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Comparative review of Smart City from an urban planning perspective in Johor Bahru City and Petaling Jaya City

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Abstract. Smart cities are of great importance globally, and Malaysia recognizes this importance. The Malaysian government has launched various initiatives to encourage the ‘Smart City’ such as the framework (Malaysia Smart City Framework), blueprints, action plans, and standard, the Malaysian Standard for Smart Cities. The outlines the definitions, key principles, and strategies for adopting smart cities in Malaysia’s development. This study aimed to contribute to the understanding of smart city development in Malaysia and provide valuable insights for policymakers, urban planners, and researchers in their efforts to create sustainable and efficient cities. The objective of this study is to compare the approaches and outcomes of smart city development between Johor Bahru City, Johor, and Petaling Jaya City, Selangor. This has analyzed and comprehended the trends in various features of smart city development of the cities. The study found that Johor Bahru City is making more efforts to develop as a smart city through effective governance and strategic planning for short-term and long-term goals same as Petaling Jaya City but focuses more on a one-stop center which promotes community togetherness with the governance. Nevertheless, at the regional level, Johor Bahru City has the Iskandar Malaysia Smart City Framework promoting Sustainable Smart City Vision, followed by the Johor Smart City Blueprint at the state level, and implemented via blueprints at the local authorities, which sets it apart from Petaling Jaya City. Both cities have well-planned smart city initiatives that integrate technology, energy, and the environment, including support for smart city components that suit their needs. Despite facing challenges, the city serves as a model for smart and sustainable development.

1. Introduction

Smart city initiatives [1] have gained significant attention and acceptance globally, including in Malaysia. A smart city is a concept that involves the application of modern technologies and data-driven conceptions that improve the quality of life, sustainability, and resilience of urban areas [2]. The concept of a smart city encompasses various characteristics that define its goals and objectives. These characteristics are derived from the attributes of a smart city, which include sustainability, rapid urbanization, quality of life (QoL), and collective intelligence [3]. Quality of life (QoL) is a crucial aspect of smart cities. The goal is to enhance the well-being and satisfaction of city dwellers by leveraging innovative technologies and providing efficient and sustainable urban services [4]. Therefore, the idea about smart city encompasses various characteristics, including sustainability, rapid



urbanization, quality of life, and collective intelligence. Smart cities aim to improve the efficiency of cities, promote socio-economic development, and enhance the quality of life for their inhabitants.

About smart city that described as a city with solid characteristics, intricate social and data-driven transformation, and information technology [5]. It is a city that is physically, socially, and digitally connected [6]. The characteristics of a smart city can be further elaborated by examining different definitions and perspectives. For example, Harrison et al. defined a smart city as an instrumented, interconnected, and intelligent city [7]. Giffinger and his colleagues identified several key dimensions of a Smart city, including a Smart Economy, Smart Mobility, Smart Environment, Smart People, Smart Living, and Smart Governance [8]. These dimensions highlight the importance of technology, and sustainability, approaches in the development of smart cities. However, it is crucial in order to note that the conception of a smart city isn't without its challenges and conflicts. While the goal of a smart city is to enhance city performance and living conditions, cities often pursue other goals that may conflict with the characteristics of a smart city, such as sustainability and competitiveness [9]. Additionally, the concept of a smart city is often indistinct and ambiguous, with various definitions and interpretations [10]. This lack of clarity can hinder the understanding and implementation of smart city initiatives succinctly. This study aimed to contribute to the understanding of smart city development in Malaysia and provide valuable insights for policymakers, urban planners, and researchers in their efforts to create sustainable and efficient cities. The objective of this study is to compare the approaches and outcomes of smart city development between Johor Bahru City and Petaling Jaya City. The study covers 7 smart city components such as; 1) Smart Mobility, 2) Smart Digital Infrastructure, 3) Smart People, 4) Smart Governance, 5) Smart Economy, 6) Smart Living, and 7) Smart Environment.

