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Smart City - Green Intellectual Capital Model for Sustainability and a Higher Quality of Life

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Abstract
Adopting a smart city initiatives will resolve challenges from the rapid urbanization process as well as for supporting resilient urban development. Transformation of city into a Smart City is complex which involve dynamic processes and various stakeholders work together to accomplish strategic aims. The development of smart cities is to uplift cities competitiveness and to prove country commitment to embark on global agenda, sustainable development goals (SDGs). In regards to this concern, many "green" strategies have been conceived due to greater awareness on sustainability and its effect on business competitiveness and performance. To pursue this SDGs a step beyond existing models is required. Thus, in this study green intellectual considered to be the foundation and as an important factor involved in smart cities development to achieve SDGs.
Purpose: To examine the role and value of green intellectual capital to the creation of stronger economic, social and environmental eco-systems of smart cities to achieve SDGs at the level of city system(s). The study also aimed to propose a comprehensive model of smart city-green intellectual capital to achieve SDGs.
Design/methodology/approach: This study will using deductive approach using survey strategy. Seven smart cities will participate which are Selangor, Putrajaya, Iskandar Malaysia, Kuala Lumpur, Kota Kinabalu, Kuching and Kulim using purposive sampling. The data will analysed using SPSS and Smart PLS software.
Practical implications: This study proposes a novel managerial understanding of smart city government bodies.
Originality/value: Scholarly research on this proposed framework has yet to be drawn and is conceived to be usable by both the IC and smart communities.

Keywords: Smart City, Green Intellectual Capital, Sustainability, Intellectual Capital, PLS

Introduction
The United Nations predicted that more than 60 percent of the world population will be living in cities by 2030, mostly in Asia and Africa due to rapid urbanization (United Nations Development Programme, 2018). Based on the forecasts, the next few decades should see cities

undergoing constant changes, including in their structures. With the expected increase in the number of urban residents around the world, the need is growing for new and innovative ways to manage the complexity of urban life. The process of urbanization involves the migration of people from rural to urban areas to improve living standard in terms of job opportunity, mobility, sanitation, safety and eco-friendly environment (UN Sustainable Development Goals, 2016).

However, the growing population in the city, tend to face many difficulties. The challenges of modern cities includes uncontrolled urban sprawl (Kovács et al., 2019; Halmy, 2019; Yu et al., 2019; Mahmoud & Divi- galpitiya, 2019); environmental pollution (Caparros-Midwood et al., 2019; Alam et al., 2019; Munoz-Pandiella et al., 2018; Kosheleva et al., 2018); urban logistics (Nataraj et al., 2019; Firdausiyah et al., 2019; Bjørgen et al., 2019; Cleophas et al., 2019; Faramehr et al., 2019; Mesjasz-Lech, 2014; Tomaszewska & Florea, 2018); technical infrastructure (Petrova & Prodromi- dou, 2019; Faramehr et al., 2019; Pham & Phan, 2018; Juget & Ryckewaert, 2018); waste management (Bugge et al., 2019; Amritha & Kumar, 2019; Dlamini et al., 2019; Scorţar et al., 2010), aging population (Jayantha et al., 2018; Fang & Lai, 2018; Onoda, 2018; Greenfield, 2018; Jarocka & Wang, 2018); stratification of wealth levels, areas of poverty (Muktiali, 2018; Lanjouw & Marra, 2018; Ma et al., 2018; Aguilar & López, 2016) and low level of citizen participation in the management of public affairs (Mavrodieva et al., 2019; Sou, 2019; van Holm, 2019; de Castro Pena et al., 2017).

Knowing the identified challenges and the expected increase in the number of urban residents around the world, there is an increasing need for the city government, policy makers and experts from academia to adopt a strategy to tackle urbanization issues in order to offer citizens with a safe and sustainable living standards (Kumar et al., 2018; UN Sustainable Development Goals, 2016).

