

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

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Abstract

In recent years, the trend of urban policy and planning has moved to designing and building cities that are smart to make them more sustainable and capable of addressing urban problems. In this respect, it is crucial to understand the concept of smart cities (SC) and how various stakeholders play their roles in SC development projects. For countries in the global south, this concept has very little empirical evidence especially concerning the framework of multiple governance based on the idea of quadruple helix (QH). Therefore, this study aims to investigate the role of multiple stakeholders in developing the township of *Bandar Cassia* (BC) in Penang, Malaysia by using the quadruple helix model. In-depth expert interviews were conducted with key informants from the local and regional authorities, government agencies, property developers, NGOs, academia, planners, and policymakers. The findings provided some insights into the characteristics, contributions, and challenges of stakeholders' involvement. It allows for the improvement of the innovative approach in addressing the needs of the city and finally provides a good test bed for applying the concept in various SC projects elsewhere.

Keywords: multiple stakeholders, quadruple helix, smart city, Cassia

1. INTRODUCTION

The rapid and increasing rate of urbanization occurring in many parts of the world in this 21st century is giving more challenges to urban planners, developers, and government in achieving a better quality of life for the urbanites. Thus, developing a sustainable city is one of the attractive options and solutions to minimize the problems generated in this urbanization process, and for that purpose, the SC concept comes in as a viable tool and solution for achieving sustainable urban development. SC has therefore received increasing attention in urban management and planning for developed as well as developing countries (Tan & Taeihagh, 2020; Masik, 2021; Söderström, T. Paasche, and F. Klause, 2014). SC has become a popular strategy to make cities smart and to overcome various problems arising from rapid urbanization, including high population density, inadequate public services, increasing crime rate, and

urban environmental pollution (Chourabi et al 2012). Nevertheless, in the process of developing a city to become smart, many urban governments are facing some degree of challenges (Allwinkle & Cruickshank, 2011). That amongst others are various issues ranging from the beginning of the development such as identifying the priority and creating the policy, to acquiring various types of resources needed for developing the city, and further to find ways in adopting to various stakeholders. Along the way, there are multiple interactions consisting of institutional and non-institutional that necessitate the transformation of these cities to become smart and sustainable. Thus, this study aims to identify the interaction of various stakeholders in the SC project of BC and to analyze their engagement by referring to the quadruple helix (QH) model. It investigates the governance aspect of SC, policy mechanisms, implementation experiences, and transformation of BC, as well as the driving forces and barriers. Finally, is to develop an approach for effective management of stakeholders in developing successful SC.

The paper is organized as follows: first, is the literature review that identifies the several aspects and characteristics of SC, and the role of multiple stakeholders in urban planning and development. Then, the discussion of the theoretical framework focusing on the description of the QH innovation model, followed by an in-depth exploratory case study of BC within the context of QH is presented along several themes related to the relations, the roles, and the challenges within the QH settings. The study concludes by discussing the possibilities and bridging the gap of various stakeholders' engagement in the SC development.

2. LITERATURE REVIEW

2.1. *Smart City as a Concept in Urban Planning*

It has been observed that the increasing interest on SC solutions have brought in many changes to city planning and development. This kind of approach focuses on investments in human and social capital and infrastructure that assist with sustainable economic growth and high quality of life, besides wise management of natural resources, through participatory governance (Caragliu et al. 2011). In this vein, SC can be described as “an intensification of the use of Information and Communication Technology (ICT) and data by local authorities, and in its execution, seeking closer collaboration with other stakeholders, in particular, the citizens” (Borghys et al. 2020; Albino et al. 2015). To move forward with designing policy, planning, and strategizing urban development, local governments can therefore use SC initiatives to manage urban challenges and support various stakeholders in initiating urban sustainability (Nam & Prado, 2011) as well as improving the quality of urban life. In a nutshell, a SC is perceived to present innovative solutions to a various socioeconomic and environmental challenges faced by cities. However,

previous studies have revealed that it is quite challenging for local government to find a role in these complex networks (see Anthopoulos et al. 2016; Walravens, 2016).

As has been noted in many cases and studies, SC projects imply the involvement of various stakeholders including industrial players such as major multinational corporations (MNCs), along with local public authorities, and also local companies, essentially with the aim to provide technological solutions to the local needs. Particularly, to improve municipal operations and services, the SC concept integrates ICT with numerous devices connected to the Internet of Things (IoT) and various other networks (Das, Sharma, & Ratha, 2019). This will assist local officials to communicate directly with the people and monitor what is happening in the communities (Caragliu & Del Bo, 2019). Moreover, ICT can be used to increase the quality, performance, and interaction of urban services while also lowering the costs and conserving the resources – in which case the SC concept can be a tool to resolve municipal problems in order to deliver equitable services to the communities (Caragliu and Del Bo, 2019; Praharaj, Han, & Hawken, 2018). In addition, government sector collaborates with the private sector to bring in technological solutions to the SC, with an emphasis on participatory approach that highlights the importance of citizens as “co-creators and collaborators behind SC governance and decision-making processes” (Glasmeyer et al. 2016; see also Martin et al. 2019; Nesti et al. 2018). Similarly, to include the civil society/citizens in development of SC and to involve many actors at various levels to collaborate have become one of the most important characteristics of SC governance (Martin et al. 2019). In this context, as noted by Glasmeyer et al. (2016), a very fundamental characteristics of the SC development is that civil society (citizens) should be the core actors in society, and through the development of the city, the civil society should benefit from incorporating intelligence in the city operations.