Malaysia recognizes the potential benefits of smart city development, such as enhanced urban planning, efficient resource management, and improved public services [11]. The evolution of smart cities in Malaysia can be traced back to the Multimedia Super Corridor (MSC) initiative in the 1990s. The MSC Malaysia initiative launched in 1996, aimed to transform Malaysia into a global hub for information and communication technology (ICT) industries [12]. It established the Multimedia Super Corridor, a designated area that provided incentives and infrastructure to attract ICT companies and promote research and development activities [12]. The success of the MSC Malaysia initiative and the development of Cyberjaya as a smart city have influenced the approach to smart city development in Malaysia. The MSC aimed to transform Malaysia into a technology-driven nation and attract investments in the information and communication technology (ICT) sector [13]. The MSC served as a precursor to the development of smart cities in Malaysia, laying the foundation for the adoption of advanced technologies and digital solutions. Cyberjaya, located within the MSC, is often cited as a model for smart city development in Malaysia [14]. It was designed as a planned city with a focus on ICT infrastructure, connectivity, and sustainable development [14]. The city incorporates smart technologies and digital solutions to strengthen the living standards of residents, encourage financial expansion [14], enhance sustainability, and optimize resource management [15]. In the field of smart cities, design thinking plays a crucial role in driving digital transformation and shaping the future of cities [16]. The integration of digital technologies supports the expansion of smart cities and enables wise resource direction and sustainable economic growth [17]. The use of ICT, IT services, IoT, AI, and ML are integrated into the governance and development of smart cities [18]. Meanwhile, Putrajaya, the administrative capital of Malaysia, is another example of a smart city in the country [19]. It was designed as a planned city with a focus on sustainable development, efficient transportation systems, and smart infrastructure [19]. Putrajaya serves as a model for urban planning and smart city development, with its emphasis on green spaces, smart transportation, and efficient resource management. The concept of smart cities in Malaysia has been influenced by international examples and models, such as the Multimedia Super Corridor Malaysia initiative, Cyberjaya, and Putrajaya. These initiatives have served as inspirations for smart city development in Malaysia, showcasing the potential benefits of integrating technology, sustainability, and efficient urban planning. Therefore, to support the development of smart cities in Malaysia, the government has launched various initiatives and policies. For example, the Malaysian Ministry of Science has launched a national IoT strategic roadmap to drive the adoption of

IoT technologies in various sectors, including smart cities [20]. The government has also emphasized the use of ICT as a key enabler for national development, as reflected in the Malaysia Plans [21]. The Malaysian government has recognized the importance of smart city development in addressing urban challenges and promoting sustainable development [2]. The rapid urbanization in Malaysia has led to increased efforts in implementing smart city initiatives to manage urban issues such as congestion, energy consumption, crime, and pollution [2].

In conclusion, smart city evolution in Malaysia has been driven by the recognition of the potential benefits of advanced technologies and data-driven solutions in improving urban living conditions. Initiatives such as Petaling Jaya City and Johor Bahru City illustrate Malaysia's efforts in creating sustainable and innovative urban environments. Hence, the evolution of smart cities in Johor Bahru City (Johor State) and Petaling Jaya City (Selangor State) in Malaysia has been influenced by various factors and initiatives especially from the development of Cyberjaya and Putrajaya as a denominator of the smart city model in Malaysia. However, the implementation of smart city initiatives in Malaysia faces challenges related to infrastructure, social inclusion, and consistent frameworks. The government's support and the active participation of stakeholders are crucial for the successful development of smart cities in Malaysia.

