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A SMART CITY ASSESSMENT FRAMEWORK

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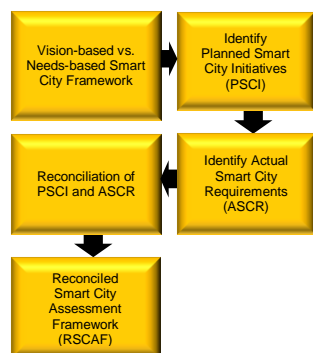
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Graphical abstract



Abstract

Smart City is a city development concept encompassing both ICT-based and urban studies-based aspects. Globalisation's influence on borderless economy shows how ICT can enhance the sustainability of a city by facilitating its management. With the trend of rapid technological advancement, Smart City is a model for cities to remain relevant and competitive. However, the adoption of the Smart City concept greatly depends on the city's functions and its stakeholders' requirements. Despite the multitude conceptual Smart City framework, there has yet been a pragmatic framework that could be used to guide other Malaysian cities that aim to pursue and adopt a Smart City agenda. This paper uses the Smart City model developed by Giffinger et al. (2007) to propose a pragmatic framework that helps to assess a city's 'smartness' by comparing planned development initiatives against stakeholders' actual needs. The "Reconciled Smart City Assessment Framework" or RSCAF is developed through the alignment of the planned "Smart City initiatives" and actual city stakeholders' "Smart City requirements". As a pragmatic framework, RSCAF can be used by city managers in the planning, operationalising and monitoring Smart City goals.

Keywords: Smart City; assessment; pragmatic framework; sustainable development

Abstrak

Bandar Bestari merupakan konsep pembangunan bandar yang merangkumi kedua-dua aspek ICT dan kajian perbandaran. Pengaruh globalisasi dalam ekonomi tanpa sempadan menunjukkan bagaimana ICT dapat meningkatkan kemampuan sesebuah bandar melalui pemudahan pengurusannya. Trend kemajuan teknologi yang pantas menjadikan Bandar Bestari sebuah model bagi membolehkan bandar kekal relevan dan berdaya saing. Walau bagaimanapun, konsep Bandar Bestari amat bergantung kepada fungsi bandar dan kehendak pihak-pihak berkepentingan bandar tersebut. Walaupun terdapat banyak kerangka konsep Bandar Bestari, masih tiada kerangka pragmatik yang dapat digunakan bagi membantu bandar-bandar Malaysia lain yang bercadang menggunakan agenda Bandar Bestari. Kajian ini menggunakan model Bandar Bestari oleh Giffinger et al. (2007) bagi mencadangkan sebuah kerangka pragmatik yang dapat membantu menilai 'kebestarian' sesebuah bandar dengan cara membandingkan rancangan inisiatif pembangunan dengan keperluan sebenar pihak-pihak berkepentingan. "Kerangka Jajaran Bandar Bestari" atau RSCAF dibangunkan dengan cara melaraskan "Inisiatif Bandar Bestari" dirancang dengan "Keperluan Bandar Bestari" sebenar pihak berkepentingan dalam sesebuah bandar. RSCAF boleh digunakan oleh pengurus bandar dalam perancangan, pengoperasian dan pemantauan matlamat Bandar Bestari.

Kata kunci: Bandar Bestari; penilaian; kerangka pragmatik; pembangunan mampan

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1.0 INTRODUCTION

Smart City is a city development concept encompassing both ICT-based and urban studies-

based aspects. With globalisation's effect on the borderless economy, ICT can play a major role in enhancing a city's sustainability by facilitating its

management. With the trend of rapid technological advancement, Smart City is a model for cities to remain relevant and competitive. The prevalence of Smart Cities throughout the world can be summed by the Smart City collaboration by China and Europe that produced the Smart Cities shown in Table 1. In Malaysia, Iskandar Malaysia was declared as pilot for all Smart City projects in 2012 [1]. The list in Table 1 and other examples indicate that Smart City is a city development concept that can be adopted for both new and existing cities.

Table 1: Examples of Smart Cities in Europe and China

EU Smart Cities	Chinese Smart Cities
Amsterdam, Netherlands	Beijing Haicdan District
Barcelona, Spain	Tianjin Binhai New Area
Bristol, UK	Shanghai Pudong New Area
Copenhagen, Denmark	Yangzhou of Jiangsu Province
Florence/Prato, Italy	Nantong of Jiansu Province
Frankfurt, Germany	Huai'an of Jiangsu Province
Issy-les-Moulineaux, France	Ningbo of Zhejiang Province
Lyons, France	Jiaxing of Zhejiang Province
Malmo, Sweden	Zhangzhou of Fujian Province
Manchester, UK	Yantai of Shandong Province
Riga, Latvia	Guangzhou Nansha District of Guangdong province
Tallinn, Estonia	Authority of Qianhai Shenzhen-Hong Kong Modern Service Industry Cooperation zone of Shenzhen, Guangdong province
Venice, Italy	Zhuhai Hengqin New Area of Guangdong province
Vilnius, Lithuania	Chengdu of Sichuan Province
Zagreb, Croatia	Korla of Xinjiang Uygur Autonomous Region

Source: [2]

Among the myriad definitions of Smart City, the most influential conceptual construct of Smart City was provided by Giffinger et al. (2007). This was the model adapted by Iskandar Malaysia in developing its Smart City framework. However, it is erroneous to assume that the Giffinger et al.'s model by itself is sufficient in providing an accurate assessment of a city's smartness.

