Role of private companies as mediators in enhancing smart city performance: insights from Malaysia.

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THE ROLE OF PRIVATE COMPANIES AS MEDIATORS IN ENHANCING SMART CITY PERFORMANCE: INSIGHTS FROM MALAYSIA

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Abstract
This study addresses two objectives: firstly, to discern the relationship between local government, private companies, and the performance of smart cities, and secondly, to elucidate the role of private companies in the nexus between local government and smart city performance. A stratified random sampling technique was used, and 2,000 questionnaires were distributed via an online survey to all urban populations of smart cities in Malaysia. About 399 responses were collected. Findings underscore a positive and significant relationship between local government and private companies as well as the performance between private companies and smart cities. Additionally, private companies were found to mediate the relationship between local government and smart city performance.

Keywords: mediator, private companies, smart city, performance.

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1.0 Introduction

Multiple studies on smart city rankings reveal that Malaysia has not been included in the evaluation process. Experts assert that Malaysia's smart cities remain underdeveloped (ASEAN Today, 2018). Urban challenges such as traffic congestion, pollution, and inefficient urban planning persist, as noted in the 12th Malaysian Plan (Lim et al., 2021; KPTP, 2019). Additionally, experts predict that by 2050, 90% of Malaysia's population will reside in urban areas (ASEAN Today, 2018). The emergence of new cities integrates advanced technologies to improve the quality of life and foster highly efficient work environments (Mao et al., 2023).

The development and performance of smart cities involve complex interactions between local governments, private companies, and citizens. However, significant challenges exist, including public-private coordination issues and failures in public procurement (Akgün, Gerli, Mora, & McTigue, 2024; Rani & Boubekeur, 2020). This study examines the influence of local government and private companies on smart city performance and clarifies the role of private companies in this governance nexus (Alaverdyan et al., 2018; Rani & Boubekeur, 2020).

Research Objectives:

1. Investigate the influence of local government on smart city performance and private companies.
2. Determine the impact of private companies on smart city performance.
3. Elucidate the role of private companies in the relationship between local government and smart city performance.

2.0 Literature Review

This section forwarded a brief discussion on smart cities in Malaysia, theory, and discussion on the relationship between local government, private companies, and smart cities' performance in Malaysia.

2.1 Overview of the Development of Smart City in Malaysia

Previously, efforts from the government towards smart cities in Malaysia were elaborated, especially for Cyberjaya, by implementing projects and infinitives to transform Cyberjaya into a smart city model (Suda, Rani, Krishnan, & Boubekeur, 2023). Transitioning to this new model requires training the municipalities and their workforce, as well as reviewing their policies and strategies as compulsory and correct. However, some of the staff of the government entities argue that this is hard to achieve due to their busy schedule and lack of skilled people (Talebkhah et al., 2021).

2.2 Smart Cities Performance

Smart cities utilise advanced technologies and data analytics to improve urban living, infrastructure, and sustainability, with performance varying based on governance, technological integration, and community involvement. In Malaysia, smart city initiatives aim to enhance the quality of life through collaboration between the government, the private sector, and academia. Policies like the National Urbanisation Policy and Smart City Framework guide developments such as smart street lighting, intelligent transport systems, and smart grids. Key hubs like Johor Bahru and Klang Valley and expanding cities like Melaka, Kuching, and Kota Kinabalu are leading these efforts (Leong, Heng, & Leong, 2023). A study found that while Malaysia's smart city policy is accepted, improvements are needed in implementation and stakeholder engagement (Lim, Malek, Yussoff, & Yigitcanlar, 2021). Research also shows local communities' awareness and readiness impact smart city sustainability (Chong et al., 2022). Effective policy execution, collaboration, and community engagement are crucial for success (Pratama et al., 2023).

2.3 Principles Related to Governance of Development and Management of Smart Cities – Public Sectors and Private Sectors

Smart city governance requires an integrated approach, combining public and private sector efforts to manage urban complexities and leverage technological innovations. Transparency, inclusivity, accountability, and sustainability are essential for effective governance, utilising technology to enhance collaboration between citizens and governments, and improving service delivery and decision-making (Anthopoulos, 2017). ICT enables efficient data collection, analysis, and policy implementation, supporting real-time responses to urban challenges. However, this adoption necessitates strong cybersecurity and data privacy protections (Meijer & Bolívar, 2016). The public sector plays a crucial role by establishing regulatory frameworks, addressing socio-economic disparities, and overcoming financial and infrastructural challenges (Tan & Taeihagh, 2020).

