PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 20 ISSUE 5 (2022), Page 108 – 121

ISSUES AND WAY FORWARD FOR THE SMART SUSTAINABLE CITIES AND COMMUNITIES STANDARDS: THE MALAYSIAN CASE IN THE POST-COVID-19 ERA

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Abstract

Governing a city's development with the use of standards started relatively recently, in the mid-2010s. However, the issues of such city standards in systematically governing future smart cities remains largely unknown under the digital infrastructural stress of the post-COVID-19 era. Therefore, this paper aims to examine the issues and directions in developing the Malaysian smart sustainable cities and communities standards that suit the post-COVID-19 era. This study applied the multiple case study method to compare the international literatures and the local smart city webinars. The results showed that smart city standards were welcomed by policymakers and practitioners, although issues such as learning, connectivity, and citizenship rationale need to be addressed. More focus should be put on how humans relearn and responsibly participate in the post-COVID-19 cyber-physical ecosystem in order to create a healthy and sustainable digital-based society. This paper has contributed as one of the first researches examining the role of smart city standards in Malaysia.

***Keywords**:* Malaysia; post-pandemic planning; smart cities; standardization; urban management

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INTRODUCTION

Never before could one imagine that a city space full of wicked problems could be measured quantitatively and qualitatively using performance indicators and standards such as those applied earlier on the smaller spaces or scales, namely a mechanical engineering process, a factory production process, or a management flow of a working organisation. The wicked problems, such as poverty, displacement of original settlers, access to education, reduction of gender violence, virus infection, environmental degradation and climate change, caused by rapid urbanisation of human race into city spaces are arguably difficult to be solved, and they need new innovations (Goodspeed, 2015; Rittel & Webber, 1973). Furthermore, Mertens (2015) also pointed out that 'business as usual' and traditional urban solution will not effectively address those complex urban wicked problems; a mixed method methodology is needed. Under such framing, the author thinks that the idea of applying a mixture of quantitative and qualitative standards into the scale of city planning is justifiably and innovatively filling such gap, and it has emerged since the early 21st century from the initial efforts of the British Standard Institutions (BSI) and the International Organization for Standardization (ISO) (Joss et al., 2017; Kitchin et al., 2015).

The global development of city standards is still in its nascent stage (Huovila et al., 2019; Lai et al., 2020). The global trend is initiated from the sustainable city-related standards (i.e., ISO 37120 measuring the economic, social and environmental sustainability) to the smart city standards (i.e., ISO 37122 or ITU 4901 measuring the technological innovations for urban management) and to other city concept standards that are still in development. Under the current fourth industrial revolution (4IR), the innovation under the urban cyber-physical ecosystem (physical, digital and biology) is full of unknown factors and challenges (Economic Planning Unit, 2021). For example, the way to measure the healthy level of a city (physical) and citizen (biology) using the available (digital) infrastructure to help overcome the COVID-19 pandemic threat is a pressing issue. Nonetheless, it is still largely uncertain that by complying to the city standards, humans can lead a prosperous and healthy city lifestyle that also benefits the next generations.

In Malaysia, two pioneer city standards are in development: one is the smart city indicator by the Federal Department of Town and Country Planning for the Peninsula Malaysia (PLANMalaysia), and the other is the smart city ICT infrastructure by the Malaysian Communications and Multimedia Commission (MCMC). To the best knowledge of the author, there is no academic study on smart city standardization in the Malaysian context to date. Largely unknown areas require more clarifications and improvements from time to time. Thus, it is the right time to fill such research gap by examining the issues and directions in specific and critical areas. This paper aims to examine the issues faced by the city

standards development in Malaysia, and thus providing some valuable directions to create holistic city standards that suit the post-COVID-19 era.

The next section will provide an overview of city standards development, organizations involved, and examples of issues faced by city indicators. Then, the methodology section explains the multiple case study method, and the findings and discussions sections include the issues and directions of city standards. Finally, this article ends with remarks on the contribution and limitation under the section of conclusion.