2.2. Stakeholder Engagement and Management in Smart Cities (SC)

In a SC context, identifying the key stakeholders are crucial in planning and delivering effective stakeholder management process. As stressed by Jayasena et al. (2019), stakeholder management involves the identification, classification, communication, engagement, empowerment and risk control. It is important, therefore, to engage stakeholders and to ensure their activities can meet the aims of the SC project. The collaboration initiated with diverse stakeholders is seen as critical in SC for solving complex urban problems and overcoming the obstacles (Clement et al. 2022). In addition, SC strategies that initiates collaboration between stakeholders and local government creates a strong ecosystem, whereby the urban municipalities that develop ‘collaborative ecosystem’ can establish ‘linkages among citizens, government, business, and educational institutions’ (Appio et al 2019: 2). This is in parallel with the idea that to solve public issues will require cross-sector collaboration, which can be defined as “partnership

involving the government, business, nonprofit organizations, communities or the public as a whole” (Bryson, et al. 2006:44). This type of collaboration is vital to handle the technical as well as the social obstacles in urban planning. Collaboration can also increase performance and outcome of smart approach. This relates well to the reason that it is difficult for just one organization to solve public problems by itself, but rather having collaborative action is much of a desired approach (Chen et al. 2019).

Furthermore, in facilitating this collaborative framework, Chen et al. (2019) have highlighted the crucial elements of leadership and trust. This trust element is an intangible value that plays important role and acts as a ‘glue’ to initiate the bonding of actors across the QH spheres. The way individuals within the helix exercise power and enforce to others affects the trust relation between them and how ready they are to collaborate. In this respect, as noted by Miller et al. (2016) the power relationships can affect stakeholders’ willingness to engage in knowledge transfer. Moreover, stakeholder engagement mostly focuses on the multi-stakeholder initiatives, the bonding partnerships, and which platforms are used (Mena and Palazzo, 2012; Rasche, 2012; Selsky and Parker, 2005).

2.3. Regional Collaboration and the Quadruple Helix (QH) Framework

QH is a model of innovation focusing on citizen perspective and engagement in developing a region. It establishes collaboration of four actors including the academia, public sector/government, industry/business and civil society (Tatar et al. 2020, Mora et al. 2019). QH has been developed following the limitation presented by the earlier Triple Helix (TH) model that focuses only on collaboration between Government, Academia and the Industry. Introduced by Etzkowitz & Leydesdorff (2000: 111), the TH framework stresses the interaction of three ‘helices’ which is the academia-industry-government relations and network. Later, an extension to this network is the fourth helix [the civil society]: namely the citizens, non-governmental organisations (NGOs) and consumers (Roman & Fellnhofer, 2022) and their involvement via the “media-based and culture-based public” (Carayannis & Campbell 2009: 206). This involvement refers to media, culture, values, lifestyles, and arts and focuses on the potential of how “public reality is constructed and communicated by the media and thus influence the national innovations system” (ibid). As stressed by these scholars, there is what they called the “innovation culture” which is important in fostering the knowledge-based economy. These processes as they pointed out would be important especially for social innovation where knowledge sharing becomes crucial.

Within this perspective, QH framework is very much aligned with the idea of SC and can create a multi-stakeholder ecosystem in that region. Regional actors and their interactions are important driving force for innovation and technological growth. As suggested by Mercan and Goktas (2011), the innovation

ecosystem in QH is: “an innovation ecosystems consisting economic agents as well as the non-economic relations such as technology, institutions, sociological interactions, and the culture”. At the same time, it also emphasises the role of local government in urban innovation process (Gillespie, 2018). Although many literature explain about the concept of QH and innovation, there are few that analyse its applicability and challenges in relation to regional stakeholders’ collaboration. In relation to QH framework, it is asserted that the municipality and civil society should work together in developing strategic plans for urban-region and to improve the quality of life. These civil society are the end users of innovation and have great influence on generating knowledge (Carayannis & Grigoroudis, 2016), which is extended through networking with stakeholders. Thus, the inclusion of civil society in projects take place through some intermediate organisations that can link with the other stakeholders (government, academia and industry) (Roman & Fellnhofer, 2022).

3. RESEARCH MATERIALS AND METHOD

This study adopts the QH framework to analyze the characteristic and collaborative mechanism of stakeholders in Cassia SC township. It contributes to the current literature on QH framework and how QH arrangement may work in practice and what problems are involved in enhancing the quantity and quality of SC township development in the context of an emerging economy like Malaysia. The research questions include (a) What are the characteristics of the SC governance in BC? (b) What factors contribute to intensive collaboration amongst stakeholders in the SC context? (c) What are the challenges faced by the stakeholders in playing their role? It should be noted that there is a scarcity found in literature that discusses the influencing factors of collaboration characteristics among stakeholders. Borkowska & Osborne (2018) assert that the QH concept emphasizes an engagement process related to development of innovative city services, which complements the public sector with academia, companies, and citizens. However, in practice, scholars have pointed out that a high level of involvement by all the stakeholders are not that easy to achieve (Borkowska and Osborne, 2018).

Nevertheless, from another perspective, this study suggests the notion of institutional readiness at the local level that will be critical for enhancing the helix development. Previous studies demonstrates that a poor focus on the extent of readiness and stakeholder involvement is likely to result in the underperformance of SC projects (Arnkil et al. 2010). Thus, the practical implementation of the BC township project promoting regional QH system propose the various stakeholders’ role and the extent to which they are ready and involved in promoting development and innovation. In this respect, trust factor plays important role and acts as a ‘glue’ to initiate binding process of agents across the helix in order to

establish a meaningful collaboration. Initial data for this study were collected from secondary sources such as planning reports from government websites, policy documents and reports from various agencies, research papers, and news articles from the internet. The empirical data is analysed based on study of the interactions in the QH. Primary data from field work was collected through in-depth interviews with various stakeholders and participant observation (from April 2022 – August 2022). The key informants represented in the sampling for the in-depth interviews were selected from the following stakeholders: (I) Local Authorities [development agencies, politician, municipal administration/management; (II) Business [firm managers and investors, enterprise, property developers]; (III) Science [urbanists, city planners]; (IV) Expert community [Academia]; and (V) Public [NGOs, civil society/local citizens]. Interviews were recorded and transcribed, besides gathering of the field notes. Content analysis technique were used in processing and interpreting the data. The empirical study is exploratory and aimed to identify possible aspects of QH in initiating the SC challenges for the local governance of Bandar Cassia. It aimed at understanding how individual agents worked on a daily basis and perceived their relations to others. By analyzing the institutional settings and the role/contribution of related agents, this study can reveal the dynamics in SC governance in the context of an emerging urban periphery.