In the last decade, the smart city concept has gained considerable popularity, ultimately enabling residents to better meet their housing, transport, energy and other infrastructure needs, but also as a key strategy to combat poverty and inequality, unemployment and energy management (Winskowska et al., 2019). In addition, the smart city concept also is an urban strategy adopted globally to convalescent the living standard of citizens in urban areas (Bibri & Krogstie, 2017; Kumar et al., 2018). The smart city concept assumes that a city should be a creative, sustainable area that improves the quality of life, creates a friendlier environment and the prospects of economic development are stronger (Lee et al., 2014). Furthermore, adopting a smart city initiatives will resolve challenges from the rapid urbanization process as well as for supporting resilient urban development (Neirotti et al., 2014).

According to the findings by Scientist at The Stockholm Environment Institute, have identified that four out the Earth's nine Planetary Boundaries have already been crossed, namely climate, biodiversity, land system changes and biogeochemical cycles. Risks will only heighten as population swells to a projected 9 billion by 2050, increasing food, materials and energy needs. In parallel, society today is under growing social and economic strain, from mounting inequality, youth unemployment, automation, and geopolitical volatility. These global challenges of today are framed by the United Nations' 17 Global Goals for Sustainable Development (SDGs). The SDGs provide an action agenda for people and planet by 2030.

In regards to this concern, the development of smart cities is to uplift cities competitiveness and to prove country commitment to embark on global agenda such as SDGs. Sustainable development is a key to future competitiveness and ensures that society's present needs do not contradict the needs of future generations (WCED, 1987). Within this debates, knowledge is often conceived as the core component of the smart city (Dameri and Ricciardi, 2015). In effect, there is growing awareness that not only is knowledge the crucial resource to achieve firm success, but also, and even more importantly, to address the paramount ecological, social and

demographic problems that our societies are facing. Therefore, the knowledge-based approaches to management are called into action, in order to contribute to the sustainability and liveability of social eco-systems.

Moreover, Wasiluk (2013) claimed that in order to cater the existing environmental problems depends heavily on how knowledge resources are deployed, which have been discussed in the emerging concept of green intellectual capital. Existing scholars have conceptualized green intellectual capital as intellectual capital to satisfy the environmental management needs (Chen, 2008; Liao, Fei, & Liu, 2008). Green intellectual capital is defined as all tangible assets or knowledge related to the green innovation or protection (Chen, 2008). Dumay and Garanina, (2013) also highlighted how knowledge resource can be leveraged at the city, regional and national levels in order to build strong social ecosystem where healthy organizations can flourish.

In order to pursue this SDGs a step beyond existing models is required, but, to the best of our knowledge, scholarly research on green intellectual capital and smart city has yet to be drawn. Much of the prior studies has been focusing on traditional view of IC concept. For instance in this context, Dameri and Ricciardi (2015) proposed smart city intellectual capital framework. There is a need to develop a framework to effectively analyze a smart city context through the green intellectual capital perspectives.

Therefore, the main objective of this study is to examine the role and value of green intellectual capital to the creation of stronger economic, social and environmental eco-systems of smart cities to achieve SDGs at the level of city system(s). The study also aimed to propose a comprehensive model of green intellectual capital from smart cities perspective. The proposed model is conceived to be usable by both the IC and smart communities, and proposes a novel managerial understanding of smart city government bodies.

Research Questions

i. How the green intellectual capital approach could help local capacity building of municipal council of smart city.
ii. How specific green intellectual capital elements impacts on smart city.
iii. How the smart city contribute to SDGs.

Objectives of Research

i. To explore whether and how the green intellectual capital approach could help local capability building of municipal council of smart city.
ii. To examine how specific green intellectual capital elements impacts on smart city.
iii. To explore whether and how the smart city contribute to SDGs.