2. Petaling Jaya City

Petaling Jaya was first introduced in the early 1950s as a satellite town to resettle squatters from Kuala Lumpur [22]. The rapid population growth in Kuala Lumpur led to the need for additional housing and the development of new towns like Petaling Jaya [22]. The squatters in Kuala Lumpur were living in informal settlements, such as along the Gombak and Klang Rivers and railway lines [13]. The resettlement program aimed to address issues such as poverty, social problems, and low education levels associated with squatter settlements [23]. The development of Petaling Jaya as a new town involved the construction of affordable housing, known as the People's Housing Programme (PPR), to relocate squatters from overcrowded areas [24]. The PPR aimed to offer rational and acceptable affordable cost-effective for settlers to be shifted to great boroughs and urban localities [24]. The construction of social housing was supported by the government through the allocation of funds in the National Plans [25]. However, there were challenges in meeting the targets for social housing construction, leading to a high rate of influx of migrants to the city and the continued existence of squatter settlements [25]. Hence, the development of Petaling Jaya as a new town also involved urban planning and design principles. The design and planning of new towns in Malaysia, including Petaling Jaya, have been influenced by British town planning principles. These principles aim to create modern ideal cities and have shaped the layout and infrastructure of Petaling Jaya, emphasizing factors such as walkability and mixed land use. However, the development of new towns in Malaysia has also taken into account local factors, resulting in the development of a unique regional character. The development of Petaling Jaya as a smart city is influenced by various factors, including the need for environmental monitoring and sustainable transportation solutions [26][27].

The evolution of smart city development in Petaling Jaya, Malaysia, has been influenced by various factors and initiatives. The Smart Selangor Blueprint has integrated planned developments like Petaling Jaya City into the larger smart city framework [14]. The implementation of e-participation platforms and participatory governance has been explored to enhance citizen engagement in smart city initiatives [28]. Additionally, the use of artificial intelligence-assisted air quality monitoring has been considered for smart city management in Petaling Jaya [29]. Therefore, the thought of data-driven smart eco-cities has also been discussed within the context of strategic sustainable urban development in Petaling Jaya [30]. The development of new towns, such as Petaling Jaya, has been a response to rapid urbanization and population growth in Malaysia [22]. The influence of new technologies on urban fiscal structure and regional integration has been examined, highlighting the potential for economic growth and knowledge spillovers [31].

In the context of Petaling Jaya, the development of smart cities is also influenced by regulatory factors and urban planning principles. The design and planning of new towns, including Petaling Jaya,

have been based on British town planning principles, which aim to create modern ideal cities [32][22]. However, these new towns have also incorporated local factors, such as local technologies and site conditions, resulting in the development of a unique regional character[32][22]. The regulatory aspects of urban planning play a pivotal role in shaping the growth of new towns and ensuring sustainable and efficient urban growth [26][22]. Regulatory factors and the influence of British town planning principles have shaped the development of new towns like Petaling Jaya in Malaysia [32][22]. These principles have shaped the layout and infrastructure of the city, emphasizing factors such as walkability, mixed land use, and the separation of vehicle traffic from pedestrian movement [33]. The underlying components of data-driven smart sustainable cities have been explored, emphasizing the need for an integrated approach to urban development [30]. The design of spaces and the consideration of sustainability have been important aspects of urban development in Petaling Jaya[1]. Therefore, the development of smart cities in Petaling Jaya, Malaysia, is influenced by regulatory factors and urban planning principles. The design and planning of new towns, including Petaling Jaya, have been based on British town planning principles, but have also incorporated local factors to create a unique regional character. The regulatory aspects of urban planning play a crucial role in shaping the development of new towns and ensuring sustainable and efficient urban growth. Additionally, the local context factors, such as geographic location and population density, also influence the design and priorities of smart city initiatives in Petaling Jaya.

The sustainability of smart cities in Malaysia, including Petaling Jaya, has been assessed using the ESG model, highlighting the importance of local communities' awareness and participation [34]. The project of Smart IoT Greenhouse is also another effort towards a smart sustainable resilient PJCity 2030 as in Figure 1. Therefore, public participation, stakeholder partnerships, and participatory governance are essential for the achievement of smart city schemes. The understanding and acceptance of smart city policies have been examined from the perspectives of practitioners, emphasizing the need for effective implementation and stakeholder engagement[28]. Hence, the understanding and acceptance of smart city policies require effective implementation strategies and stakeholder engagement. The development of smart cities should consider the needs and perspectives of citizens, promote inclusivity, and address urban challenges. Government support, cross-sector partnerships, and evaluation frameworks are crucial for the successful implementation and assessment of smart city initiatives.



