologies and evolving demands. To maximise the benefits offered through smart city projects, Dayan et al. (2017) argue for further research to develop appropriate Knowledge Management (KM) practices that support smart city initiatives. Laurini (2017) and Ardito et al. (2019) also highlight the need to explore smart city development from a KM perspective. If the objective is to employ emerging technology to offer new generation of services, it is imperative that the new image of modern, knowledge-intensive, cities is explored.

As Caragliu et al. (2011) note smart cities depend not only on a city's endowment of hard infrastructure (physical capital), but also and increasingly so, on the availability and quality of knowledge communication and social infrastructure (human and social capital). This emerging role of cities as information hubs and knowledge repositories is particularly decisive for urban competitiveness as well as enhancing the quality of citizens' life. Arguably, many smart city projects die after the pilot stage and the lessons learned from previous projects never scale up to inform subsequent implementations (van Winden and van den Buuse, 2017). This is a major impediment in the future development of smart cities, particularly around facilitating successful technological and procedural replication. In line with a recent call for a cautious rethink of the very rationale and relevance of the smart cities debate to further incorporate interdisciplinary perspectives (Lytras and Visvizi, 2018), it is important to understand how the smart city literature might integrate knowledge management concepts, such as harvesting lessons learned and fostering stakeholder collaboration, to enhance existing discourse.

KM is of particular relevance for building competitive advantage and creating value proposition (Dixon, 2000). From a sociotechnical perspective, it also contributes greatly in sharing lessons learned, reducing implementation costs and fostering organizational learning within and across programmes (e.g., Argote and Ingram, 2000; Cummings, 2004). Although, managing knowledge has often been discussed amongst scholars (Gold et al., 2001), little attention has been given to this particular context (Neirotti et al., 2014). This paper reviews the extant smart city literature in an attempt to identify current theoretical streams and provide further insight into the role of KM in smart city development. It also explores how cities can benefit equally from the shift towards a knowledge-based economy after deriving policy conclusions for local and national governments.

In the next section, we provide a description of the research method used to identify relevant research for this review. Finally, Section 3 presents the preliminary findings of the review and concludes with the proposed way forward for smart city research from a KM perspective.

2. Research Method

Our review takes a broader view of the smart city literature without restricting to a domain being aware of the multidisciplinary nature of the topic of the smart city. To achieve this goal, we conducted keyword searches for the term 'smart city' and its closely-related terms 'digital city', 'intelligent city', 'knowledge city', 'sustainable city', 'ubiquitous city', 'learning city', 'smart community', 'information city', 'virtual city', 'wired city', 'green city', 'knowledge-based city' via the Scopus database. Next, we included only peer-reviewed journal articles in which smart city was a core concept. Thus, we excluded papers that mentioned 'smart city' or its related terms only in passing and with no description of its meaning. In addition, we focused on scholarly and peer-reviewed articles published in well-known international academic journals to ensure that papers included in our systematic review were of sufficient scholarly quality. Motivated by our need to maximize the review's contextualized focus on empirical research, we excluded related literature reviews or conceptual papers on smart cities, although we acknowledge that these papers set the stage for our paper especially with regards to framing the focus of this study's contribution. The initial search was limited to the years 2008 onwards where development around smart city policy became more evident due to increasing urban challenges, resulting in a corpus of forty-eight papers.

3. Preliminary Findings and Conclusions

As a result of our search strategy, a wide range of studies were reviewed. Attention to this subject is quite recent since the oldest paper was from 2008 and most papers were either from 2018 (13 papers) and 2016 (12 papers). Interestingly, the majority of our sample papers were published in 2015 or after; only ten papers were published before 2015.

The systematic review showed thematic intersections among emerging elements of smart cities, generating an argument that themes could together form a conceptual approach for improving smart city KM mechanisms. Specifically, we analysed the keywords used and categorised the literature into five different themes, namely citizen participation in smart cities; benefits and disbenefits of smart cities; enablers/inhibitors of smart city development; smart city concepts and frameworks; and strategy and vision in the context of smart cities. Within these themes, it is important to note the increasing need of knowledge management as a facilitator in delivering smart cities. For example, increasing participation of citizens is closely linked to the socio-technical aspects of smart city development and particularly leadership empowerment and socialisation. Besides, there is growing debate among scholars for the need to reassess the current design and management of smart cities to embed KM perspectives to ensure that certain outcomes are achieved (Bakici et al., 2013). Similarly, studies that focused on process enabling factors in smart city research appear to be closely linked with the elements of trust and collaboration. In addition, studies that evaluate strategies and vision were mainly associated and linked with knowledge sharing and organisational learning. Although elements of KM appear to be evident across all themes, there are only a few papers making explicit references to the role of knowledge sharing in smart city replication.

Three key research thrusts were identified; (1) Sociotechnical approaches to Smart Cities, (2) Integrating Knowledge Sharing Perspectives and (3) Developing Organisational Learning Capabilities. These are emerging and interlinked elements of smart city development and present a conceptual approach for improving smart city knowledge management mechanisms. Smart cities have multidimensional components such as ICT applications, citizen engagement and governance. However, the concept of 'smart city' has been mainly drawing on technical aspects and a few economic theories. On the other hand, the current technically inclined discourse is unlikely to encapsulate more nuanced contributions of key stakeholders involved in smart city initiatives. For example,

citizens have an important role in ensuring they imbibe supportive attitudinal behaviours for successful smart city projects.

This paper is work in progress and requires further development to inform empirical research. Future work will explore how local authorities share knowledge and learn to facilitate smart city development through the lens of knowledge management. This strengthens the case to look at smart cities in a wider scale and the transition towards a more knowledge-driven system.

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