LITERATURE REVIEW

Since 2014, BSI has initiated the publication of smart city standards such as the BSI-RoS:2014 The Role of Standards in Smart Cities; and BSI-PAS180, 181 and 182 on smart cities vocabulary, framework and conceptual model. To date, BSI has published nineteen smart cities and communities standards, and the BSI team has also acted as one of the initial committees in setting up the ISO city standards (BSI, 2021; Lim et al., 2021). The technical committees started their work in 2012, producing a report on the ISO/TC 268 that later was translated into the first edition of ISO 37120:2014 Sustainable Development of Communities. To effectively develop the city standards, the World Council on City Data (WCCD) was founded in Canada in 2014, thus accelerating the ISO city standard development. To date, the ISO 37120 (indicators for sustainable cities) series has been expanded to include indicators for smart cities (ISO 37122) and for resilient cities (ISO 37123). The ISO 37120 and 37122 are available online while the ISO 37123 is still in development (WCCD, 2021a). Altogether, there are estimated more than 30 available related ISO city standards and the list keeps on increasing.

It is important to highlight that the global trend currently is on smart sustainable city development. Recent literature has reported that the smart element of ICT technologies is a means for city management; and ultimately, the management is directed back towards the triple bottom sustainability direction (economic, social and environmental sustainability) propagated since the early 1990s, and is progressing through the realisation of the 17 sustainable development goals (SDGs) for humankind (Liu et al., 2021). This article has adopted the International Telecommunication Union (ITU, 2016)'s definition of a smart sustainable city as "an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects". As this definition indicates, forthcoming city developments must involve a combination of conventional urban sustainability, ICT requirements and novel participatory strategies.

Besides the aforementioned organisations of BSI and ISO, there are many other international, regional and national organisations which collaborate

to develop the smart sustainable city standards. The notable international ones include the ITU, International Electrotechnical Commission (IEC), and the United Nations' (UN) Sustainable Development Goal 11+. From a regional perspective, various principal actors are involved in the standardisation of European cities: the European Telecommunications Standards Institute (ETSI), the European Committee for Electrotechnical Standardisation (CENELEC), and the European Committee for Standardisation (CEN) (EU, n.d.). Meanwhile, the are 167 national standards bodies that are the country's members of the ISO, such as the North America's American National Standard Institute (ANSI), Standards Council of Canada (SCC) and National Institute of Standards (NIST) (Kubina et al., 2021), and Malaysia's Standards Malaysia.

As for the Asian region, WCCD has collaborated with the Dubai city, and launched the Dubai-WCCD Local Data Hub in 2019. This Dubai-WCCD Local Data Hub is a platform for cities across the Middle East, North Africa, and South Asia (MENASA) region to connect and share data-driven innovations and policies, hence getting certification for the ISO 37120 series.

There are many benefits of city standards, and these benefits are stated in the WCCD website (WCCD, 2021b). In summary, standards create a common language of worldwide data communication, facilitate inter or intra urban management, streamline activities towards realising the SDGs, and identify potential areas of city investment.

In the study by Huovila et al. (2019), a taxonomy of city standards has been formulated, especially on dividing the indicators into input, process, output, outcome, and impact indicators. The author found that this division was important and useful for further explaining the nature of the formed indicators. The description of the types of indicators is summarised in Table 1.

Table 1: Descriptions on the types of indicators

Types of Indicator	Explanation	In Other Term	Assessment Level	Example
Input	What resources are required?	Resource	Planning-Identify resources and constraints	Policies, human resources, materials, and financial resources
Process	What your project does	Activity	Implementation-Quality assessment on means of implementation	Holding of meetings, training courses, and distribution of smart meters
Output	What your project produces	Product, service	Monitoring-Short-term monitoring	How many smart meters have been issued, the total extent of the isolated roof

				area and how many electric buses are registered.
Outcome	What your project achieves	Result, intervention	Evaluation Mid-term evaluation	The target population the project aimed to reach, such as the proportion of car owners who use an app for parking.
Impact	How your project contributes to higher-level strategic goals	Benefit, Contribution	Evaluation Long-term evaluation	The effects of policies such as the energy consumption of a city. It is possible to use this measure to conduct evaluations of, for instance, how a smart solution may have a sustainability impact.