Figure 1. Smart IoT Greenhouse PJCity 2030[35]



Figure 2. PJ Smart Center or Smart Development Control System (SmartDeC)

Overall, Petaling Jaya was established in the 1950s as a satellite town to resettle squatters from Kuala Lumpur. Then, it evolve with the evolution of smart city development in Petaling Jaya, Malaysia, has been driven by various factors such as urbanization, technological advancements, sustainability goals, and citizen engagement. The integration of technology, participatory governance, and data-driven approaches has performed a significant function in shaping the development of smart cities in Petaling Jaya. In addition, the development also involves environmental monitoring, urban planning, regulatory factors, transportation, waste management, and education. These aspects are interconnected and require a comprehensive and integrated approach to ensure the successful transformation of Petaling Jaya into a smart and livable city.

3. Johor Bahru City

The Johor Bahru, the second-largest metropolitan area in Malaysia after the capital city, has experienced rapid urbanization and development [36]. The city is strategically located near the border with Singapore, making it an important economic hub in the region [37]. The location of Johor Bahru City, situated in a strategic location and space, has also influenced its evolution as a smart city[37].

The evolution of smart cities in Johor Bahru City (Johor State) has been influenced by various factors and initiatives. The Iskandar Malaysia Smart City Framework and the Johor Smart City Blueprint have been implemented to guide the development of smart city initiatives at the regional and state levels [38]. The focus in Johor Bahru City has been on effective governance, strategic planning, and short-term and long-term goals [2]. The implementation of smart city initiatives in Johor Bahru City has been supported by the use of technology and the integration of various elements such as smart mobility, smart technology, smart governance, and smart living [2]. Figure 2 shows the smart city components adapt in Johor Bahru.

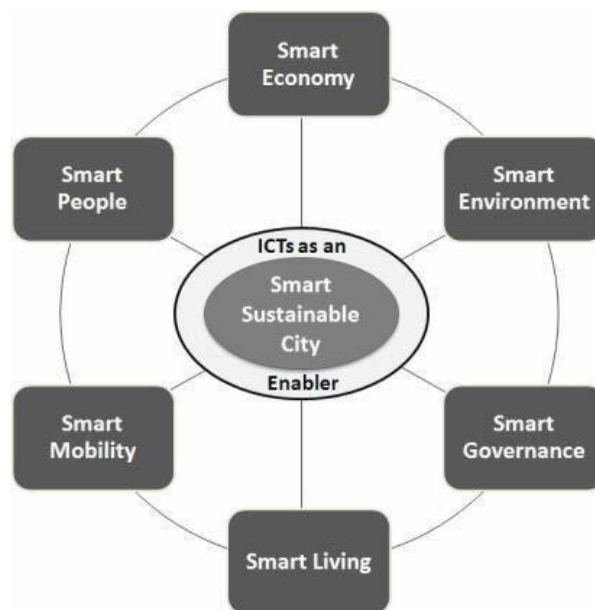


Figure 3. Smart City components adapt in Johor Bahru[39]



Figure 4. Johor Bahru Smart City Transformation website[40]

The city has been actively involved in climate alleviation and modification actions, with plans to achieve smart city status[38]. Use of technology has been employed to advance climate decreasing and

alteration efforts[38]. This can be seen from the procedure for environmental sustainability and green college initiatives at Universiti Teknologi Malaysia in Johor Bahru has also been reviewed [41]. Therefore, the approach to environmental sustainability and green campus initiatives at Universiti Teknologi Malaysia in Johor Bahru has been important in reducing environmental pollution, engaging students and faculty members in eco-campus activities, assessing the campus environment, promoting waste management, and considering the perceptions and behaviors of the university community. These initiatives are essential for creating a smart and sustainable environmentally friendly environment in Johor Bahru.