3.1. Characteristic of SC Governance, Policy Framework & Participation of Stakeholders

Previous studies have highlighted the importance of policy, technology and community as the drivers of SC (Yigitcanlar, 2018). Policy includes not merely the regulation and the laws but also a conducive governance environment assisting the smartness of a city. The use of technology for instance is emphasized as an element that enables the interaction between citizens and public agencies. In this context, the Malaysian Smart City Framework (MSCF) has defined SC as “cities that use ICT as well as technological advances and innovations in addressing urban issues to improve quality of life and economic growth, create a sustainable and safe environment and promote more efficient urban management” (MSCF: 16). The components stated in MSCF emphasized the “intensification of the application of technology and digitalization in core business functions, enhance the usage of e-payment, attract investment in high value-added industries, create a workforce to match the jobs in these industries, provide technology labs and collaborative platforms, establish incubators and accelerators, and leverage existing government assistance and funding” (Lim et al. 2021). In addition, the federal government specifically emphasised the development of SC in its Eleventh Malaysia Plan (2016-2020), highlighting the challenges of dealing with large populations in cities as “pain points”. These include congestion; pollution; inefficient deployment of public services; and stresses on transport systems. The Plan underlines SC as the solution, citing it as “a next generation approach to urban management with solutions

that address these issues and improve the quality of life of urban dwellers” (Lii Inn, 2019). In this context, there are various issues pertaining to developing a SC -- ranging from identifying the priorities and creating the policy, to acquiring various types of resources, as well as ways in adopting to key stakeholders. For these SC, the application of QH conceptual framework can be a useful approach that is associated with multi stakeholder governance. The key stakeholders and resources involved in facilitating the development of BC can be identified and characterized as local and regional institutions, private sectors, academia, and the communities. This namely includes stakeholders like the Malaysian Industrial Development Authority (MIDA), Penang Development Corporation (PDC), Invest Penang (IP), Seberang Prai Municipal Council (MPSP), State Planning Division (PLAN Malaysia Penang), and Northern Corridor Implementation Agency (NCIA); the private sector/industry [MNCs, SMEs], the academia [KDU, Peninsula College, USM, polytechnics], and the communities [NGOs, local citizens and the media].

In terms of policy formulation, the initiative in Penang is aligned with the federal government policy on SC development. In parallel to achieving the nation’s ideas of SC urban development, an important move by the local government of Penang is the launching of Penang 2030 vision – a blueprint to involve various stakeholders in a “collective effort to bring Penang towards greater heights”- a ‘Family Friendly Green and Smart State to Inspire the Nation’ (voice of Asean, June 23, 2021). In this context, the local government has been very proactive as the driving force of these initiatives and achievement of the strategies/program. This further highlights the importance of initiating partnership between stakeholders in this region (the Public-Private Partnership or the PPP approach). Important themes from the interview findings also emphasized on the element of leadership, trust and executive support that have been highlighted as crucial to facilitate collaboration between key stakeholders. In the case of developing BC, this relationship was developed on local levels, initiated by the state government, and then passed through to other agencies. For instance, in 1989, the then Penang chief minister, instructed the Penang Development Corporation (PDC) to identify an area in south of Seberang Perai to be developed into an economic hub. At that time, it was instructed that PDC is to set up a special task force to investigate which area could be the focus for future development. Then in 1990, the state agency acquired Batu Kawan (see Fig.1), formerly an oil palm plantation owned by a company named Batu Kawan Bhd (theedgemarket.com, march 8, 2022). The state agency official stated how the empty land was firstly initiated for development purpose via some state initiatives:

“We acquired 6000 acres of land in this area where Batu Kawan is an island and we felt that it is the only land that is free from any types of development because it only has oil palm plantation, swampy areas and scattered Batu Kawan village” [PDC ex-CEO, Interviewed 9 June, 2022].

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

In this respect, the state agency official further stated (Malay Mail, 3 June, 2022):

“The PDC strategic plan is to focus on new area of growth based on green and smart city and Batu Kawan was identified as one of the growth areas in Seberang Perai,”

Initially, the aim of the township development was to provide affordable housing for Penangites, generate employment and to reduce the rural and urban gap. In this context, PDC acts as the government think-tank to spearhead the township whereby key experts of the agency were responsible to lead and facilitate the project. A good relationship between the state government and its development arm has been a powerful player in this progress and here the elements of leadership, trust and power had played a significant role. The state government highly relied on PDC’s executive support, with trust on its leadership to initiate and facilitate the project. It was almost for five decades (dating back to the 1970s), that PDC were involved in the planning and implementation of development activities in the state- the planning and creation of townships and transforming rural areas into urban nodes. It started with the opening of the first industrial park in Bayan Lepas, followed by various other township projects and industrial parks that were executed from the framework set by the government (See Figure 1). Policy framework were set up clearly and strategically with PDC heading through with a significant role. Regarding the policy priorities, it was noted by the PDC official:

“We drew up a five-year strategic plan 2019-2023 that is comprehensive, focused action plan to ensure PDC continues to create new growth centres, enhance the value of the assets that we have, support the state government’s initiatives, and strengthen our human capital...And we have been working closely with Invest Penang- another industrial development arm of the state” [PDC ex-CEO, interviewed 9 June, 2022]

More specifically, the policy measures used by PDC in the implementation of development in this region included the following plans (NST, June 3, 2022):

- i. PDC Strategic Plan focuses on new growth areas based on the concept of green and intelligent city.
- ii. Bandar Cassia Development Master Plan which involves a combination of mixed and integrated development
- iii. Development plan at Bandar Cassia Technology Park (BCTP) and Batu Kawan Industrial Park 3 (BKIP 3) to ensure industrial land sufficient demands for investors to promote industries such as 'Electrical & Electronics (E&E), Electronics Manufacturing Services (EMS), Light Emitting Diodes (LED), Medical Devices, Aerospace, Semiconductor, Automotive and other activities
- iv. Penang Science Park South (PSPS) as a general industrial area and halal hub
- v. Focus on the Environmental Social Governance (ESG) and Sustainable Development Goals (SDG) at the land planning stage

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

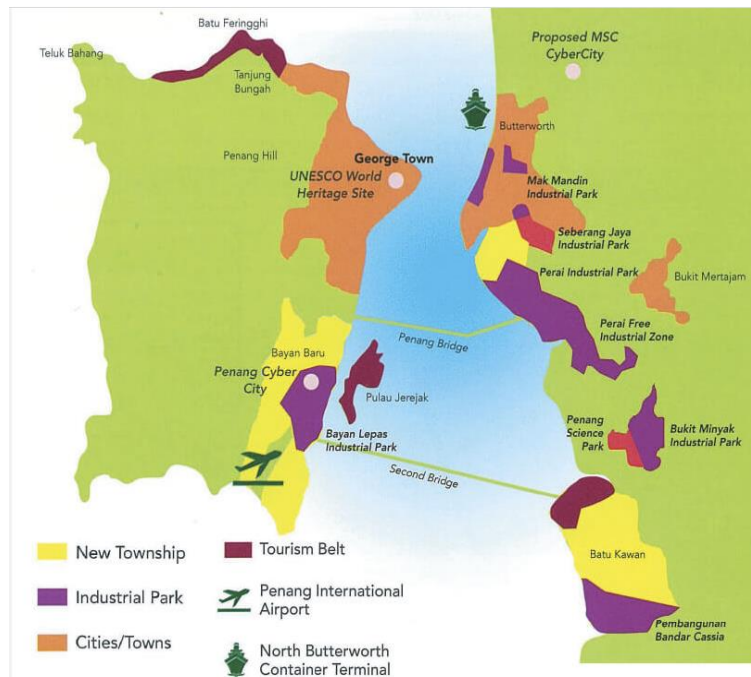


Figure 1 - PDC Industrial Parks in Penang [source:theedgemarkets.com]

A strategic plan was developed, as stated by the agency (penang2030, July 1, 2021):

“The Strategic Plan has three main thrusts: “The first is to create new growth areas. PDC is currently and actively promoting and developing its third township in Bandar Cassia; and has planned for a comprehensive, integrated smart eco-city that boost residential, commercial, educational, medical and industrial components ”

In line with this, PDC specifically developed a series of Master Plan for BC that features a combination of mixed and integrated development involving housing, commercial, education, medical and industries. It was emphasized that the policy priority for developing BC was to focus on a more balanced development with the model of smart and eco city concept, while taking into consideration the importance of collaborative roles from various stakeholders. Pointing out the importance of this collaborative framework, the state agency official stated:

“PDC has positioned Bandar Cassia as a smart city, that is the vision but is the infrastructure adequate? 4G and 5G still not strong enough. Our role is not the whole Penang, there are also other agencies such as TELCO and Digital Penang that needs to take action. The Data Center need to be in Penang and all the stakeholders need to work together” (PDC ex-CEO, Interviewed 9 June, 2022)

In Penang, the state-initiated planning has been practiced for a while with the tradition where the public sector led the project. This state-guided collaboration becomes helpful especially in the beginning stage where the township is being established and new projects are developing. However, at this point participatory governance is still quite limited and most initiatives of SC is based on construction projects

rather than a holistic urban planning [since development were more focusing on ICT infrastructure and real estate development]. After the initial stage of planning and execution, however, the process is sometimes incomplete and not quite transparent. There are sometimes unclear roles and responsibilities that can lead to misunderstanding and conflict. The state agency also must acquire land and sometimes issues arise with property developers [before project proceeds- PDC, Apr 2022].

3.2. Prospects, Challenges and Conflicts Within the QH Framework

As noted before, interaction and networking especially in QH settings are part of a dynamic relationship where regional actors can take role interchangeably through collaboration/joint ventures. However, not much is explored in the literature about this interaction, thus by analysing the QH as a process can inform about the interactions and how or to what extent actors influence the environment. The collaborative efforts in developing SC in BC is conceptualized through the QH framework – through four key stakeholders comprising: local government, industry, universities, and civil society. In addition, the interaction between four helices is designed based on notions of what each of it could contribute to achieve the project targets. Public sectors were expected to contribute with financial resources, policy making, innovation system support and business advisory services. Meanwhile, the private sector provide technologies related to products and services (i.e. ICT-based solutions to increase the visibility of firms to their customers), and knowledge on innovation systems, business clusters and other forms of collaborative practices. The Academia provides training and education, as well as access to business incubators and research spin-offs (see Figure 2).

