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Evaluating the Smart City Status and Acceptance of ISO Standards: A case study of Malaysian Local Authority

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Abstract
While most national smart city frameworks outline the urban challenges, local authorities struggle to translate the top-down plan and align the action plan with ISO 37122 indicators, including the case of Majlis Bandaraya Diraja Klang (MBDK), Malaysia. This study aims to evaluate MBDK's smart city status and examines the acceptance of ISO standards. The quantitative survey findings indicate a positive perception of smart city status, with unanimous agreement on the importance of ISO standards. This research contributed to one of the pioneer studies evaluating the acceptance of ISO indicators in smart city development in Malaysia and beyond.

Keywords: ISO indicator; smart city action plan; smart city standard acceptance; stakeholder collaboration

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1.0 Introduction

Many countries in the developed and developing world are executing smart urbanism to achieve a sustainable urban future. Ensuring the smart city action plan's compliance with the national smart city blueprints and (ISO) international standards is crucial for dispelling scepticism and ensuring comprehensive implementation. Malaysia introduced its national smart city framework (MSCF) in 2018, with local implementation planned for 2022–2023 (Ministry of Housing and Local Government, 2018). This MSCF provides guidance for local authorities, governments, businesses, academics, and other stakeholders in planning and developing smart cities (Lim, Malek, Hussain, et al., 2021). It emphasises the importance of smart cities in Malaysia, aiming to achieve national and international goals while addressing urban challenges such as inefficient service delivery, pollution, and traffic congestion. It also ensures Malaysia remains aligned with global urban development trends (British High Commission Kuala Lumpur, 2021; Lim, Malek, & Hashim, 2021).

Malaysian smart city initiatives focus on improving livability, fostering economic growth, ensuring safety, and promoting effective urban management (Lim & Malek, 2022). The main goals are a competitive economy, a sustainable environment, and an enhanced quality of life. The MSCF includes seven key components: smart economy, smart living, smart environment, smart people, smart

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government, smart mobility, and smart digital infrastructure (Malek, Lim, & Palutturi, 2021). Several cities/states, including Iskandar Malaysia, Putrajaya, Ipoh, Penang, Melaka, and Selangor, have begun implementing the MSCF. Furthermore, Malaysian Standard MS ISO 37122:2019 Sustainable cities and communities – Indicators for smart cities was launched in 2021, and Malaysia National Annex to MS ISO 37122:2019, Sustainable cities and communities – Indicators for smart cities was launched in 2023. According to the Federal Department of Town and Country Planning Malaysia (PLANMalaysia, 2023), these Malaysian standards should be considered when drafting smart city action plans at the local level.

While MSCF outlines the urban challenges, local authorities are struggling to translate the challenges and align their smart city action plans with MS ISO 37122 indicators (Lim, 2022; Lim, Malek, & Hashim, 2021; Ravimalar, 2024), including the case of Majlis Bandaraya Diraja Klang (MBDK) is undetermined, leading to uncertainties. The objective of this study is twofold. First, it evaluates MBDK's smart city status, and secondly, it examines the acceptance of ISO standards. The former is through assessing the smart city status from the perspectives of sustainability, collaboration and implementation of smart city action plan, while the later is through examining the.respondents' acceptance of the ISO standards from the six smart city domains of smart city action plan implementation. The following sections reviews the background of adoption ISO smart city standards in Malaysia, and the city of Klang in moving towards smart city development, followed by the explanation fo research methodology, discussion and conclusion.