Source: Adapted from Huovila et al. (2019) and Parsons et al. (2013)

Aside from the various indicators, a study by Yigitcanlar et al. (2022) revealed that within regional or metropolitan contexts, a city's location was excluded from every global smart city indicator and standard. The measurement of this factor occurred by means of a smart city readiness for transformation indicator that was unrelated to ICT, the remoteness value. This outlines the value of accessing various services that may be found in small settlements or only in more populous areas. Another interesting finding from Vianello (2021) is that the issue of displacement of people is frequently highlighted by scholars in new or smart cities development (Moser, 2020), and is suggested to be incorporated into the city standards. This suggestion is viable through the incorporation of the Core Humanitarian Standard published by CHS Alliance (2014). While in the case of shaping smart Malaysian citizenship, Lim et al. (2021) has proposed to learn from ISO standards to bring in more responsible roles for the direct participation of citizens.

METHODOLOGY

This study applied multiple case study method. An example of application can be referred to Mora et al. (2019) in investigating four European smart cities, namely Amsterdam, Barcelona, Helsinki and Vienna. Mora et al. (2019) adopted the literal replication logic (Yin, 2018) to ensure that the selected cases are subject to the same analytical process. Similarly, this study divided the cases into international and local cases to examine the study context – the issues with city standards formation in Malaysia. The selected international cases included the standards by ISO, ITU, ETSI, and UN SDG 11+ (Table 2). These cases are important international references for city standards as studied by scholars such as Guo et al. (2018), Huovila et al. (2019), Lai et al. (2020), Santana et al. (2018)

and Zhang et al. (2021). The author decided not to include the BSI standards in this analysis since the contents were mostly covered by the ISO standards as explained by an informant from BSI during the webinar covered in this study (also refer to BSI (2021)).

Table 2: Selected Cases

Case	Detail	
International Cases	ISO	ISO 37120; ISO 37122
	ITU	ITU 4901; ITU 4902; ITU 4903
	ETSI	ETSI 103
	UN	UN SDG 11+
Local Malaysian Cases	1st Webinar discussion	On 6 Sep 2021, "The roles of standard in Malaysia smart city development: How standard can assist the development of smart cities in the road to recovery from COVID-19", a network event in the Malaysia Urban Forum, organized by Urbanice Malaysia.
	2nd Webinar discussion	On 21 Sep 2021, "The role of standards in smart city development", a sharing session in the Cities 4.0 webinar: Reimagining city transformation, organized by MiGHT.

Note: ISO 37120: 2018 – Sustainable cities and communities – Indicators of urban services and living standards (worldwide non-mandatory standard; the abbreviation used is "ISO 37120"); ISO 37122:2019 – Sustainable cities and communities – Indicators for smart cities (worldwide non-mandatory standard; the abbreviation used is "ISO 37122"); ITU-T Y.4901/L.1601 – Key performance indicators concerning how information and communication technology are used in smart sustainable cities (recommendation; the abbreviation used is "ITU 4901"); ITU-T Y.4902/L.1602 – Key performance indicators concerning how information and communication technology have sustainability impacts on smart sustainable cities (recommendation; the abbreviation used is "ITU 4902"); ITU-T Y.4903/L.1603 – Key performance indicators for smart sustainable cities; these form an assessment of the extent to which sustainable development goals have been achieved (recommendation; the abbreviation used is "ITU 4903"); ETSI TS 103 – 463 key performance indicators for sustainable digital multi-service urban areas (TS = technical specification; the abbreviation used is "ETSI 103"); monitoring framework for United Nations Sustainable Development Goal 11+ (definition by the UN Inter-Agency Expert Group; the abbreviation used is "UN SDG 11+").

As for the local case, the Malaysian city standards were still under development, and the author analysed the issues through webinar discussions by the stakeholders on the 6 and 21 Sep 2021. The informant's details are shown in Table 3. The length of the first webinar was 1 hour 29 minutes, and it could be accessed at https://www.airmeet.com/event/21fd28b0-041b-11ec-a196-873037e98dd7 while the length of the second webinar was 26 minutes, and it could be accessed at https://youtu.be/FB3zlLHRtvo. As for the analysis, the data from the webinars were transcribed and together with data from the international cases, were tabulated through thematic analysis. Its purpose was to derive the themes related to issues with city standards. This analysis process was conducted using Atlas.ti, Mendeley, and Microsoft Excel.