For the case of BC, public sector particularly the state government and its implementing agencies contribute towards financial resources. Funds from the federal government is often limited and the state have to work on finding their own resources. For instance, the Penang state government in 2022 approved an allocation of RM316.13 million for the implementation of development projects taking into consideration the needs of critical and high-impact projects [BERNAMA, 3 June, 2022]. The funding, however was not sufficient as stated below:

“However, this allocation alone is insufficient to upgrade the facility and requirement network in Seberang Perai and we need a bigger allocation to improve facilities and amenities”

Nevertheless, in supporting the local government, PDC contributed to the state by carrying out some infrastructure projects such as financing the construction of Penang State Stadium in Batu Kawan on PDC owned 120 acres of land (with total cost of RM110 million). All in total, PDC spent over RM 1 billion for developing the state since 1970 (voice of Asean, June 23, 2021). The official described:

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

“PDC is financially autonomous. We make our own money, state and central government are not providing but is this effective? Smart, is the way to go now [thus more funding is needed to develop further]” [PDC ex-CEO, interviewed 9 June, 2022]

Figure 4 below illustrates the QH framework and the elements that each of the helices contributes. A supportive ecosystem that encourage citizen participation, nurture start-up, promote public-private partnership needs to be created to realise their SC vision. In terms of helices connection, the government actors had played their role but the interconnection between the government and academia as well as government and industry seem to be little unclear/not transparent. Meanwhile, collaboration between academia and industry were much clearer [compared to academia and government/government and industry].

Interaction between the academia and other stakeholders [mainly the industry] were focused on the needs for training, technology and incubators for developing the region, as elaborated by the official from K University:

“If you want to grow, it cannot be an organic growth. It has to be fast growth. We have started entering students even during pandemic and we tried to approach industry visit to flat things out with MNCs and SMEs... We bring in final year project, and we started to work with MNCs and SMEs [K University President, interviewed 22 June, 2022]

Regarding collaboration with MNCs and SMEs, the informant stated as follows:

“Penang has a lot of potential, the prospect is good. We provide internship at Flextronics, Intel and Vitrox...we collaborate with Next Glass, they will start operation in August 2022—we have research collaboration with them —Artificial Intelligence in glass technology—it applies new technology to the industry—new emerging technology” [K University President, interviewed 22 June, 2022]

Working collaboratively with other academia and the industry players, the President of K University further highlighted:

“We work with Universiti Sains Malaysia [USM] and sign agreement with USM and we work with other organisations like Study Penang, etc. The industry is very supportive in collaborating with us. We work with the School of Computer Science, USM and also other institutions. We have Study Penang (members among HEI) so we do international marketing together like to Sri Lanka, Indonesia, Thailand, China...”

In addition, the importance of collaborative network between industry and academia is also for nurturing talent and human capital, as the PS College official pointed out:

“The relationship between the industry and the academia should be close as a relationship, but also physically close. The strategy was a lot to provide talent for Batu Kawan Industrial Park [BKIP]. That was what behind the decision to locate here. As I suggest its actively to work with big companies. So the course we offer is much in line with the requirement of the industry here. We also have strong industrial advisory panel to discuss how to align with the industry” [PS College Vice President, interviewed on 8th June, 2022]

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

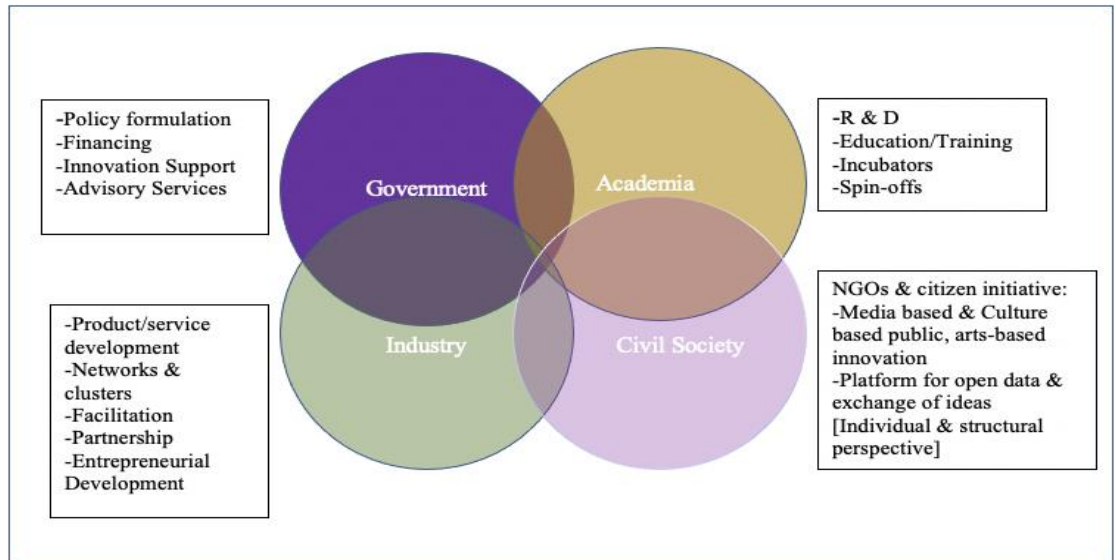


FIGURE 2 - QUADRUPLE HELIX MODEL (SOURCE: ADAPTED FROM LINDBERG, LINDGREN & PACKENDORFF, 2022)

The PS Campus [which is under the PKT Logistics Group] is the first campus to train talents for the BKIP. It was highlighted that: “The campus is fitted with a variety of state-of-the-art facilities to provide students, tenants and the BKIP community at large with an exciting space for education, business, TVET upskilling, events and leisure activities” (PS CEO, 2022). As noted by the CEO of the campus:

“Having top-notch hardware is only the first step, the next is to build a robust ecosystem to help create synergies among all stakeholders – students, businesses, government and community leaders”

The idea of the campus-in-industry model is to expose students to real working environments while they study. Besides that, the college also have a Business Advisory Panel – consisting of key industry players in the region including Bosch, Boston Scientific, Penang Port, Digital Penang, Invest Penang, MIDA, Penang Global Tourism, Federation of Malaysian Manufacturers (FMM) Penang, Lam Research whereby they meet periodically [every six months] for fine tuning and to get feedback on how the college can meet the industry needs [PSC Vice President, interviewed on the 8th of June, 2022]. Meanwhile, the Curriculum Advisory Panel [each of their program here have an advisory panel]--- consisting of UUM, USM (Business School), UNIMEP, UTP, own Board Panels, poly-techs in the northern region, and Industry Program Manager (Academic and non-Academic)[PS Campus Vice President, interviewed on the 8th of June, 2022].