2.0 Literature Review

2.1 Indicator of MS ISO 37122 and the National Annex: Measuring progress with 85 Indicators across 19 Categories

In 2021, Malaysia identically adopted ISO 37122 and published it as MS ISO 37122 (with 80 indicators). 2023, it added another five indicators by publishing the national annex to MS ISO 37122. The adoption of the MS ISO 37122 Smart City Standard includes indicators in domains such as economy, governance, environment, living, mobility, and people. These indicators, tailored by PLANMalaysia, provide a framework for evaluating economic growth, transparency, environmental sustainability, quality of life, transportation infrastructure, and social inclusion. They serve as essential metrics for tracking the performance and progress of smart city projects in Malaysia, enabling effective monitoring and data-driven decisions for sustainable and inclusive urban development. The MS ISO 37122:2019 Standard Smart City Indicators benchmark Malaysia's smart city efforts against global standards. Malaysia has approved these indicators as "identical adoption," with a 'National Annex' adapting them to local needs (PLANMalaysia, 2023).

Moreover, the MS ISO 37122 standard for smart cities offers indicators to assess cities' performance and progress in their journey toward smart and sustainable development. However, access to the specific list of indicators within MS ISO 37122 is currently unavailable (Yussoff, 2021). Therefore, PLANMalaysia has prepared a comprehensive framework for evaluating and monitoring cities' success in transitioning to smart cities, encompassing 85 indicators across 19 categories (Figure 1). These indicators, carefully designed within the categories, measure various aspects of urban development and sustainability, allowing cities to assess their performance, identify improvement areas, and track progress. The adoption of such a standardised framework enables comparability and benchmarking among cities, fostering the exchange of best practices and promoting sustainable smart city development globally.

Fig. 1. MS ISO 37122 - 85 Indicators across 19 Categories
(Source: PLANMalaysia, 2023)

The Ministry of Housing and Local Government explains that the ISO 37122:2019 standard covers diverse smart city indicators in various categories (Figure 2). For Smart Government, it includes non-emergency response time, online city services, citizen engagement in planning, and e-submission for building permits. Smart Living indicators encompass indoor air quality, sensor-equipped garbage bins, smart energy meters, river water quality monitoring, green buildings, and electronic waste recycling. In the Smart Mobility – Transportation category, there are indicators like sharing economy transportation, real-time transport lines, e-payment for parking, intelligent traffic lights, low-emission vehicles, and micro-mobility-sharing services. The Smart Economy category includes open data city services, new businesses, ICT labour force, education, R&D, sharing economy, and e-payment. Smart Digital Infrastructure – Telecommunication indicators cover high-speed broadband, internet coverage, and addressing connectivity gaps. Lastly, the Smart People category focuses on indicators such as digital learning devices, STEM higher education degrees, and proficiency in other languages. These indicators offer a comprehensive assessment of a city's progress in becoming a smart city, facilitating a holistic evaluation and enabling targeted improvements to achieve smart city goals.