The spatiotemporal land use and land cover change in major river basins in Johor Bahru have been studied to understand the spatial characteristics and environmental consequences of development [42]. However, the social production of space in Johor Bahru has been analyzed to understand how different social perceptions and experiences contribute to urban transformation[43]. The integration of public art and the assessment of adaptable urban environments have been explored to enhance the image and liveability of Johor Bahru City Centre[45][44].

The urban transformation in Johor Bahru is closely linked to economic development and globalization. Iskandar Malaysia, launched in 2006, is a major economic development corridor that aims to cater to the needs of Johor Bahru and promote future economic involvement in the country [46]. The rapid development activities in Iskandar Malaysia have transformed Johor Bahru into a more production- and services-based economy [47]. This development has led to changes in the social and physical landscapes of the city, impacting the social perceptions and experiences of space towards the influence of the smart city concept in Johor Bahru.

Overall, the evolution of smart cities in Johor Bahru City has been driven by a combination of technological advancements, environmental considerations, and urban planning, impacting the social and economic perceptions of the smart city concept in Johor Bahru.

4. Comparative studies

Therefore, to examine the implementation of smart city initiatives in the neighboring south region, Johor Bahru City and Petaling Jaya City were chosen. Smart city initiatives aim to influence technology and data to enhance living standards, sustainability, as well as efficiency in urban areas[48]. These initiatives involve various aspects such as urban planning, transportation, energy management, and governance [49][50]. These cities have declared their smart city initiatives through various city authority sources namely city authority documents. A smart city initiative identified from these cities consists of a compilation of information and data obtained from various municipal websites and publicly accessible documents. Observations and data were also gathered from the websites of these cities. Although the study observed several comparative exercises, it found the city function epitomized in the city's vision and mission prevents a true comparison of cities. Aside from economic and technological variables, structural factors, and other city-specific factors, [51] indicated that other factors might influence the type and level of Smart City implementation. Hence, Petaling Jaya is a city near Kuala Lumpur that has been growing since the 1950s. The city has a plan to become a world-class metropolis that is smart, sustainable, and resilient. The Petaling Jaya City Council is working on a new blueprint for this, which will be published soon. This blueprint will help make Petaling Jaya a leading and dynamic city. In addition, Johor Bahru and Petaling Jaya are two cities in Malaysia that are working towards becoming smart, sustainable, and resilient. Johor Bahru has a city council called the MBBJ that manages the city center and other areas. The state government of Johor has created a blueprint called the Johor Smart City Blueprint 2030 to help the city reach developed status by 2030. This blueprint has seven parts: smart government, smart people, smart economy, smart living, smart mobility, smart environment, and smart digital infrastructure. There are many policies, strategies, projects, agencies, and target indicators to help guide the city. Petaling Jaya also has a vision of becoming a leading, dynamic, and sustainable city. Both cities have plans to achieve their goals. However, while Petaling Jaya's blueprint is still being written and will be published soon, Johor Bahru has already published its blueprint. Both cities want to be sustainable, smart, and resilient. It will be interesting to see how they both grow in the future. Based

on comparing the initiatives implemented in selected cities like Petaling Jaya and Johor Bahru, the table was developed. These two cities have undertaken a variety of initiatives and the table attempts to show the level of implementation of those initiatives. An overview of the descriptors is presented in Table 1. A comparison of smart city initiatives is made by comparing the two cities' implementations.

Table 1. Comparison of Smart City initiatives in Petaling Jaya City and Johor Bahru City.