Table 3: Informants in the local webinar discussions

Webinar	Sector	Detail
1st Webinar	Government	G1, Head of Smart City Division, PLANMalaysia
		G2, Principal assistant director, Standards Malaysia
		G3, Head of Department Technology Development, MCMC
	Private	P1, Representative of British Standards Institution
	NGOs	N1, Representative of Malaysian Smart Cities Alliance Association (MSCA)
2nd Webinar	Government	G4, Director general of PLANMalaysia

Note: G1 represents informant number one from the government sector. For the first webinar, the presentation slides can be downloaded at https://drive.google.com/drive/folders/1ql6azVGUCJ3nCyPr7fQqvlgd_jVl30iH.

FINDINGS

THE INTERNATIONAL CASES

In general, the selected international cases had different contents of indicators (Table 4). The issues were discussed based on the main focus, and types of indicators as follows.

Table 4: Content of the international cases

Standard	Main Focus	Category	Indicator
ISO 37120:2018	For sustainable city services and quality of life	19 categories	104
ISO 37122:2019	For smart (ICT) cities	19 categories (same as above)	80
ITU 4901	For the use of ICT in SSC	6 categories: ICT, environmental sustainability, productivity, quality of life, equity and social inclusion, physical infrastructure	48
ITU 4902	For the sustainability impacts of ICT in SSC	5 categories: same as above except ICT	30
ITU 4903	For SSC to assess the achievement of SDGs	3 categories: Economy, environment, society and culture	52
ETSI 103	For sustainable digital multiservice cities	4 categories: People, planet, prosperity, governance	76
UN SDG 11+	For SDG11 "Make cities inclusive, safe, resilient and sustainable", SDG1.4 on poverty, and SDG6.3 on water and wastewater	12 targets	18

Note: ICT stands for information and communication technology, SSC stands for smart and sustainable cities, SDGs stands for sustainable development goals.

The issue of main focus: Sustainability Vs. Smartness

From the observation on the seven international cases, there were two different focuses. First, the majority of the five standards were focused on sustainability, namely the UN SDG 11+, ISO 37120, ITU 4902, ITU 4903 and ETSI. Second, two standards were focused on smartness or ICT, namely the ISO 37122 and ITU 4901.

The issue of indicator: Different quantities and types

Among the cases, one standard has exceeded 100 indicators, with the ISO 37120 having the most indicators of 104. On the other hand, two standards had 30 and less indicators, with the UN SDG 11+ having the least indicators of 18, followed by ITU 4902 with 30 indicators. Overall, there were an average of 59 indicators for each standard. The types of indicators could be divided into five types: indicators for measuring input, process, outcome, output, and impact. From the findings of Huovila et al. (2019), the most popular type of indicator was the impact indicator (32%), followed by output indicator (30%), and outcome indicator (24%). Meanwhile, the least popular type of indicators was the process indicator (6%) and the input indicator (8%).

THE MALAYSIAN CASES

The sixth of the 16 policies under the Malaysia Smart City Framework stated clearly that "Accreditation of smart city standards shall be introduced to set a standard for smart city qualification and recognition" (Ministry of Housing and Local Government, 2019, p. 35). The major issue faced by the Malaysian context was that there was no current standard to measure a city's qualification to be recognized as a smart city in the nation. The related issues of the Malaysian cases are elaborated below.

The issue of adoption

Table 5 shows the draft of the Malaysian standards, MS ISO 37122 Sustainable cities and communities – Indicators for smart cities. In general, this draft was adopted and adapted from ISO 37122. As mentioned by an informant of Standard Malaysia, G3, "We are not going to reinvent another wheel. We should jump start whatever available standards at the international level." There were 80 indicators, with the majority of indicators (55%) being totally adopted for the Malaysian context, 37.5% being modified and another small amount of 7.5% being reserved for future considerations.

Table 5: The draft of MS ISO 37122

	Theme	Indicator with Total Adoption	Indicator that Require Modification	Indicator for Future Consideration	Total
1.	Economy	-	4	-	4
2.	Education	2	1	-	3
3.	Energy	3	5	2	10
4.	Environment and climate change	-	3	-	3
5.	Finance	2	-	-	2
6.	Governance	2	2	-	4
7.	Health	1	2	-	4
8.	Housing	-	2	-	2
9.	Population and social conditions	4	-	-	4
10.	Recreation	1	-	-	1
11.	Safety	1	-	-	1
12.	Solid Waste	2	2	2	6
13.	Sport and culture	3	1	-	4
14.	Telecommunication	3	-	-	3
15.	Transportation	9	5	-	14
16.	Urban/ local agriculture and food security	3	-	-	3
17.	Urban planning	3	1	-	4
18.	Wastewater	2	1	2	5
19.	Water	3	1	-	4
	Total	44 (55%)	30 (37.5%)	6 (7.5%)	80 (100%)