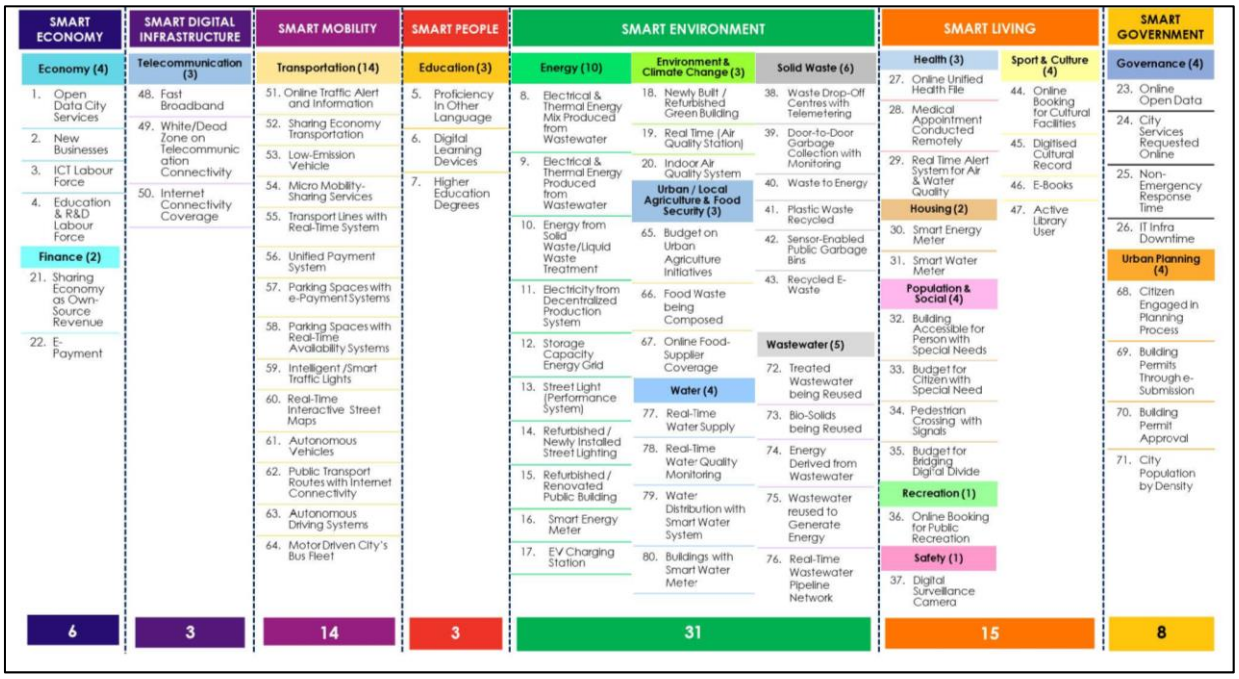

Fig. 2. Alignment of the ISO 37122 City Indicator according to the seven domains of a smart city
(Source: Ministry of Housing and Local Government (2023))

2.2 Klang smart city

Klang, located in Selangor, Malaysia, is progressing towards becoming a smart city, aiming to enhance the quality of life for its residents and promote sustainability through technology and data integration. Klang proclaimed a royal city status effective from 23rd November 2023, has officially changed its name, Majlis Perbandaran Klang (MPK), to Majlis Bandarayja Klof Klang ang (MBDK) (Muthiah, 2024). The Klang city has published its Draft Klang Smart City Action Plan in May 2023 and endeavours to establish a connected and efficient urban environment by incorporating digital technologies into various facets of city life. This initiative aligns with the implementation of the MS ISO 37122:2019 indicator, reflecting Klang's commitment to leveraging innovation for a more sustainable and inclusive urban future (Table 1). These efforts underscore Klang's dedication to creating a vibrant and forward-thinking city for its residents.

Table 1. Seven domains of implementing smart city in Majlis Bandaraya Diraja Klang (MBDK)

Domains	Functions	Aspect / Focus
Smart Government	Enhancing governance and public service delivery through digital technologies and data-driven decision-making.	• Digitising government services. • Promoting transparency. • Citizen engagement. • Efficient administrative processes.
Smart Economy	Promoting economic growth, innovation, and entrepreneurship through integrating digital technologies into business processes.	• Supporting digital industries. • Fostering startups. • Facilitating e-commerce. • Enhancing international trade and investment.
Smart Community	Empowering and engaging the community through technology-enabled platforms for participation, collaboration, and access to information.	• Citizen engagement. • Digital inclusion. • Promoting social cohesion. • Providing platforms for community collaboration and communication.

Smart Mobility	Improving transportation systems, reducing traffic congestion, and enhancing the efficiency and sustainability of mobility.	• Intelligent traffic management. • Integrated public transportation. • Smart parking solutions. • Promoting active transportation and alternative mobility options.
Smart Living	Enhancing the quality of life for residents through the adoption of smart technologies in various aspects of daily living.	• Smart homes. • Energy-efficient buildings. • Digital healthcare services. • Smart safety and security systems. • Promoting a healthy and connected lifestyle.
Smart Environment	Promoting sustainability, environmental conservation, and efficient use of resources through the application of smart technologies.	• Smart waste management. • Monitoring and reducing environmental impacts. • Promoting renewable energy. • Encouraging eco-friendly practices.
Smart Digital Infrastructure	Establishing a robust digital infrastructure to support and enable various smart city initiatives and services.	• High-speed internet connectivity. • Data centers. • IoT infrastructure, cybersecurity measures. • Data management systems.

