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THE URBAN PLANNING CONCEPT BASED ON SMART CITY APPROACH

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Abstract

Smart City is considered as a strategy to reduce the problem due to the rapid urban growth and urbanization. From the review of previous reported studies, it is resolved that smart city has provided various different perspectives. In order to understand smart city from the context of urban planning, it is essential to recognize the considerable aspects which is important from both sides. This article comprises the result of literature review from the related studies resulting on the development of a diagrammatical model figuring the summary of those studies.

Keywords: Smart city, Urban Planning, a diagrammatical model.

INTRODUCTION

The rapid development of human population poses various challenges in various aspects of life. Department of Population of the Division of Social and Economic Affairs of the United Nations 2017, reported that the number of current population is nearly 7.6 billion and it will increase to be 8.6 billion by 2030, 9.8 billion in 2050 and 11.2 billion in the year of 2100 (Majalah Tempo, 208: 18-20). The current urbanization rate is 32 percent; and it is predicted that 30.53 million population of the city is emerge annually. The increasing rates number of urban population compared to the rural one is an indicator of dynamic distribution of population around the world (Shah, 2016). Today, the occupancy of urban areas is estimated 3 percent of the planet's surface. It consumes 75 percent of global primary energy and impacted on the increase of 50-60 percent of the world's total greenhouse gases.

Urbanization phenomenon has encouraged the emergence of needs for a better quality of life. People move from one country to another looking for better living opportunities which impacted on generating the problems of high pollution, traffic congestion, waste and social problems (Dameri, 2017). Other problems are the scarcity of energy resources that related to the need of healthy living, daily activities, social facilities and urban infrastructures. Almost all the problem resulted on the change in economic situation which entails to the fluctuated cost price. In addition, the increase of carbon emission has contributed the negative impact on the intensive climate change (Alawadhi et al., 2012).

One of the strategic solutions which is currently being discussed to solve the above problems is the application of smart city concept into urban planning. The recent advances of Information and Communication Technology (ICT) are considered align with the need of reducing technology costs by applying low-cost mobility, free social media, cloud computing, and effective cost in handling big-data management.

The previous study that contribute to the core material of this article are the studies reported by: Baum et al. (2004), Leonidas and Vakali (2011), Sotiris and

Margarita (2012), Chourabi et al. (2012), Batty (2012), Marsal-Llacuna et al., (2016), Trisandade (2017), Anthopoulos (2017), Komninos (2018), Yigitcanlar and Kamruzzaman (2018), Nicos and Mora (2018), Serano (2018), Sinkonde (2018), Nathali, Kan and Han (2018), Falkner (2018). Based on the review of these previous studies, a model of diagrammatical ideas is proposed summarizing the understanding of smart city concept in the context of urban planning.

METHOD

This article is a result of literature study (sources: books, magazine and journal articles). The finding of this study that will be found at the end of this article is *a diagrammatical model* as an effort to simplify the complex information collected from the sources. The information quoted is classified and structured systematically by using the approach of inductive logical thinking to formulate the final diagram.

RESULT AND DISCUSSION

In the last two decades, the concept of "smart city" has become increasingly popular in international scientific and policy literature. Anthopoulos (2017) defined that smart city is an urban space that managed and operated by smart systems as well as inhabited by clever insight/ideas of citizens. ICT (The Digital or Information City) and its innovations are utilized as a means to achieve the sustainability of economic, social and environmental aspects referred to solving the problems on the dimensions of people, economy, governance, mobility, environment and living. Smart Cities initiatives aim to “provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration amongst different economic actors and to encourage innovative business models in both private and public sectors" (Marsal-Llacuna et al., 2015: p. 618).

a. The review of previous related studies

As mentioned previously, this article summarizes the ideas reported from the following articles, such as, Baum et al. (2004), Leonidas and Vakali (2011), Sotiris and Margarita (2012), Chourabi et al. (2012), Batty (2012), Marsal-Llacuna, et al. (2015), Meijer and Pedro (2016), Hajduk (2016), Trisandade (2017), Anthopoulos (2017), Komninos (2018), Yigitcanlar and Kamruzzaman (2018), Nicos and Mora (2018), Serano (2018), Sinkonde (2018), Nathali, Kan and Han (2018), Falkner (2018). The discussion from the articles emphasizes on: the limitations of study, definition of smart city, relationship between smart city and urban planning as well as urban management, and the internet system in managing urban ecosystem.

Nicos and Mora (2018) reported on the result of their study emphasizing on the ‘big picture’ of smart city through the research field undertaken between 1992 and 2012 based on the bibliometric analysis. The result of the analysis revealed the maps of: 1) intellectual structure of the smart city research field; 2) main research perspectives; 3) the key aspects of smart city connected to new city planning and development paradigm**.**

In the context of urban planning, Meijer and Pedro (2016) analyzed a corpus of 51 publications and mapping their varied discussions related to smart city

governance. They found that the publications differ in terms of defining the features of smart cities, the incremental perspective of urban governance changes and the legitimacy claim of governance in realizing the city smarter. Serano (2018) stated that the understanding of definition, scope and interconnections of Smart City depends on the approach used, and this determines the collaborated multidisciplinary environments. According to Baum et al. (2004) three disciplines environments should be considered in creating smart city, they are technology, environment and sustainable outcome, in which technology is needed to generate environmental gains and sustainable outcomes.