Meanwhile, the private sector contributes through investment, innovation, and infrastructure development via public-private partnerships (PPPs). For PPPs to succeed, transparent contracts and alignment between private incentives and public welfare are necessary (Osei-Kyei & Chan, 2017). Smart city governance must be adaptive and inclusive to avoid exacerbating inequalities while building sustainable, resilient urban environments (Mora, Deakin, & Reid, 2019).

2.4 The Role of Public and Private Sectors on Smart Cities Development and Performance

The collaboration between the public and private sectors is crucial for the success of smart cities, enabling technological innovation, efficient services, and sustainable urban growth. The public sector provides the regulatory framework, funding, and fosters public-private partnerships (PPPs), ensuring that smart city projects meet societal needs. In developing countries, policies focused on digital inclusivity and environmental sustainability are vital (Tan & Taeihagh, 2020). The private sector offers ICT, infrastructure, and data analytics expertise, enhancing efficiency and scalability (Scholl & Thorson, 2019). Private investments improve service delivery, making cities more sustainable and cost-effective (Batty & Xie, 2020). PPPs combine public oversight with private-sector innovation but raise concerns about accountability (Voorwinden, 2021). Tatu City in Kenya illustrates how PPPs can address urban challenges through investment and technology (Moyo, 2021). However, issues on data privacy, surveillance, and privatisation of public spaces require transparent policies and community engagement to maintain public trust (Graham, 2022).

2.5 Theories Related to the Study

The New Public Management (NPM) Theory and the Neoclassical Growth Theory provide a foundational framework for understanding this study. Emerging in the late 1970s and widely adopted by OECD nations, NPM introduced a series of initiatives and policies to integrate commercial management principles and entrepreneurial approaches into public sector administration (Ridley, 1996). This theory has played a pivotal role in driving innovation within the public sector, particularly influencing the accounting and auditing industries. Given that the primary objective of NPM reforms was to enhance efficiency, effectiveness, and accountability in public administration, these reforms were highly appealing to various governments (Pudjono et al., 2025). Consequently, NPM can help explain the role of the private sector as a key stakeholder in the implementation of local government policies and projects, thereby indirectly contributing to the success of smart cities in Malaysia. Additionally, the Neoclassical Growth Theory provides an economic perspective on the stability and sustainability of economic growth, emphasising the interplay of three fundamental factors: labour, capital, and technology (Banton, 2019). This theory serves as a valuable tool for researchers in examining the relationship between private enterprises, local government, and the development of smart cities, highlighting the economic mechanisms that underpin their success.

2.7 Knowledge Gaps

The exploration of public and private sector roles in enhancing smart city performance in Malaysia reveals knowledge gaps, especially regarding the private sector's role as a mediator. Malaysia's unique socio-economic and political landscape demands tailored governance frameworks for smart cities, but research on effective public-private partnerships (PPPs) specific to the country is limited. The "Smart City Handbook: Malaysia" provides foundational insight but calls for more research on PPP models (Ministry of Housing and Local Government Malaysia (KPKT), 2021). Additionally, understanding factors influencing stakeholder acceptance of smart city initiatives is essential. While some research touches on this, there is limited focus on the private sector's mediation in gaining stakeholder buy-in. The article by Hamamurad, Jusoh, and Ujang (2022) suggests further investigation into private sector contributions. Addressing these gaps will enhance the understanding of public-private dynamics, supporting effective and sustainable urban development strategies.

2.7 The Interaction Between Private Companies, Local Government, and Malaysian Smart City Performance

Partnerships between public entities, corporations, nonprofits, government agencies, and philanthropies are essential for the development of smart cities (Cui et al., 2022; Leite, 2022). These cities offer numerous business opportunities, especially for small and medium-sized enterprises (SMEs) and self-employed individuals, all contributing to the revitalisation of urban areas. Such initiatives align with attributes like vibrant urban environments, local identity, and social networks that foster creative and innovative cultures (Paskaleva et al., 2021). Smart cities present vast business potential, attracting companies with access to large urban markets globally. Governments back long-term strategic infrastructure investments to enhance citizens' quality of life and urban transformation (Boubekeur, Rani, & Krishnan, 2021). However, successfully implementing these initiatives in local markets requires the government and private sector's combined capacity and capabilities (Flynn et al., 2018). Effective policymaking is crucial for the success of Malaysian private firms in smart city projects. Therefore, four hypotheses were deduced, and Figure 1 illustrates the conceptual framework forwarded for this study.