Literature Review

Smart City

The existing literature studies reveals that smart city concept comprehend different social, economic, urban, institutional, technological and environmental aspects in an exceedingly general approach (Selada, 2014). The idea of smart city is still emerging and many working definitions proposed to date by smart city experts. The smart city definition is diversified with some cohesive components exist in the respective definitions. One of the common components in the definition is technology because many cities acknowledging their city as smart by incorporating ICTs in delivering city services (Zubizarreta et al., 2015). The definitions also emphasizes on critical infrastructure such as physical infrastructure and network infrastructure as the devices in the city has to be inter-connected to deliver a cohesive output (Giffinger et

al., 2007). Providing a quality services to the population is the next most regularly mentioned component (Angelidou, 2017).

Many authors have also defined integration of systems and infrastructure interconnection is an important characteristic of a city to be called smart (Dameri & Benevolo, 2016; Lee et al., 2014). In some of the definitions, the use of networked infrastructure plays a role to cater social, environmental, economic and cultural development (Zygiaris, 2013). There are several authors envisioning a smart city as a well performing city in a forward looking manner and a city that gives inspiration (Dameri & Benevolo, 2016). The important aspect in a smart city is the citizens. Catering citizen's needs is vital component in the smart city definitions (Zubizarreta et al., 2015). Besides that, technology implementation only does not guarantee the success of smart city implementation and technology is an enabler component for smart city (De Jong et al., 2015). Importantly, is to address the paramount ecological, social and demographic problems that our societies are facing. Therefore, the knowledge-based approaches to management are called into action, in order to contribute to the sustainability and liveability of social eco-systems.

Smart city dimensions

The smart city dimensions consist of diverse views that build up the growth of smart cities (Angelidou & Psaltoglou, 2017). The combination of different dimensions of smart city will enhance the smartness of a city (Selada, 2014). The six dimensions namely Smart Government, Smart Mobility, Smart Living, Smart People, Smart Environment and Smart Economy (Camboim, 2018) that are constantly cited in literature studies.

The smart governance is the connection of services in the city enabled by ICTs. This is to link public, private and civil organization so that city can function efficiently in implementing and managing smart city initiatives under a unified model. The next dimension of smart mobility provides safe, sustainable and interconnected transportation system in the city. Smart Living caters a happy, healthy and safe living in an ICT enabled city to improve living standard. Smart People dimension is citizens with adequate computing knowledge, able to adapt to technological advancement, having access to education and able to work in the ICT enabled environment. The smart environment consists of smart energy, smart grid, pollution control and monitoring, green building and to create a healthy environment for the people. Smart economy cater e-business and e-commerce and to increase productivity by using smart computing in manufacturing to innovate product and services.

Table 1: Smart City Dimensions

Smart Governance	Smart Mobility
Smart Living	Smart People
Smart Environment	Smart Economy

Smart City in Malaysia

The emphasis towards making Malaysian Cities into smart cities are strengthening digital infrastructure has been the fore front of Malaysia's development plans such as Eleventh Malaysia Plan (11MP), National Physical Plan 3 (NPP3) and National Urbanization Policy 2 (NUP 2). The Government of Malaysia has started to encourage all local authorities to generate new ideas and new mode of promoting smart city planning, smart city management services and smart city administration. The development of smart cities is also to uplift Malaysia Cities Competitiveness and to prove Malaysia commitment to embark on global agenda such as Sustainable Development Goals (SDGs).

Selangor

The state government of Selangor launched Smart Selangor in 2016 to transform Selangor into a Smart State by 2025. Twelve areas have been identified for this purpose – Smart Governance, Smart Digital Infrastructure, Smart Transportation & Mobility, Smart Waste Management, Smart Healthcare & Wellbeing, Smart Education, Smart Water Management, Smart Energy & Utility, Smart Food & Agro, Smart Safety & Security, Smart Buildings, and Smart Disaster Management. What is interesting to note is that Smart Selangor takes a different approach by modifying its prioritised areas into twelve domains instead of six domains that widely used by other state. Selangor Local Councils, Selangor District Offices and Selangor Public Works Department are the local authorities.