The paper of Trisandade (2017) analyzed both environmental sustainability and smart city concepts by a systematic review of three data bases of Scopus, Science Direct, and Emerald. The important notations of the papers accentuate that smart city concept is viewed as a vision, manifesto or promise aiming to constitute the twenty-first century's sustainable and ideal city form. Quoted the Vanolo (2014) and Yigitcanlar (2016), she stated that smart city should be an efficient (economic), technologically advanced, green (ecological), socially (societal) inclusive city.

Leonidas and Vakali (2011) highlighted and measured the interrelation and intersection of smart city and urban planning. They consider that the new practices and services of smart city impacted on policy making and urban planning especially in terms of urban facilities regulation. In a specific perspective, they associated urban planning as smart city's architecture layers in the form of software and services layers. The multi-tier architecture of a digital city consists of: user layer (servants), infrastructure layer, information layer, service layer and end-user layer. Urban planning based smart city concept should have various e-service portofolio such as: E-Government services, E-democracy services, E-Business services, E-health and tele-care services, E-learning services, E-Security services, Environmental services, Intelligent Transportation, and Communication services.

The paper written by Hajduk (2016) focused on the role of smart city in urban management. He further stated that three important things related to this, among others: the level of coverage planning, investment pressure and green areas. Meijer and Pedro (2016) stated that in the context of urban management, the role of Digital as a Service (DaaS) is an independent complete digitalization for the needs of managing cities' physical infrastructure in a Cloud environment through reviews of the current Digital Systems, Transmission Networks, Servers and Management Systems. This can be done with the assumption that in the future Human Resources will be replaced by the Internet of Things (IoT), the Cloud, Block Chain, Big Data, Virtual Reality and the combination of digital and real infrastructure of city. Space, Services and Structure (3S) of a Smart City are determined by a system of interconnection, integration and virtualization.

In order to meet the current and future needs, the practices of urban planning and smart city must be oriented to solve the environmental issues (climatic and ecological problems). Related to this,

Sotiris and Margarita (2012) stated that smart city concept in terms of urban planning must be related to the considerations of sustainable future based on the characteristic of local development. Through the study of port cities of the Black Sea region, they highlighted that competitiveness, sustainability and productivity of the city must be in line with the development of Innovation Ecosystem. The cities should invest green infrastructures, improve the quality of public space and imply the policies of sustainability that are managed by technology innovation.

Komninos (2018), Yigitcanlar and Kamruzzaman (2018), Trisandade (2017) and Sinkonde (2018) examined the innovation of digital technology related to urban environment management. Komninos (2018) referred to the case of Thessaloniki on how digital technology can optimize urban ecosystem management. The successful of Thessaloniki as smart city fundamentally supported by taking advantage of opportunities offered by IBM Smarter Cities Challenge, the Rockefeller 100 Resilient Cities, the World Bank, and the EU Horizon 2020 Program. This proved that private stakeholders play the important role in creating a smart city.

Yigitcanlar and Kamruzzaman (2018) used a multivariate multiple regression models to examine the influence of increasing access to broadband internet connections toward the choice of a sustainable commuting mode in the Australian local government areas. The study found that high accessibility of broadband internet tends to reduce the level of working from home and public to the using of active transport, but it impacted to the increasing use of private vehicles. While Sinkonde (2018) described a system of using PostGIS for storing and retrieving information of particular paths in order to provide an enjoyable and accessible public pedestrian as the privilege of using technology as well as recognizing the problem of urban accessibility through the Web.

b. Supporting factors and the dimensions of Smart City in the context of Urban Planning

Chourabi et al. (2012) stated that there are eight factors related to the interrelationship between urban development and Smart City. The eight factors consist of: community, government, economy, technology, organization, policy, natural environment and infrastructure development (Falkner, 2018; Batty et al, 2012; Anthopoulos, 2015). Three out of eight factors are considered as the main factors in managing smart urban planning i.e., Technology, Organization and Policy. The three mentioned factors are interconnected with each of the other five factors i.e., Governance, People communities, Economy, Natural Environment and Built Infrastructure.

The concept of Chourabi et al. (2012) is in line with the concept of Falkner (2018) and Anthopoulos (2017) emphasizing on some aspects that should be supported by smart technology. The aspects are as follows:

1) Mobility dimension (smart mobility): in which the city is quipped by smart parking, traffic light, bike, driverless bus/car, electric and hybrid cars, and active transport.
2) Services dimension (smart urban service): in which the city is facilitated by the systems of smart wastes, lights, parks, and gardens.
3) Government dimension (smart government): in which the city is

governed by smart system of administration, payment, data sharing and business services.