(Source: Majlis Perbandaran Klang, 2023)

In Klang Smart City Action Plan 2030, ongoing initiatives are working towards transforming the city into a more connected, sustainable, and technologically advanced urban environment, such as smart traffic management, digital government services, green initiatives and sustainability, digital infrastructure development, and smart community engagement. Additionally, Klang strongly emphasises improving digital skills among residents, recognising the importance of preparing individuals for the digital economy's demands. These efforts align with Klang's goal of creating a smarter, more livable, and inclusive city for its residents (Rajendra, 2023). While specific projects may vary, the overarching objective of Klang's smart city transformation remains consistent: to build a city that meets the needs of its citizens, enhances their quality of life, and ensures a sustainable and technologically advanced future.

3.0 Methodology

The study used quantitative survey questionnaires. By incorporating appropriate question structures and thoughtful guidance, the questionnaire served as a reliable tool to gather accurate and meaningful data, contributing to the overall success of the research project. This research included two types of questions, close-ended and open-ended, in the questionnaire. The assessment of respondent experience and opinion on the standards of a smart city in Klang primarily relies on open-ended questions utilising a 5-point Likert scale. The questionnaire is thoughtfully divided into four main sections (Table 2).

Table 2. Section in questionnaire

Section A Respondent's Demography	Gender, age, marital status, race, and other relevant details.
Section B The Perception of Klang Smart City Status	Delves into perceptions of the status of smart city in Klang through the Klang Smart City Action Plan 2030.
Section C The acceptance of ISO Smart City Standard	Respondent's acceptance of incorporating ISO standards in the six domains of Klang Smart City Action Plan 2030.
Section D Respondent Suggestion	Respondent's suggestion for improvement in smart city development in Klang.

(Source: authors)

In this case, the questionnaire distribution occurred at MBDK from June to July 2023. The research collected 120 respondents, comprising MBDK officers, consulting officers, and members of the public through stratified random sampling in the Planning Department, one-stop center, and MBDK's main lobby. All respondents were knowledgeable about the ISO standards. This sample size of 120 participants was deemed acceptable and reliable, providing a 95% confidence level with a 10% margin of error, ensuring a representative data collection process (Israel, 1992).

4.0 Findings

4.1 Respondent's demography

In this study, 120 respondents were sampled from various categories within MBDK. According to Table 3, gender distribution was evenly split, with 50% identifying as male and 50% as female. The age distribution showed that most respondents were in the 18-24 age group (38%), followed by 25-34 (40%). Participants aged 35-44 comprised 20%, while those aged 45-54 were 0.8%. Marital status revealed that 50% were single, 49.2% were married, and none were divorced. Regarding race, the majority were Malay at 49.2%, Indian at 20.8%, and Chinese at 30%.

Table 3. Respondent's demography

	Item	Frequency	Percent (%)
Gender	Male	60	50.0
	Female	60	50.0
Total		120	100
Ages	18 – 24 years old	46	38.0
	25 – 34 years old	48	40.0
	35 – 44 years old	25	20.0
	45 - 54 years old	1	0.8
	55 – 64 years old	0	0
	> 65 years old	0	0
Total		120	100
Marital status	Single	61	50.8
	Married	59	49.2
	Divorced	0	0
Total		120	100
Race	Malay	59	49.2
	Indian	25	20.8
	Chinese	36	30.0
Total		120	100
Employment	Government	47	39.2
	Private	53	44.2
	Self-employed	20	16.7
Total		120	100
Position	Supervisor	11	9.2
	Officer	52	43.3
	Assistance technical	57	47.5
Total		120	100
Sector	Education	18	15.0
	Urban planning	102	85.0
Total		120	100
Origin	Local (inside MBDK)	48	40.0
	Inside Selangor	63	52.5
	Outside Selangor	9	7.5
Total		120	100