Putrajaya

The city of Putrajaya has come a long way since its conceptualization in 1995. Putrajaya was planned as a Garden and Intelligent City and it has progressed remarkably well since its inception. The landmark buildings now stand tall in the heart of Putrajaya, portraying Malaysia as a modern and developing country. The vision for Putrajaya is to transform itself from a Garden City into a Green City by the year 2025. Putrajaya Smart City can play a major role in the implementation of the New Urban Agenda and the Sustainable Development Goals. The implementation of Internet of Things (IoT) and other information and communication technology (ICT) innovations, Putrajaya becoming global model city.

Iskandar Malaysia

The vision of Iskandar Malaysia is that of 'Strong and Sustainable Metropolis of International Standing'. In 2012, Iskandar Malaysia was declared as a pilot Smart City project for Malaysia (IRDA, 2013). Based on economic opportunities, the Smart City initiative for Iskandar Malaysia was endorsed by the government in the Global Science and Innovation Advisory Council in May 2012. Johor Bahru City Council (MBJB), Iskandar Puteri City Council (MBIP) and Pasir Gudang Municipal Council (MPPG) are the local authorities.

Kuala Lumpur

Kuala Lumpur functions as a federal, state and local administration, major national and international transportation nodes, storages and warehousing facilities, wholesale and retail, campus based educational institutions, space intensive, recreational facilities, professional services wide range of manufacturing activity. Kuala Lumpur categorized as global city and Kuala Lumpur City Hall (KLCH) is the local authority.

Kota Kinabalu

Kota Kinabalu has a higher proportion of residential land than other Malaysian cities, and its open/green space accounts for nearly half of the city's total area (due to the large hills terrain close to the city centre). Local authority in this regional city are Kota Kinabalu City Hall (KKCH)

Kuching

Kuching is the capital city of Sarawak. Kuching is one of the main commercial and industrial centres in Sarawak, and it aims to become a major growth centre in East Malaysia. Network. As a member city, Kuching has been active in developing action plans and specific projects that they will undertake from 2018 – 2025. Kuching South City Council (KSCC), Kuching North City Hall (KNCH) and Padawan City Council are the local authorities for this State City.

Kulim

Kulim is an ever-developing industrial district where the Kulim Hi-Tech Park (KHTP) is the first high technology industrial park in Malaysia that was established in 1996. The KHTP accommodates high technology related industries and becoming one of an attractive destination for foreign direct investment around the world especially Japanese investors. Kulim City Council and KHTP are local authorities for Smart City.

Green Intellectual Capital

Chen (2008) was the first researcher to introduce the concept of green intellectual capital (GIC). Previous researchers suggested that environmental capital is part of IC (Claver-Cortés et al., 2007). Maditinos et al. (2011) have added an element of green into IC. Later, Mohd Yusoff et al., (2019) posited the view of GIC as an unimportant field in management literature and thus its very scarce definitions. Of these few definitions, Chen (2008) defined GIC as "the total stocks of all kinds of intangible assets, knowledge, capabilities, and relationships, etc. about environmental protection or green innovation at the individual level and at the organisation level within a company". Liu (2010) described GIC as "the integration of green and environmental knowledge sources and the knowing capability of companies to improve their competitive advantage". Another contributor to the field, Lopez-Gamero et al. (2011), suggested GIC as "the sum of all knowledge that an organisation is able to leverage on in the process of conducting environmental management to gain a competitive advantage".

Proposed Model

Current study proposes that the green intellectual capital of the smart cities should possess six main constructs, being green human capital, green social capital, green institutional capital, environmental capital, green process capital and green renewal capital as shown in Figure 1 and Figure 2.

Green Human Capital

The knowledge and learning potential embedded in people; it is included as a key knowledge resource in all the City Intellectual Capital (CIC) models considered (Edvinsson and Malone, 1997; Carrillo, 2004; Viedma, 2005; Schiuma and Lerro, 2008; Cabrita and Cabrita, 2010). In context of green human capital, it can be viewed as citizen's knowledge, skills, capabilities, experience, commitment, attitude and motivation to address the environmental issues throughout the city.