H1: There is a direct influence of local government on smart city performance.
H2: There is a direct influence of local government on private companies.
H3: There is a direct influence of private companies on smart city performance.
H4: Private companies play a mediating role in the relationship between the government and smart cities' performance.

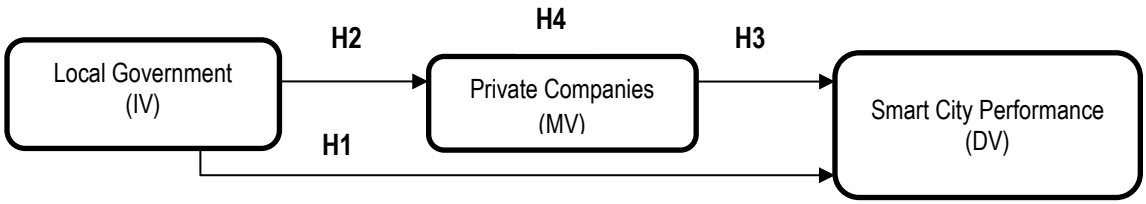

Figure 1 Conceptual Framework

3.0 Methodology

This section briefly discussed sampling, data collection, questionnaire development, reliability analysis results, ethical issues and concerns, and pilot study.

3.1 Sampling and Data Collection

This study utilised purposive sampling to target individuals living in and using smart cities in Malaysia, a non-probability method that selects respondents based on predefined criteria (Etikan & Bala, 2023; Palinkas et al., 2022). Additionally, convenience sampling was used by sourcing respondents from LinkedIn for easy access (Saunders et al., 2023; Taherdoost, 2022). While purposive and convenience sampling can lead to sample bias and limit generalizability (Taherdoost, 2022), it was necessary for the study's criteria. For the pilot study, 600 questionnaires were distributed online, with 50 responses (8.3%), and the full data collection yielded 399 responses (9.98%) over two years.

Table 1 Sampling and Data Collection

Smart Cities in Malaysia	Population	%	Question Link 1st Phase	Question Link 2nd Phase	Usable Data	Usable %
Georgetown – Penang	222,200	2%	40	40	3	0.7%
Kuala Lumpur – Greater KL	1.8 million	18%	360	360	202	51%
Selangor & Cyberjaya - Selangor	6.3 million	64%	1,280	1,280	157	39%
Johor Bahru-Johor	502,900	5%	100	100	22	6%
Kuching - Sarawak	570,407	6%	120	120	5	1%
Kulim - Kedah	336,440	3%	60	60	9	2%
Kota Kinabalu - Sabah	244,700	2%	40	40	1	0.3%
Total	**9,976,647**	**100%**	**2,000**	**2,000**	**399**	**100%**

3.2 Questionnaires Development and Reliability Analysis Results

The questionnaires divided into two (2) parts which are part A is on the profiles of the respondents, and Part B is on the variables for the study, which are local government (independent variable), private companies (mediating variable), and smart city performance (dependent variable). For part B, a five-point Likert scale (1= "strongly disagree", 2= "disagree", 3= "neither agree nor disagree", 4=" agree'', 5 = "strongly agree'') was used to measure the agreement of respondents with the statement for Local Government, Private Companies, and Smart City Performance (refer Table 2).

Table 2 Part B Questionnaires: Factors, Items, Source, and Cronbach's Alpha

Factor (Variable)	Total Items	Source	Pilot Study	N	Final	N
			Cronbach's Alpha		Cronbach's Alpha	
Local Government	9	Joshi et al, 2016; Alaverdyan et al, 2018	0.930	50	0.952	399
Private Companies	5	Picatoste, et al., 2018; Gupta, 2019	0.969		0.979	
Smart City Performance	11	Lombardi, et al, 2011	0.956		0.956	

3.3 Ethical Issues and Concerns

During data collection, the researchers did not force any individual to participate. Since the data was collected using an online survey, the respondents responded voluntarily and at their own pace. The researcher did not expose the personal particulars of the respondents, such as their names and workplaces, which were kept confidential.

3.4 Pilot Study

In the pilot study, 86% of the 50 respondents were Malaysian, 68% were female, 78% were under 40, and 80% were Malay. Additionally, 78% were from the non-government sector, 64% held bachelor's or diploma degrees, and 64% had under 10 years of work experience. Most participants earned less than RM10,000, and 58% held managerial positions. Regionally, 54% were from Greater KL. Reliability analysis revealed internal consistency scores above 0.900, confirming the suitability of the variables: Local Government (α = 0.930), Private Companies (α = 0.969), and Smart City Performance (α = 0.956). The strongest relationship with Smart City Performance was found with Private Companies (r = 0.789**), followed by Local Government (r = 0.618**).