(Source: authors)

4.2 The status of smart city in Klang

Respondents in Klang showed strong agreement on the potential of the Klang Smart City Action Plan to enhance sustainability and reduce environmental impact, with a mean rating of 4.05 (Table 4). They also recognised the importance of collaboration among government, businesses, and citizens for effective implementation, reflected by a mean rating of 4.08. These results underscore the respondents' appreciation for collective efforts in achieving smart city goals. Overall, there was moderate acceptance of implementing smart city standards in Klang, with a mean rating of 3.91, indicating a generally positive attitude. The low standard deviations suggest a consistent level of agreement among respondents on each statement.

Table 4. The implementation status of smart city initiatives in Klang

Item	Scale					Mean	Sd.	Total
	1	2	3	4	5			
To enhance sustainability and reduce environmental impact.	0 (0%)	0 (0%)	25 (20.8%)	64 (53.3%)	31 (25.8%)	4.05	0.684	120 (100%)
A successful smart city requires collaboration between the government, businesses, and citizens.	0 (0%)	0 (0%)	25 (20.8%)	61 (50.8%)	34 (28.3%)	4.08	0.700	120 (100%)
The implementation of smart city standards in my city.	0 (0%)	0 (0%)	34 (28.3%)	63 (52.5%)	23 (19.2%)	3.91	0.686	120 (100%)

Notes: (1) Strongly Disagree (2) Disagree (3) Either Agree or Disagree (4) Agree (5) Strongly Agree. (Source: authors)

4.3 The acceptance of ISO Smart City Standards in Klang

According to the survey results, implementing MS ISO 37122 - Indicators for Smart Cities is expected to significantly enhance six domains of smart city initiatives (Table 5). The highest mean rating of 4.08 was for Smart Government initiatives, indicating that respondents believe these standards will greatly improve governance and public services in Klang. Smart Mobility initiatives also received a high mean rating of 4.05, suggesting perceived significant benefits in transportation and connectivity. Other areas, including Smart Living, Smart Environment, Smart Digital Infrastructure, and Smart Community, had mean ratings between 3.88 and 4.03, reflecting positive expectations for improvements in healthcare, waste management, environmental sustainability, digital infrastructure, and community development.

Table 5. Respondents' acceptance of MS ISO 37122 in smart city initiatives in Klang

Item	Scale					Mean	Sd.	Total
	1	2	3	4	5			
Smart Government initiatives	0 (0%)	0 (0%)	25 (20.8%)	60 (50.0%)	35 (29.2%)	4.08	0.705	120 (100%)
Smart Economy initiatives	0 (0%)	0 (0%)	36 (30.0%)	61 (50.8%)	23 (19.2%)	3.89	0.696	120 (100%)
Smart Community initiatives	0 (0%)	0 (0%)	33 (27.5%)	60 (50.0%)	27 (22.5%)	3.95	0.708	120 (100%)
Smart Mobility initiatives (i.e., Transportation)	0 (0%)	0 (0%)	28 (23.3%)	58 (48.3%)	34 (28.3%)	4.05	0.720	120 (100%)
Smart Living initiatives (i.e., Healthcare, Waste Management)	0 (0%)	0 (0%)	28 (23.3%)	60 (50.0%)	32 (26.7%)	4.03	0.709	120 (100%)
Smart Environment initiatives	0 (0%)	0 (0%)	38 (31.7%)	59 (49.2%)	23 (19.2%)	3.88	0.705	120 (100%)
Smart Digital Infrastructure initiatives	0 (0%)	0 (0%)	33 (27.5%)	61 (50.8%)	26 (21.7%)	3.94	0.702	120 (100%)

Notes: (1) Strongly Disagree (2) Disagree (3) Either Agree or Disagree (4) Agree (5) Strongly Agree. (Source: authors)

5.0 Discussion

This research aimed to identify the status of smart city action plan implementation and to examine the acceptance of ISO smart city standards by MBDK, Selangor, Malaysia. Findings showed unanimous agreement on the need for a smart city in Klang and the significance of ISO Smart City Standards for MBDK. This positive result is aligned with Rajendra (2023). However, opinions varied on whether Klang is currently perceived as a smart city, with most respondents agreeing but a few dissenting.