4) Inhabitant dimension (smart citizens): in which the citizen is facilitated by the smart system of community services, tourism and major events, civic app (social networks, NBN and public WIFI), digital hubs, libraries, citizen involvement, and labs.
5) Building component dimensions (smart building): in which the city consists of intelligence buildings completed by smart infrastructure.
6) Environment dimension (smart environment): in which the city consists of smart system of environmental monitoring, electrical cars and charging stations, as well as renewable energy.
7) Public health and safety dimensions (smart public health and safety): in which the city has intelligence systems in managing incident, security services, health and human services (smart aged car, smart homeless reduction)
8) City development planning dimension (smart city development planning): in which the city is managed as smart growth and public realm.

Batty (2012) explained that the smartness of a city is related to the components that must be measured from each factor below:

1) Smart economy is measured by the level and variety of competitiveness (innovation spirit, entrepreneurship, productivity, flexibility of labor market, international contributions, ability to transform);
2) Smart people are measured by the level and variety of social and human capital (level of qualification, affinity to lifelong learning, social and ethnic plurality, flexibility, creativity, cosmopolitanism/open-mindedness, participation in public life.
3) Smart governance is measured by the level of participation (participation in decision making, public and social service, transparent governance, political strategies and perspectives)
4) Smart mobility is determined by the service level of transport and ICT (local and international accessibility, availability of ICT-infrastructure, sustainable, innovative and safe transport system);
5) Smart environment is concerned with the sustainability of natural resources (attractiveness of natural condition, pollution, environmental protection, sustainable resource management);
6) Smart living is measured by the quality level of life (cultural facilities, health conditions, individual safety, housing quality, educational facilities, touristic attractiveness and social congestion)

Nathali, Khan and Han (2012) highlighted four dimensions that should be included in the urban planning element of smart city-based approach. Each of the four dimensions is sustainability (covers the problem solution of infrastructure & governance; energy & climate change; pollution & waste; social, economic & health), quality of life (covers the human guarantee of financial well-being, emotional well-being), urbanization (covers the term of technical, infrastructure, governance and economics), smartness (covers the aspects of economic, social and environment).

The most common characteristics of a smart city are (Krishna, 2017):

1) The infrastructure of urban networks facilitates political efficiency, social, and cultural development.
2) Stressing on business-led urban development and creative activities.
3) Social inclusion of various urban populations and social capital integrated in urban development.
4) The sustainability of natural environment as a strategic component for the future.

Other sources mentioned that the implementation of smart city concept covers the sustainability, quality of life, intelligence and urbanism (Nathali, 2018) as it is referred to in Figure 1 below.

c. Diagrammatical Model

The summary of the above review of literature is elucidated as in the following diagram:

CONCLUSION

The features of smart cities are formulated in various perspectives which are determined by the context. Based on the above review, the re-conceptualization of smart city in the context of urban planning covers the multi-tier architecture of a digital city planning. The city planning includes: E-Government services, E-democracy services, E-Business services, E-health and tele-care services, E-learning services, E-Security services, Environmental services, Intelligent Transportation, Communication services. The city planning is further based on sustainable environment vision to solve the local development problems on the dimensions of people, economy, governance, mobility, environment and quality of life.

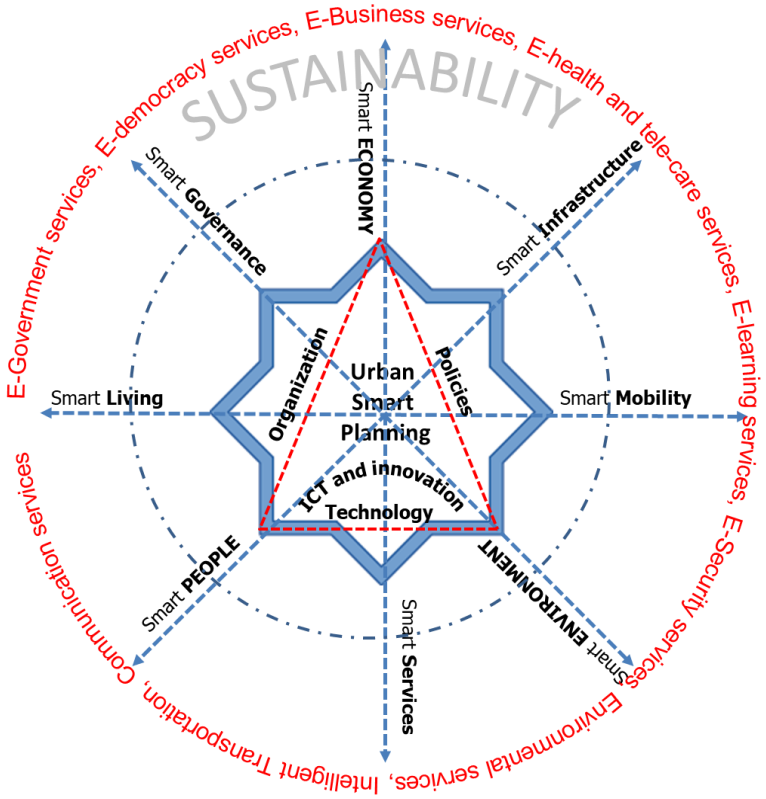

Figure 1: The concept of smart city in the context of urban planning according to Chourabi et al. (2012), Nathali, Khan and Han (2018), Batty (2012), Falkner (2018), Leonidas and Vakali (2011).

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