A city is unique because its physical, demographic and socio-economic characters set it apart from another city. Following this argument, then an evaluation of a city's smartness ought to be made in relation to the city's own needs and aspirations. This idea underpinned the development of a pragmatic Smart City framework that model for 'localised' evaluation of cities. This paper uses the Giffinger et al.'s Smart City model to propose a pragmatic framework that helps to assess a city's smartness by comparing the city's Smart City Ideal against its actual smart initiatives. The "Reconciled Smart City Assessment Framework" or RSCAF is a pragmatic framework that is beneficial in revealing the areas of focus in achieving the city's penultimate Smart City ideal, thus promoting effective and efficient decision-making practice.

This remainder of the paper is divided into two main sections. In the first section, the components of the proposed pragmatic Smart City evaluation framework will be discussed. This section includes the components' methods of construction and/or evaluation. In the second section, the final output i.e. RSCAF will be explained. This section puts together the various components and explains the operation of RSCAF.

2.0 COMPONENTS OF THE PROPOSED SMART CITY ASSESSMENT FRAMEWORK

This section discusses the factors that were taken into consideration in developing the pragmatic Smart City assessment framework.

i. Smart City dimensions

Whilst there is an abundant literature on the subject, there is no definitive definition Smart City. Nonetheless, the pervasive definition of smart cities concerns the use of *technology*, specifically information and communications technology (ICT) and smart computing, in shaping the liveability and sustainability of cities. Within the above context, technology is seen as central to the operation of the future city at large. The scenario entails the usage of ICT, together with diverse instruments, techniques, organizational structures and initiatives that build upon online engagement, to solve the key problems of cities

The most influential Smart City framework concept was provided by Giffinger et al. in 2007 in their report entitled *Smart cities: Ranking of European medium-sized cities* [3]. Since then, the model has been cited in numerous other works by researchers who seek to refine the Smart City Concept [4, 5] [6] [7].

The model by Giffinger et al. encompasses six dimensions i.e. Smart Economy, Smart Governance, Smart Mobility, Smart Environment, Smart People and Smart Living. In Malaysia, the Giffinger et al.'s model has been used to guide Iskandar Malaysia's Smart City implementation. The Smart City framework followed by Iskandar Malaysia links the dimensions to the three pillars of sustainable development thusly: Smart Economy and Smart Governance with the Economy pillar; Smart Environment and Smart Mobility with the Environment pillar and Smart People and Smart Living with the Social pillar.

ii. City's functions

Cities are currently home of the majority of the world's population, centre place of modernisation and communication, and engine of a country's economic development [8]. As such, a city can have multiple functions encompassing political, economic and social goals and activities. However, the prevailing character of a city – its demography, level of technology, administrative structure, environment,

geography and socio-political conditions – are dependent on the main function of the city. Among others, a city's main function can be administration (e.g. Washington, Canberra, Putrajaya, etc.), commerce (e.g. New York, London, Tokyo, etc.), industry (e.g. Jubail in Saudi Arabia, Manchester, Detroit, etc.), logistics (e.g. Los Angeles, Cape Town, etc.) and religion (e.g. the Vatican, Mecca, Jerusalem, etc.).

As each city is unique what is appropriate for one city may not work for another city. As such, any proposed implementation of Smart City principles for any city must be studied within its pre-existing institutional framework in order to ensure a viable enhancement to the city development plans.

iii. City authority's planned initiatives

A city's vision (or goal, or set of goals) is contained in its city development plan, which is normally statutory in nature. The statutory development plan outlines schemes, policies and programmes to be implemented towards achieving the city's vision. Planned Smart Cities have specific Smart City-directed development plans, whereas existing cities that intend to adopt the smart agenda may adopt a separate smart development plan. However, the planning system may differ from one country to another. In a non-statutory plan system, the development strategies, policies and programmes may be contained in official documents and websites. Whatever the form of the development plans, the schemes, policies and programmes are the *planned initiatives* that can indicate a city's smartness. Limited resources, externalities, threat of political setback and potential irreversible impacts provide the rationale for careful consideration during the formulation, implementation and monitoring of the planned initiatives.

For new and planned Smart Cities, the plans contain Smart City-specific development strategies and initiatives guided by Smart City principles. However, for existing cities, initiatives that are specifically designed as smart are absent from their development plans. However, 'conventional' development initiatives can still fall within the Giffinger et al.'s Smart City dimensions. To establish the smart initiatives within non-planned Smart Cities, a careful and methodical examination can be carried out. The quasi audit involves firstly, identifying initiatives with smart characteristic within the statutory development plans and secondly, sorting these initiatives according to the Smart City dimensions.

iv. Stakeholders' actual requirements

The implementation of a new city-wide management strategy has to suit the requirements of the city's stakeholders. The city's main stakeholders are residents and workers as they represent the major users of the

city and the groups most likely to be affected by changes in city development measures.