Regarding the smart city status, respondents strongly agreed that implementing the smart city action plan could enhance sustainability, reduce environmental impact, and require collaboration among government, businesses, and citizens. This understanding reflects the importance of collective efforts in achieving smart city goals while considering the multi-stakeholder collaboration issues, as pointed out in Ravimalar (2024). Most respondents acknowledged a correlation between incorporating the ISO standards into the Klang Smart City Action Plan, suggesting alignment between the action plan and ISO standards. However, some respondents did not perceive or were unaware of this relationship. The data also revealed that while most respondents rated the potential benefits of smart city standards highly, indicating a positive outlook, a smaller group expressed a neutral rating, reflecting uncertainty.

For the acceptance of ISO smart city standards, respondents identified smart government, mobility, and living as the domains that would benefit most from smart city standards in Klang. While smart environment, economy, digital infrastructure, and smart community initiatives were also considered important, they were slightly less prioritised. These findings contradict Lim, Malek, Yussoff et al. (2021) study on the acceptance of the MSCF as practitioners accepted the domains of economy, living, people, and governance and rejected the domains of environment, digital infrastructure, and mobility. Especially on smart mobility, Lim, Malek, Yusoff et al. (2021) found that respondents were worried about the traffic planning presented in the MSCF and were unconvinced by the solutions related to electric vehicles, smart traffic management, and public transport applications. These three aspects can be reference points for the MBDK to scrutinise in their implementation.

While there is general acceptance and a positive perception of adopting MS ISO 37122 standards in the Draft of Klang Smart City Action Plan 2030, challenges such as high implementation costs, privacy and security concerns, lack of public awareness, and resistance to change from traditional systems need to be addressed. These challenges underscore financial implications, data privacy and security risks, the need for education and communication, and overcoming resistance from established systems as seemingly raised by Lim (2022), Lim, Malek and Hashim (2021), and Ravimalar (2024). Strategies for improvement include targeted communication, education, demonstrating cost-effectiveness, ensuring data privacy and security, and promoting stakeholder collaboration. Despite its importance, the smart environment has yet to receive specific development proposals.

6.0 Conclusion

In conclusion, the research on evaluating the smart city status and acceptance of smart city standards in MBDK offers valuable insights into the perceptions, challenges, and benefits of implementing smart city initiatives. The findings reveal a general acceptance and positive perception of smart city standards among participants and an understanding of the importance of ISO Smart City Standards. However, challenges such as implementation costs, privacy, security concerns, lack of public awareness, and resistance to change were identified. Embracing smart city standards will position the city as a model for technological innovation, environmental sustainability, and citizen-centric services. Successful implementation will require ongoing commitment, collaboration, and adaptability to meet residents' and stakeholders' evolving needs and expectations. The limitations of this study include not reviewing other developing and developed countries' smart city standard development. This has resulted in a lack of comparison between the findings of the case of MBDK. Future research may consider conducting comparative studies in different countries, such as Indonesia and Thailand. This research provides a foundation for informed decision-making, policy development, and practical interventions in implementing smart city standards. By embracing smart city standards, other Malaysian cities can learn from the case of MBDK to create a sustainable, technologically advanced, and livable city for its residents and future generations.

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Paper Contribution to Related Field of Study

This research contributed to one of the pioneer studies in evaluating the acceptance of ISO indicators in smart city development in Malaysia, and it serves as a valuable resource for decision-makers and practitioners in smart city implementation locally and beyond.

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