Source: Author

As for the main themes' analysis, the majority (ten categories or 52.6%) required both hybrid action of total adoption and modification. Another six categories or 31.6% that adopted the entire original ISO global measurement included Finance, Population and Social Conditions, Recreation, Safety, Telecommunication, Urban or Local Agriculture, and Food Security. Meanwhile, another three categories or 15.8% needed total modifications to suit the Malaysian context, namely the Economy, Environment and Climate Change, and Housing. The above practice is considered as a type of identical adoption of ISO 37122 rather than the direct use of it. This identical adoption is also practised by many countries such as the UK, Indonesia, Philippines, and others. Meanwhile, as mentioned by the informant of PLANMalaysia, G4, only a few countries practise the direct use, namely the USA, Singapore, Japan and Germany.

The above proposal of MS ISO 37122 – smart city indicators – is being developed under the working group, WG/D/29-1, led by PLANMalaysia. The progress updates of the current status of MS ISO 37122 as shared by the informant from MCMC, G3, showed that the technical committee, TC/D/29, has submitted this proposal to the final stages of review by the NSC-D before being sent to the minister for the final approval in 2021. As for the second proposal of smart city ICT infrastructure standard (the name of the MS has not been confirmed yet), it was still under the public deliberation process prior to the submission to the NSC. The second proposal was led by MCMC under the working group, WG/D/29-2, and the contents were adapted from ITU standards. The technical committee, TC/D/29, targeted to complete this second proposal by 2022.

The issue of COVID-19 and readiness of digital infrastructure

Given the existing threat of COVID-19, Malaysia, along with the majority of countries, introduced strategies to monitor the movements of citizens (in Malaysia, this was termed the MCO). The regulation and prevention of direct human contact aimed to stop the potentially fatal disease from spreading. In terms of maintaining the means of communication in everyday life, the interaction through virtual spaces has become significantly more important than before. This online communication is central for the government, businesses and service-based industries, education for students through home-based learning, and communities and societies to constantly stay in touch with families and friends. This unprecedented high volume of online communication under the period of COVID-19 has been a stress test to the nation's digital infrastructure. For example, the informant from MCMC, G3, has pointed out four scenarios in Malaysia: a) the internet traffic has increased by 30 to 70%, b) internet speed has reduced by 30 to 40%, c) internet use has moved to residential areas by 50 to 70%, and d) complaints on internet speed, new and indoor coverage have increased from 40 to 70%.

The issue of data, connectivity, and information security

Data exchange and sharing on smart cities applications are crucial. But, what makes those local, stand-alone or proprietary smart cities applications, such as electric/water metering, lightings, home equipment, and autonomous vehicles, share the data to the level considered smart? Informant from MCMC, G3 explained that, for the "smart insertion" to happen, the local smart cities application should connect seamlessly to the communication and multimedia applications, such as remote monitoring, remote controlling, data management, smart billing and big data.

From the above explanation, the MCMC informant G3 highlighted that in the post-COVID-19 era, the focus area of standardisation would be

connectivity. In detail, connectivity should also look at the devices, with incorporation of the IoT or monitoring sensors into devices and then, through the internet such as the 5G networks in order to make them communicate with each other, and to or from the controlling system. Including the readiness of the physical interface such as Coax, RJ11/25 and Fibre, if the standardisation of ICT infrastructure connectivity is not achieved, then it will be an empty promise or wasted investment in the smart city planning. On top of connectivity on supporting the built environment of digital transformation, another important issue emerged: information security. This was highlighted by BSI informant, P1, "Often we will see how wonderful the smart is; but with being more digital, you are being more vulnerable."