Green Social Capital

The knowledge and learning potential embedded in relationship among citizens and firms (Edvinsson and Malone, 1997; Carrillo, 2004; Viedma, 2005; Schiuma and Lerro, 2008; Cabrita and Cabrita, 2010).

Green Institutional Capital

The green institutional capital, which corresponds to the management and generation of knowledge in addressing the environmental issues effectively, that supporting citizen‟ productivity. This construct emphasize on the establishment of environmental system and procedures to improve environmental operations through a system than plans, schedules, implements and checks daily activities and promotes codification and retention of most relevant knowledge concerning the accumulated experience of employees.

Environmental Capital
All that constitutes the physical environment, including both natural and artificial things such as bridges, trees, and phones.

Green Process Capital
The knowledge and learning potential embedded in processes, practices and procedures, which of course imply software, databases, archives, repositories, etc. and is considered a key aspect in all the CIC models (Edvinsson and Malone, 1997; Carrillo, 2004; Viedma, 2005; Schiuma and Lerro, 2008; Cabrita and Cabrita, 2010). Indicators include, for example digital store per capita, availability and extent of software usage, volumes in libraries per capita.

Green Renewal Capital
The knowledge and learning potential embedded in innovative products and organizations is understood as going far beyond patents, licenses and intellectual property rights; these aspects are included in a the much wider concept expressing the territory's innovation capabilities, mentioned in two of the CIC models considered (Edvinsson and Malone, 1997; Viedma, 2005). In context of green perspective, which represent the ability of a company to generate new knowledge, new product and any creative ideas aimed at addressing the environmental issues. For this dimension, it can be indicated by the allocation amount of research and development expenses incurred in producing the green product or green process. The allocation for R&D expenses enables companies to improve and achieve higher levels of knowledge and technological improvement. Another important indicator is the number of Intellectual Property rights (IPRs) such as patents and trademarks due to green production or process. The IPRs gained by company can reduce the scope of imitation, which enables firms that own patented technologies to keep prices prohibitively high and to maintain its long term competitiveness. Another indicators include, for example, the number of patents, scientific papers published in top ranking journals, innovative start-ups and so on.