Realising the importance of knowledge and technology transfer to industry and commercialisation of knowledge, the Malaysian Industrial Development Authority (MIDA) also stressed on the need of collaboration with local research institutions/universities and industries to initiate collaboration [MIDA official, interviewed September 5th, 2022]. The programme is set to foster more linkages, interactions,

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

smart partnerships and collaborations between universities and industries through scientific research, innovation and commercialisation of university products and technologies.

Furthermore, to assist with the implementation of SC services infrastructure in place, the Telekom Malaysia (TM) collaborates with Aspen Vision [a subsidiary of Penang based Aspen Group-property developer in BC] to facilitate the deployment of SC services (converged IT and ICT services) for the development of Aspen Vision City in BC. The services includes amongst others smart solutions and services like security surveillance (CCTV), digital signage, smart parking, energy, waste management and others. The Aspen Vision City includes an IKEA store, a gated and guarded commercial enclave, residential and mixed developments, exclusive landed homes, a financial hub, a business hotel, and a 25 acre central park. The collaboration was expected to facilitate the property developer in developing the first SC in the northern region.

Nevertheless, some NGOs have mentioned their concern about the development in this region. As noted below (NST, Sept 11, 2016):

"With increasing awareness of the importance of ecology and environment, we're now seeing the value of industrial heritage and cultural landscapes ...We need to understand the industrial and environmental history of Seberang Perai as the basis of identifying how we can conserve this sense of place through planning and sustainable development."(SKN from PHT)

Regarding collaboration and its challenges, the state agency official stated the following:

"PDC needs to collaborate with state departments, but are the local authorities ready? We work with the City Council, they are like our sibling, but we are more private, not really government. In terms of project, they know what we do.... but when we want to implement, our new ideas are sometimes not accepted by them because they have their own set of requirement that needs approval process....Engagement [with the council] is there but sometimes the acceptance by the officials whether they take our idea or not. If they accept, we need to sit down and discuss further" [PDC ex-CEO, interviewed 9 June, 2022]

Some issues and challenges arise as stated by official:

"The council need to be more proactive in every aspect of development. We as private developers, always have new ideas but cannot proceed because of cost, law, and acceptance" [PDC ex-CEO, interviewed 9 June, 2022]

Furthermore, it is also observed that most of the benefits is not solely for the local communities, but caters for outsiders and foreigners as well. As the Municipal official stated:

"The history of BC is a piece of empty land, unlike in Juru where there is protest from the local communities in the land development agenda, the case for BC is different...the project proceed first...most of the development had no objection from the local communities. The government vision in SPS especially in BC is well planned. It changes with situation although the Master Plan is already approved – we change. Agency 'AB' brings in outside community to purchase property there – they think it is for long term investment ---commercial activity. BC as an Iconic city, a planned township and the residential property sold gets marketing for foreign buyers- sub-sale (Singaporean and Taiwanese)" [PLAN Malaysia, interviewed 20 June, 2022]

In terms of governance process and collaboration with the stakeholders, the municipal official addressed few issues including the following:

“The challenges is the mixed development...to decide what type of commercial, housing etc. in terms of policy, BC is under PDC, sometimes agencies have their own agenda that contradicts with the policy. If needed, they have to change...there are many times they have to change the Master Plan [PLAN Malaysia, interviewed 20 June, 2022].

3.3. Bridging the Gap amongst the Stakeholders – The Roles and Challenges ahead for Urban Innovation Ecosystem

There is some essential characteristic of the SC governance framework: the first is the emphasis on various stakeholders' participation (Nam & Pardo, 2011) whereby their interaction is said to foster innovative and sustainable urban development. The participation of citizen in planning process can identify their needs and lead to development of better services and better living. A SC can support citizen involvement by providing a communication platform, built upon the ICT infrastructure. The second characteristic entails using ICT in governance to enable active participation, collaboration, and transparent decision-making (Pereira et al. 2017). In this sense, the use of online participatory tools can actually encourage the public to participate in decision making process (Afzalan et al. 2017). Commenting on the need to promote more collaboration, one of the state local governments noted on the use of various social media platform:

“State government and agencies should do more to promote stakeholders- system changes, apps development, funding problem etc... some agencies already using social media platform with more than 3.1 million users. We have programs with the communities such as mobile kiosk/van by PBT for development and awareness to the public [PSDU official, interviewed on the 30th of June, 2022]

A similar emphasis can be found in the works by Arnkil et al. (2010) who claim that the user of ICT systems is actually also a co-developer in the modern world of open source innovation. In this respect the concept of a “quadruple helix” is highly beneficial. This is the case, because innovation processes are becoming increasingly open to different stakeholders.

Based on the empirical data, it can thus be discerned of several aspects related to the roles of various stakeholders in the region and how this reveals the perceived notion of each stakeholders in terms of what expectations and challenges that were laid upon them. The collaborative nature between academia and the industry were more straightforward and visible, however collaboration of the government with other stakeholders were not quite transparent, and often incomplete. It seems that the government is

more independent and work on their own and less collaboration, they seem to be working in silo, as noted by the agency themselves.