DISCUSSION

From the findings, the issues varied among the international and local cases. For the seven international standards, each has their focuses; however, in general, the main focus areas are sustainability (economic, social and environmental aspects) and smart ICT infrastructure. This means that for the future direction of Malaysia city standards formation, the policymakers should put higher emphasis on the broader aspect of sustainability instead of the narrow aspects of the "smart city standards" naming. For the technical committee, TC/D/29, the priority seems to have skipped the formation of the standards for sustainable city. If the current working group, WG/D/29, only focuses on the smart city indicators (led by PLANMalaysia) and the other one on smart ICT infrastructure (led by MCMC), then the society will tend to prioritise the ICT elements than balancing the sustainability measurements.

The five types of indicators proposed by Huovila et al. (2019) are something new for the Malaysian policymakers to learn as no evidence has shown that the technical committee is adopting this aspect. The reason for this is that a clear measurement of the various forms of indicators (for instance, those signifying input, procedures, output, results, and contributions) will enable the deficiencies of many designated indicators to be identified. For example, the impact indicators are found to be the most popular, and the type of process and input indicators are frequently being ignored. The author argues that setting up more input and process indicators are as important as the impact indicators because if the resources invested and processes used are quantified clearly in the early value chain of decision making and planning, then mistakes will be minimised and investment direction will be much clearer for the city stakeholders.

Besides that, the common practice of totally adopting standards of areas such as the population and social conditions, recreation, and safety in the MS ISO 37122 from the ISO standards is to be cautioned as the global landscape has been disrupted by COVID-19. The socio-cultural background of citizens in Malaysia

is also unique such as the need to advocate for ageing communities (Elsawahli et al. 2016) and dense city planning (Lim, Malek, et al., 2021). In the author's opinion, modifying and differentiating the types of indicators are better moves to review the draft MS ISO 37122. Moreover, Indicators unrelated to ICT measure how remote the value of the city's location is, in terms of regional or metropolitan circumstances (Yigitcanlar et al., 2022), and incorporating the Core Humanitarian Standard to measure the issue of the displaced community (Vianello, 2021) are new indicators proposed for future working group in forming more inclusive Malaysian city standards in the post-COVID-19 era.

From the qualitative analysis of the local webinar cases, the author found that most of the concerns for the local players were on the ICT infrastructure, connectivity and data security. These three technicalities played important role as highlighted under the JENDELA, MyDigital blueprint, and the cyber-physical system imagined under the national 4IR policy. However, these issues should be handled in a cautious manner because all these needs high investment and potentially causes a city to bankrupt or go in debts to giant techno-companies, thus in long-term, subjugating the citizen's interest to the private profit interest (Cardullo et al., 2019; Kummitha & Crutzen, 2017). In other words, in building better connectivity and data security, the city administrators should think creatively (i.e., practical-critical-imaginative mindset as proposed by Perry-Kessaris (2020)) to encourage grassroots-invented IoTs, together with viewing 5G connection as a public utility provided freely to the public. On the social side, smart-society type of non-governmental organisations (NGOs) could be set up, such as the formation of MSCA. However, in this grassroot case, the vision of the NGO should be promoting PPPP (public private people partnership) and public values.

CONCLUSION

Issues of city standards could be solved through the consensus of all, and turned into benefits for the people. The future direction for the Malaysian city standards development, not limited to the findings of this article, should be on considering the main focuses of smart and sustainable cities; clarifying and differentiating the different types of indicators; critically modifying the international standards to uphold public values; and handling the ICT infrastructure, connectivity and data security with great grassroot innovation rather than private-driven interest. With regards to the directions in the post-COVID-19 era, the author summarizes that the future cities and standards need more responsible citizenship to achieve the greatest consensus for all, be it from the governance that allows more participatory approaches to the ground innovations with more proactive and aware citizens (Lim et al., 2021; Malek et al., 2021). This study was limited by the method of data collection in Malaysia which was webinar inputs. Future studies could drive more detailed indicators, such as understanding the total

adoption from international standards, proposing working groups on drafting the basic foundation for sustainable city indicators, detailing the existing indicators into five different types as proposed by Huovila et al. (2019), and critically adding new indicators, such as measuring the grassroot-invented IoTs that suit the local contexts.

ACKNOWLEDGEMENTS

The previous version of this article was presented at the International Conference on Integrated Urban Planning (ICIUP2021), Universiti Malaya, Malaysia, on 12 Oct 2021. This article has received no funding sources from any organisation.

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Received: 28th September 2022. Accepted: 1st December 2022