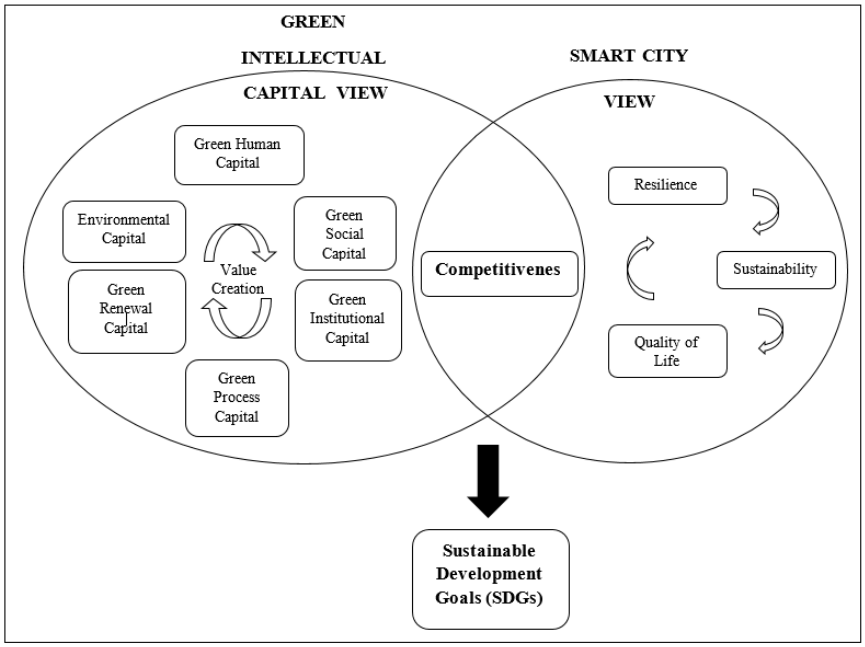

Figure 1: SC-GIC Proposed Framework

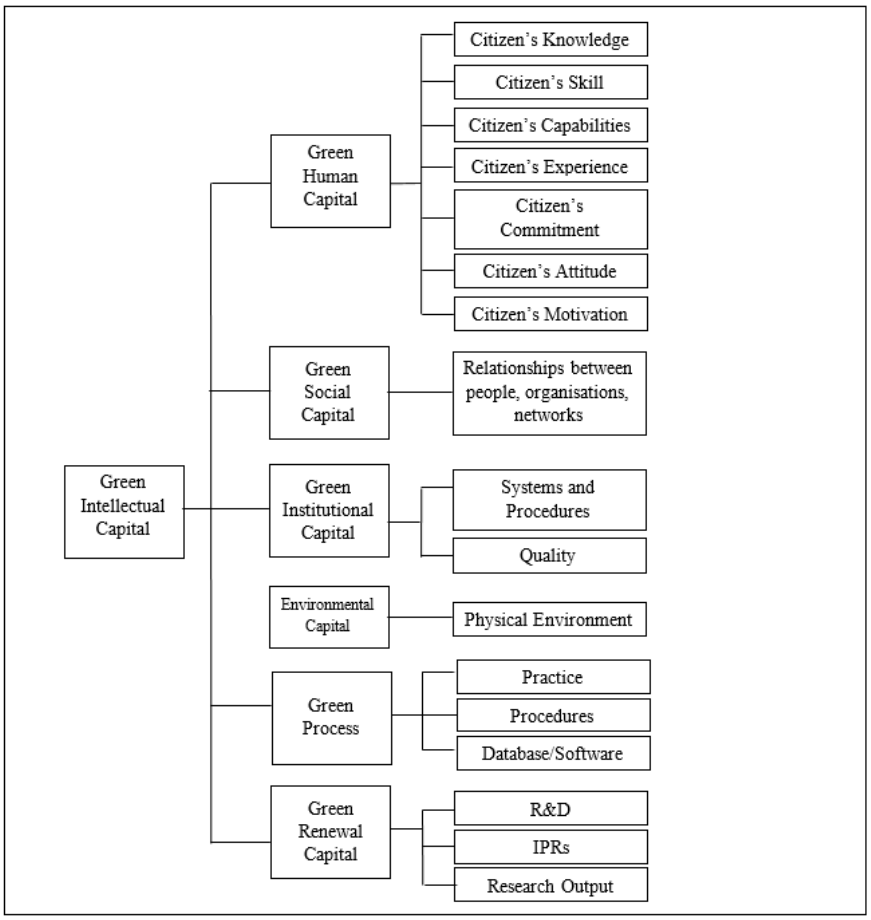

Figure 2: The proposed green intellectual capital constructs and their sub-constructs

Method

This study will using deductive approach using survey strategy. Seven smart cities will participate in this study which are Selangor, Putrajaya, Iskandar Malaysia, Kuala Lumpur, Kota Kinabalu, Kuching and Kulim. Purposive sampling is used in this study to gather information from specific target groups (Sekaran & Bougie, 2013). The respondents are employees of municipal council involved in smart city initiatives; Johor Bahru City Council (MBJB), Selangor Local Councils, Selangor District Offices, Selangor Public Works Department, Iskandar Puteri City Council (MBIP), Pasir Gudang Municipal Council (MPPG), Kuala Lumpur City Hall (KLCH), Kota Kinabalu City Hall (KKCH), Kuching South City Council (KSCC), Kuching North City Hall (KNCH), Padawan City Council, Kulim City Council and Kulim Hi-Tech Park (KHTP). The reason of focusing on these groups is due to the fact that they are the key players of sustainable development's agenda in the smart city projects. Therefore, they have the ideas and knowledge related to the topic. Hence, they are within the control of the researcher. The data will analysed using SPSS and Smart PLS software.

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