In terms of engagement and effective collaboration, it was also highlighted that:

“We do start up the ecosystem but we are not actively involved...to form a panel and to discuss is still a problem of territorial...they don't want others to involve and we don't have the power...you have many stakeholders but there is very limited engagement, forum or discussions...there should be more involvement and engagement” [Digital Penang, interviewed on the 28th of June, 2022]

In terms of readiness and the infrastructure, there are few obstacles as mentioned by one of the officials:

“A lot of things have to be done in Batu Kawan...the whole city is driven by the government [state government via PDC] and government has certain targets....the drive is there but some people are still reluctant. The problem is that basic services is very limited, the demand is not quite there – advance in technology is important to attract the population” [K University President, interviewed 22 June, 2022]

The official further stressed that:

“Infrastructure needs to be fast – shopping mall, entertainment, food, petrol station. Challenges here in BC is the infrastructure especially road transportation and traffic congestion are an issue especially during peak hours...the facilities need to grow faster, the 5 G and internet connectivity is not as good, it cannot support life video. If BC is to develop as a digital hub, it must move faster... The city needs to be modern and advance in technology. International students want better infrastructure, world class amenities like Singapore” [K University President, interviewed 22 June, 2022]

“The problem we have here in BC is that the industry move faster than academia...lifelong learning is important, and we need to continue to work with the industry and on knowledge sharing...academia really need to catch up” [K University President, interviewed 22 June, 2022]

3.4. Challenges in Incorporating the Fourth Helix:

In the context of BC, the involvement of the fourth helix (the civil society) can be seen at a later stage- where SC is served as a platform, a holistic approach that engage private and civil actors' active participation (Hwang, 2020). In this case the municipal tries to engage private sector and citizens more in the development – private sector develops technological solution and at the same time consults citizens on developing citizen-centric smart services. The priority given to the governance and its network, therefore, shows that SC is not merely emphasizing on technology but also human and institutions (Neirotti et al. 2014). Here all actors collaborate with government as the facilitator. In this context, the public agency provides a platform that encourage networks among private, academic, and civil society, whereby the government [state agencies, planning department etc.] promote communication among stakeholders and reflect their opinions in the ongoing planning process.

Relating to the involvement of the civil society, one of the state agencies commented:

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

"MBSB also conduct programs with the communities. We also have Town Hall session and invite/receive comments from social media users. There are many constructive comments and can be accepted. In line with this, many apps have been developed" (SUK, 30 June 2022).

He further noted the following:

"There are some NGOs giving courses like program to teach the golden ages to use smart phones for payment, awareness programs...though it will take some time [for the communities to adapt and change with the technology]" (PSDU, interviewed 30 June 2022).

In relation to the quadruple helix conceptualizations that also emphasize (1) the involvement of citizens; (2) adding media-based and culture-based publics, this study reveal some notion and extent of this perspective. Taking the case of the role of citizen in media based and culture based public for example, the Ikano Centres [the developer and part of IKEA Southeast Asia], has launched the Creative Spark, an art-based platform aimed at bringing communities together through arts mentorship program. The initiative started with the unveiling of the 'Building Yourself' graffiti mural, anchored by IKEA Batu Kawan. Connecting back to the conceptual framework of QH, Carayannis and Campbell (2017) suggest that the fourth helix is "the societal elite of well-educated, well-informed consumers that participate in innovation systems by being active, demanding and imaginative".

The mural (Figure 3 below) was completed by a local artist and graduate students in collaboration with Can Public Art, a creative place-making team specialising in street and public art. It is a symbolic representation to the new community living and township at BC, whereby the mural portrays cultural elements inspired by music, education, learning, arts, and pop-culture. An augmented reality component is applied where viewers can use their smartphones to scan the mural to watch it animate. 'Building Yourself' is the largest interactive outdoor painted mural in Penang supported by the Penang State Art Gallery and in this context it provides the community to embrace their innovative and imaginative mind

As noted by the Assistant Manager of IKEA (<https://en.pnasia.com/releases/apac/ikano-centres-ignites-creative-spark-an-initiative-to-transform-its-meeting-place-in-batu-kawan-314142>):

"The Creative Spark project is just one of the many initiatives we launch with our local communities. We aim to empower our visitors to get involved, participate, and enjoy our meeting places across all regions...Our plan for every destination is to facilitate learning, provide inspiration and memorable experiences, as well as ignite connections within the community," [AM, IKEA Southeast Asia's Shopping Centre and Mixed-Used Director]

On further note, he stated that:

"We are thrilled to be able to provide a platform for new uprising talents to showcase their abilities, sharpen their skills, and connect with like-minded people.



FIGURE 3 - MURAL AT BC (SOURCE: AUTHOR'S FIELD WORK COLLECTION, JUNE 2022)

The importance of public participation/citizen involvement is acknowledged by the city governance, however, their role is limited to participation in public contests or events that public agencies organized. For instance, the establishment of the *facebook* community of the BC as stated below (Figure 4), which functions as a communicative and interactive platform to inform new updates and to express community concerns of the current development:

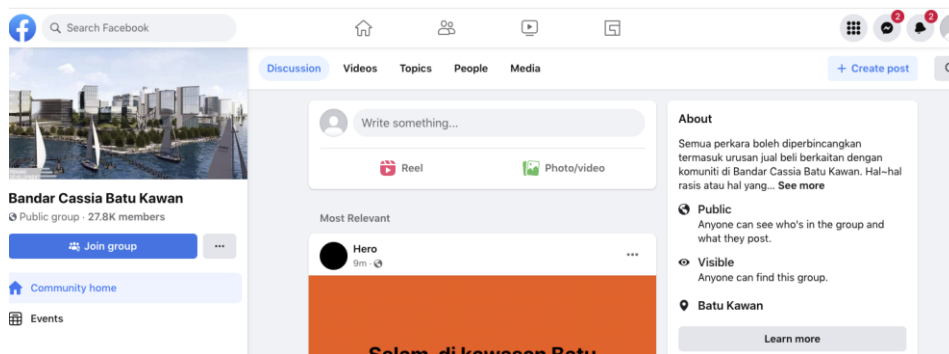


FIGURE 4 - BC FACEBOOK PLATFORM (SOURCE: [HTTPS://WWW.FACEBOOK.COM/BANDARCASSIA](https://www.facebook.com/BANDARCASSIA))