Table 3 Pilot Study - Results from Correlation Analysis

Factor	Mean	Standard Deviation	N	Relationship	r-value	Sig. (2-tailed)
Smart Cities Performance	4.108	0.647	50	LG → SCP	0.618**	0.000
Local Government	4.229	0.622	50	PC → SCP	0.789**	0.000
Private Companies	4.250	0.576	50	LG →PC	0.671**	0.000

Note: **. Correlation is significant at the 0.01 level (2-tailed).

4.0 Findings

This section forwarded the profiles of respondents and hypotheses testing.

4.1 Respondent Profiles

The profiles of respondents show that out of 399 respondents, 69% are from the private sector, 77% are above 30 years old, 57% are female, 61.2% have postgraduate education, 79% have more than 5 years of work experience, 95% Malaysian, 80% Malay, 70% earn more than RM5,000 per month, and 45% with job position in the category of manager and above.

4.2 Descriptive Results – Smart Cities Performance, Local Government, and Private Companies

The descriptive analysis presented provides insights into the perception of Smart Cities Performance (SCP), Local Government (LG), and Private Companies (PC) using a 5-point Likert scale.

The mean values for smart city performance (SCP) variables range from 3.93 to 4.21, with standard deviations between 0.787 and 0.884, indicating general agreement with the effectiveness of smart city initiatives, though with some variation. The highest-rated items are SCP4 (electronic forms, $\mu = 4.211$, $\sigma = 0.787$) and SCP5 (public transport network, $\mu = 4.193$, $\sigma = 0.836$), reflecting strong perceptions of digital governance and smart mobility, aligning with Caragliu et al. (2021). The lowest-rated item is SCP11 (patent applications, $\mu = 3.93$, $\sigma = 0.877$), suggesting weaker perceptions of innovation, similar to Mora et al. (2019).

The mean values for local government (LG) variables range from 4.22 to 4.40, with standard deviations between 0.727 and 0.794, indicating strong agreement on the local government's role in managing smart city strategies. The highest-rated items are LG3 (Physical development system, $\mu = 4.406$, $\sigma = 0.727$) and LG2 (Economic development system, $\mu = 4.393$, $\sigma = 0.794$), highlighting economic and infrastructure development as key aspects of governance. This aligns with Nam and Pardo (2011). The lowest-rated item is LG9 (Strategic planning and programs management, $\mu = 4.228$, $\sigma = 0.793$), reflecting challenges in long-term planning, as noted by Harrison and Donnelly (2019).

The mean values for private companies' roles in smart cities range from 4.11 to 4.38, with standard deviations between 0.713 and 0.819, indicating strong agreement among respondents. The highest-rated item is PC5 (Green technology adoption for businesses, $\mu = 4.381$, $\sigma = 0.713$), suggesting that businesses in smart cities actively adopt sustainable technologies, in line with Kitchin (2022). The lowest-rated item is PC1 (Employment opportunities in digital work platforms, $\mu = 4.110$, $\sigma = 0.819$), indicating that the digital job market may not grow as fast as expected, a concern raised by Duarte and Pires (2021).

The findings suggest positive perceptions of smart city initiatives, local government efficiency, and private sector contributions. However, gaps in R&D, strategic planning, and employment generation indicate areas for further improvement.

4.3 Hypotheses testing

The researcher used structural equation modelling with IBM SPSS AMOS V.29.0 to test the study's hypotheses. Direct impact hypotheses were tested using unstandardised estimates and regression weights, focusing on the influence of local government and private companies on smart city performance, and the indirect effect involves the mediating role of private companies (refer to Table 4).

Table 4 Testing the Causal Effects of the Constructs

			Estimate	***S.E***	***C.R***	***P***	***Results***	***Hypothesis***
Private Companies	<-	*Local Government*	*0.677 (a)*	*0.042*	*16.031*	***	*Significant*	*H2*
SCperformance	<-	*Local Government*	*-0.092 (c)*	*0.059*	*-1.546*	*0.122*	*Not Significant*	*H1*
SCperformance	<-	*Private Companies*	*0.750 (b)*	*0.099*	*7.473*	***	*Significant*	*H3 & H4*

*Note: *** indicates a p-value of 0.001*

Table 7 presents the results of hypothesis testing for the causal effect of local government on Smart City Performance (H1). The path coefficient of local government on smart city performance is -0.092 with a standard error of 0.059, indicating that a one-unit increase in local government leads to a 0.092 decrease in smart city performance. The critical ratio is calculated as z = -0.092 / 0.059 = -1.546, with a probability of 0.122%. Given that the result is not statistically significant at the 0.05 level, local government has no direct impact on smart city performance, thus not supporting hypothesis H1.