	Petaling Jaya City	Johor Bahru City	Similarity	Differences
Name of Policy	Petaling Jaya Smart, Sustainable and Resilient City Blueprint	Johor Bahru Smart City transformation	Strategies that focus on e-governance and community-centric	Johor Bahru Smart City Action Plan 2030(Pelan Tindakan Khas Bandar Pintar MBBJ (2030) While MBPJ is the first city council to launch a smart command center
Level	Local authority/City	Local authority/City	Both with city council status	
Local authority	Petaling Jaya City Council(MBPJ)	Johor Bahru City Council(MBBJ)	-	-
Start	2018	2018	-	-
Dimensions	Smart IoT Green House Smart Land Use	Community-centric	Community-centric	MBPJ launched an e-platform, PJKita for citizens to involve in smart sustainable city
No. of initiatives/actions/strategies	-	29 policies,54 strategies, 111 projects involving 119 agencies as well as 124 target indicators	-	29 policies,54 strategies, 111 projects involving 119 agencies as well as 124 target indicators for MBBJ
Description	SmartDec innovation by the Department of Urban Planning to control, manages, and plan development in the administrative area	Johor Bahru Smart City Transformation under City Council	-	Specific department handle in MBPJ compare to MBBJ

of the Petaling Jaya City

Therefore, the Malaysia Smart City Framework (MSCF) is a national-level framework that leads the planning and development of smart cities in Malaysia. It serves as a recommendation for diverse stakeholders and key players, including local authorities, state governments, federal ministries, industry players, and academicians. The MSCF includes a definition of a smart city comprehensively in the context of Malaysia's standpoints and pinpoints seven key components of a smart city: Smart Economy, Smart Living, Smart Environment, Smart People, Smart Government, Smart Mobility, and Smart Digital Infrastructure. Hence, Johor Bahru is one of the cities in Malaysia that is actively implementing smart city initiatives meticulously. Subsequently, the Johor Smart City Forum (JSCF) held in June 2023, organized by PLANMalaysia@Johor, has focused on urban management, solutions, and technological revolution to develop a human-centric smart city with the involvement of multi-stakeholders. In addition, the Country Garden Forest City project in Johor Bahru aims to create a smart and green futuristic city that integrates environment, technology, and cutting-edge technology showing how strong the influence of smart city development in Johor Bahru City. Despite that, Petaling Jaya is another city in Malaysia that is actively implementing smart city initiatives. The Petaling Jaya City Council (PJCC) has implemented various low-carbon projects based on the MSCF, emphasizing a low-carbon approach with intelligent technology for urban planning, and even developed a center that manages it in detail as PJSmart Center. This has shown how the PJ Smart City project in Petaling Jaya genuinely concentrates on achieving a sustainable and resilient vision for the city through the use of smart technology. For this reason, both Johor Bahru and Petaling Jaya's smart city initiatives align with the seven key components of the MSCF. In conclusion, the Malaysia Smart City Framework provides a comprehensive guide for planning and developing smart cities in Malaysia. Johor Bahru and Petaling Jaya are actively implementing smart city initiatives based on this framework, with a focus on improving various aspects of urban life through the use of technology and ICT that aim to improve the quality of life for urban residents by addressing urban challenges respectively.

5. Conclusion

In conclusion, the evolution of smart cities in Johor Bahru City and Petaling Jaya City in Malaysia has been influenced by various factors, including rapid urbanization, government initiatives, participatory governance, technological advancements, and international examples. The integration of technology, participatory governance, and data-driven approaches has acted a significant responsibility in shaping the development concerning smart cities in Petaling Jaya. In addition, the development also involves environmental monitoring, urban planning, regulatory factors, transportation, waste management, and education. These aspects are interconnected and require a comprehensive and integrated approach to ensure the successful transformation of Petaling Jaya into a smart and sustainable city. The execution concerning smart city initiatives in such cities aims to handle urban difficulties and achieve living standards, sustainability, and resilience from the development of the smart city concept. Meanwhile, the evolution of smart cities in Johor Bahru City has been driven by a combination of technological advancements, environmental considerations, and urban planning, impacting the social and economic perceptions of the smart city concept in Johor Bahru. However, when the comparative review was made regarding the smart city initiatives in Johor Bahru City and Petaling Jaya City these two cities achieved an advanced level of implementation in terms of smartness. It is submitted that Johor Bahru City had no choice but to employ the smart agenda to ensure its survival as a city-state.

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