The participation of the citizens is considered as meaningful development where one can see their involvement in SC development based on the government's initiatives/framework. In relation to this, it was highlighted that the local government should be playing the prime role in facilitating and implementing:

"The focus on local government is very important because they are the one very close to the rakyat (the citizen)" (PSDU official, interviewed on the 30th of June, 2022).

It was further emphasized that there is still a lack of engagement that binds together all the actors, as noted by the following official:

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

"I think the state department like Penang Smart Delivery Unit (PSDU) should not look at smart city as a government driven thing, PSDU should be involved and engaged in projects as well...you have many stakeholders and private sectors there [in BC] but there is no engagement, forum and discussion" (Digital Penang official, interviewed on the 28th of June, 2022).



FIGURE 5 - ASPEN VISION CITY AT BC [SOURCE: AUTHOR'S FIELD WORK, JUNE 2022]

Covering 245 acres of freehold land in Bandar Cassia, AVC is the collaboration between Aspen Group and Ikano Pte Ltd, owner of popular furniture franchise IKEA.

4. CONCLUSIONS

This exploratory study aimed to gauge the extent of multiple stakeholder engagement and local government role and to identify the challenges encountered in promoting and encouraging the QH framework in SC development. The study integrates existing issues depicting the experience of SC in Malaysia and to tease out the various aspects of its development within the QH framework. The BC governance framework is a mixture of multilevel participation and partnership of public and private sector, academia, industry and civil society. Different government departments and agencies involved in planning while the project's execution is contracted out to private firms and developers. The planning documents emphasized on citizen centric services however citizen involvement is limited at the policy and planning stage but more visible at the implementation level.

The key success factor for BC would be more on the connectivity aspects (physical and non-physical), availability of services, data sharing and inclusivity with higher public participation. For BC although it is well recognized that it is vital to involve citizens in decision making and agenda setting in the SC initiatives, the participation is still limited. Citizens are involved in Town Hall session in giving opinion and anticipated

and purported by the local governance to be heard but often this can be very minimal and less effective when it comes to the decision making that favors the respective agencies and policy makers. From the data analysis, it is evident that the local government agencies use social media for public involvement in city planning. Those who use social media, use it in a way for communicating with people which often precludes their scope of direct participation in actual city planning. To make sure that the social media can be a supplemental tool of public involvement in planning, local government need to develop further distinct policies and invest resources as well as giving access to participation not merely at the implementation level but also at the initial level where the planning itself takes place. Nevertheless, in the case of BC and in Penang generally, the advancement in ICT made it possible for local government agencies to use social media tools like Facebook, Twitter, Flickr, YouTube and others to provide information to the public, educate them, and seek their inputs and ideas for meaningful decision making in SC projects (at a minimal level). Good governance practices need to be exercised in this context and more collaboration need to be strengthened between the agents/actors. An effective measure to intensity this interaction of the helices is that universities can take more effective leadership role in promoting the urban governance and advancing not only technological matters, but also emphasising the active role of the helices in developing process innovations and carrying individual and structural perspectives for the SC in BC. In conclusion, SC strategies should not merely rely on narrow 'technological approach'. With smart infrastructure, it cannot solve many urban problems and improve the quality of life. The technology do not address many socio-economic factors and the real needs of the population. Certain targets remain largely unfulfilled, and the implementation of an integrated approach implies a number of things such as the ability to integrate management decisions taken at various levels and predict how change in one system can affect other systems. Thus, a focus on effective interdisciplinary collaboration through the QH and the ability to deal with resistance to changes should be the focus.

Findings further revealed that the limitation of achieving a smart city in Penang municipalities includes a lack of financial resources, inadequate infrastructure, delays in the decision-making process, lack of clarity, proper engagement, and compliance in various strategic actions of the stakeholders. There is a need for an increased and new forms of cooperation and knowledge sharing between cities and beyond silo administration. The study recommends, inter alia, that the municipal leadership should encourage techno-centric governance while adhering to human-centric approach, a source for external funding, engage knowledgeable strategic leadership, facilitate public education, and ICT inclusive strategy. The governance process here could be more intricate than the developed nation because developing countries are still en route to meeting the basic needs of all citizens. The high financial cost involved in infrastructure maintenance pose unique challenges to the governments SC ideals which need to be

THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

unpacked. Governments need to step up their efforts to fulfil the basic infrastructure needs of citizens, raise more revenue, construct clear regulatory frameworks to mitigate the technological risks involved, develop human capital, ensure digital inclusivity, and promote environmental sustainability. A supportive ecosystem that encourages citizen participation, nurtures start-ups, and promotes public-private partnerships need to be created to realise their smart city vision. This study explored the state of SC development in developing country and the unique sets of driving factors that propel the rise of SC in BC and the exclusive challenges that it faces, thus providing policy insights and practice recommendation that government in developing countries could anchor on and draw lessons from in SC development.

ACKNOWLEDGEMENT

The author would like to thank the Penang Development Corporation for the opportunity given during the data collection period.

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THE USE OF QUADRUPLE HELIX MODEL IN SMART CITIES DEVELOPMENT: EVIDENCE FROM BANDAR CASSIA TOWNSHIP IN PENANG, MALAYSIA

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