Hypothesis H2, which investigates the causal relationship between local government and private enterprises, shows a path coefficient of 0.677, suggesting that a one-unit increase in local government results in a 0.677 increase in private sector employment. The critical ratio of 16.031 with a probability of less than 0.001 indicates a significant positive relationship between local government and private businesses, thus supporting hypothesis H2.

Hypothesis H4 examines whether private enterprises mediate the relationship between local government and smart city performance. The mediation analysis indicates that private businesses fully mediate this relationship. When private enterprises are included in the model, the direct effect of local government on smart city performance becomes non-significant, confirming complete mediation (Awang, 2015). Therefore, private companies serve as a complete mediator in the relationship between local government and smart city performance, as supported by the significant indirect effects in hypotheses H2 and H3.

5.0 Discussion

This part forwarded a brief discussion on the objectives of this study, which are to examine the influence of local government and private companies on the performance of smart cities in Malaysia and the role of private companies in the relationship between local government and smart city performance.

5.1 Discussion on the Relationship Between Local Government, Private Companies, and Smart City Performance

This study offers insights into the relationship between local governments, private companies, and smart city performance in Malaysia. Contrary to Flynn et al. (2018), which suggested a misalignment, a pilot study shows a positive and significant link between government involvement and smart city performance. Further research highlights the crucial role of private companies as intermediaries, revealing a full mediation effect between local governments and smart city performance. The Malaysian Smart City Framework stresses the need for collaboration among stakeholders, advocating sustainable business models and frugal innovation to overcome funding challenges. These findings emphasise the importance of strong partnerships in successful smart city development (Clement et al., 2022).

5.2 Discussion on the Private Companies as Mediators between Local Government and Smart City Performance

This empirical study in Malaysia confirms the mediating role of private companies in the relationship between local governments and smart city performance. Using stratified random sampling, 2,000 questionnaires were distributed across Malaysian smart cities, with 399 responses collected. Results showed a positive relationship between local governments, private companies, and smart city performance, with private companies fully mediating the connection between local governments and performance. These findings align with Snow, Håkonsson, and Obel's (2016) focus on organisational collaboration and Komninos et al.'s (2019) emphasis on multi-stakeholder involvement. The Malaysian Smart City Framework supports this by advocating stakeholder collaboration for sustainable development.

6.0 Conclusion & Recommendations

This section forwarded a brief discussion on the recommendations and conclusion of this study.

6.1 Recommendations

Findings indicate that private companies fully mediate the relationship between local governments and smart city performance in Malaysia, highlighting their crucial role in translating governmental efforts into practical outcomes. In order to improve the performance, several recommendations are proposed: 1) strengthen partnerships between local governments and private companies to leverage expertise (Suda et al., 2023); 2) promote collaboration among stakeholders, including government, private companies, and academia (Clement et al., 2022); 3) ensure transparent communication and inclusive policymaking to foster acceptance (Lim et al., 2021); 4) establish a clear PPP framework for effective growth (Leong et al., 2023); and 5) integrate private-sector technologies to enhance efficiency and quality of life (Leong et al., 2023).

6.2 Conclusion

This study examines the relationship between local governments, private companies, and smart city performance in Malaysia. The analysis of H1 reveals that local governments do not directly influence smart city performance, contrary to previous findings (Flynn et al., 2018). This suggests unique structural challenges in Malaysia's evolving smart city landscape, requiring further exploration of policy and governance issues. Conversely, H2 and H3 confirm the vital role of private companies in smart city development. The strong connection between local governments and private companies (H2), alongside the impact of private companies on performance (H3), highlights the importance of public-private partnerships. Mediation analysis (H4) shows that private companies fully mediate the relationship between local governments and smart city performance. These findings align with previous research on the role of intermediaries in urban development (Komninos et al., 2019). Policymakers should enhance public-private synergies through supportive regulatory frameworks to foster innovation while ensuring public interest and equity. Future research should investigate the factors influencing this mediation and explore comparative studies in various contexts.

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Paper Contribution to Related Field of Study

Smart City Development, Management, Economic Development.

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