The city's demographic profile - household size, education level, income level and distribution and cosmopolitanism – can be attributed to its primary function. For instance, the population of a commerce city is most likely to enjoy higher income level compared to an administration city. The population of an administration city may be more transient than a commerce city. There are more likely a larger proportion of blue-collar workers in a logistics city compared to an administration city.

The most effective method of generalising the actual user requirement for a large sample size is the questionnaire survey. The usage of Likert scale options enables the respondents to indicate the degree of fulfilment they experienced against their expectations of the smart initiatives.

v. On-the-ground smart initiatives

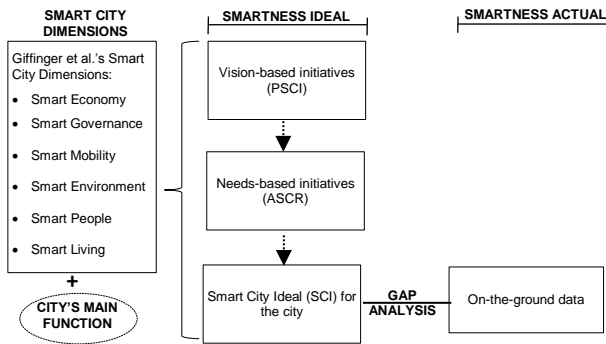
Cities may have already implemented smart initiatives that may or may not have been planned. In other words, some initiatives that are considered smart under Giffinger et al.'s Smart City dimensions may have been *ad hoc* policy initiatives not contained in the statutory development plan. The implementation could be ongoing or have been fully executed. As assessment of a city's smartness should incorporate these on-the-ground smart initiatives.

Evaluation of on-the-ground initiatives can be conducted by observation (site visit, photograph documentation, field notes, etc.) and document review of the Smart City initiatives provisions that are already in existence.

3.0 THE FRAMEWORK: RECONCILED SMART CITY ASSESSMENT FRAMEWORK (RSCAF)

To surmise from the above discussion, the important components of the proposed framework to assess a city's smartness are the Smart City dimensions and the city's main function, the city's planned smart initiatives, city stakeholders' actual requirements and on-the-ground smart initiatives. The proposed framework is titled the Reconciled Smart City Assessment Framework (RSCAF) (Figure 1). The main principle of RSCAF is to determine the gap between the city's Smartness Ideal against its Smartness Actual.

Figure 1: The Reconciled Smart City Assessment Framework (RSCAF)



RSCAF's overall assessment operation is generally guided by the Smart City dimensions and the city's main function. This means that the determination of Smartness Ideal and Smartness Actual must be based on the six dimensions proposed by Giffinger et al. and disregard smart city dimensions proposed by other authors to ensure consistency especially if RSCAF is to be used in a benchmarking exercise. The city's main function plays a latent but important role throughout the assessment exercise, serving as a baseline or point of reference when the Smartness Ideal and the Smartness Actual are measured.

In RSCAF, the Smartness Ideal is the process of determining the Smart City Ideal (SCI) for the city. First, the vision-based initiatives, i.e. Planned Smart City Initiatives (PSCI) are identified. Next, the PSCI are used to formulate the questionnaire survey to examine the Actual Smart City Requirements (ASCR) of the city's stakeholders. A needs-based inquiry, ASCR takes the form of a questionnaire survey among the city's users that determines the level of users' satisfaction of the PSCI. Likert scale is the main rating method in the questionnaire survey. On the premise that users' rating on the satisfaction also reflects to a significant extent their expectation level, this rating denotes users' expectations. The analysis and interpretation of ASCR denote SCI, a comprehensive configuration of the Smart City initiatives that the city **should** have to achieve a level of smartness that fits in its main function.

At the same time, the Smartness Actual is ascertained to reflect the reality of the city's current smartness level. Smartness Actual is established from a survey of the smart initiatives currently available in the city. Based on the survey, each content provision is heuristically assessed and rated on a scale, with each scale corresponding to the level of achievement from the lowest to the highest.

The difference between Smartness Ideal and Smartness Actual is computed. This gap indicates where the city lies in relation to being a perfectly smart city in its own right i.e. in its drive towards the achievement of the city's vision in terms of both

authority's vision and users' requirements. This gap will signify the extent to which the city would need to improve to become a truly smart city according to its main function.

4.0 CONCLUSION

The Smart City concept could further the sustainability agenda of cities and nations. Nonetheless, each city is unique in terms of its social, economic, geographical, political and environmental conditions. One city's smart model may not work with another city, as the city's main function determines the working smart model for the city. To this end, a pragmatic assessment framework would enable a city to measure its current smartness and compare that against its ideal smartness, all within the confines of its long-term vision.

RSCAF enables a systematic analysis of where a city currently stands on the Smart City agenda, and where it should go should that agenda is to be pursued. From the onset, RSCAF acknowledges how institutional factors play a role in city development and must be incorporated in a city development strategy. As such, RSCAF is as accurate as it is practical and offers a useful tool for city authorities that seek the smart path.

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