Research Article

Agile and Dynamic Governance: Driving Smart City Innovations in Indonesia

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Abstract.

This study examines the impact of agile and dynamic governance on smart city development, in Indonesia. The smart city framework, which encompasses dimensions such as smart economy, smart mobility, smart environment, smart people, smart living, and smart governance, aims to address urban challenges like traffic congestion, pollution, and social inequality by integrating advanced technologies and effective governance. Indonesia has embraced smart city initiatives, with 25 cities and regencies designated as pioneers in 2017. The country's strategy, outlined in Presidential Regulation No. 63 of 2022, involves collaborative efforts between local governments and various stakeholders to create sustainable urban environments. This study uses a comprehensive literature review to evaluate the role of agile governance in smart city projects, identifying key governance practices, technological challenges, and community engagement efforts. The findings highlight the importance of agile governance principles—flexibility, adaptability, collaboration, and a focus on customer value—in overcoming urban challenges and implementing sustainable development. The analysis underscores the need for integrated planning, innovative financing, and active public participation to enhance the effectiveness of smart city initiatives.

Keywords: agile governance, dynamic governance, smart city, digital transformation

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1. Introduction

In the digital era, the concept of smart cities has emerged as a global paradigm in urban development, driven by rapid advancements in information and communication technology (ICT). Smart cities aim to address complex urban challenges such as traffic congestion, pollution, and social inequality by integrating advanced technologies with effective governance [1]. The smart city framework encompasses various dimensions, including smart economy, smart mobility, smart environment, smart people, smart living, and smart governance, all of which collectively enhance the quality of life for urban residents [2]. In Indonesia, the initiative to develop smart cities has been embraced by numerous cities and regencies. In 2017, 25 cities and regencies were designated as pioneers of the smart city movement, underscoring the country's commitment to improving technology for urban development [1]. These cities have been implementing various

smart city programs focusing on infrastructure, economic growth, urban security, public health services, education, and integrated transportation systems [3]. The Indonesian government's strategy includes the "Movement towards 100 Smart Cities", which aims to expand the smart city model across the nation by 2045 [4]

The legal framework supporting smart city initiatives in Indonesia is outlined in several regulations and laws. Notably, the Presidential Regulation No. 63 of 2022 details the master plan, emphasizing the development of smart cities through six key systems: urban systems, safety and security, livability and urban life, government services, environment and sustainability, and access and mobility. This comprehensive approach aims to create sustainable and efficient urban environments that enhance public services and community well-being. The implementation of smart cities in Indonesia involves collaborative efforts between local governments, urban development partners, and various stakeholders. Programs such as technical assistance, resilient city initiatives, green city action plans, and urban nexus projects are being executed in multiple cities to provide sustainable urban development [1]; [5]. For instance, technical assistance programs in cities like Banda Aceh and Balikpapan focus on preparing technical documents and linking to alternative financing sources, while resilient city programs in Palembang and Denpasar address risk zoning and urban ecosystem rehabilitation [1]; [6].

Given the complexity and dynamic nature of urban challenges, agile and dynamic governance emerges as a critical factor in the successful implementation of smart city initiatives. Agile governance, characterized by flexibility, adaptability, collaboration, and a focus on customer value, enables local governments to respond quickly to changes, involve communities actively, and optimize resource use [7]. In the context of Indonesia, agile governance can help overcome obstacles such as limited resources, socio-political dynamics, and resistance to change, thereby enhancing the effectiveness and sustainability of smart city projects [8] This review examines the impact of agile and dynamic governance on smart city development in Indonesia. By analyzing the role of agile governance in smart city initiatives, this study aims to contribute to the theoretical and practical understanding of urban development strategies in the era of technological transformation.

2. Methods

This study used a comprehensive literature review to examine the impact of agile and dynamic governance on smart city development in Indonesia. The literature review

methodology involves systematically identifying, evaluating, and synthesizing existing research and documentation relevant to agile governance, smart city concepts, and technological transformations in urban development.

2.1. Data Sources and Selection Criteria

The primary data sources for this literature review include peer-reviewed journal articles, conference papers, official government documents, and relevant books. The selection criteria for the literature were based on the following:

1. Relevance: Only studies directly related to smart city development, agile governance, and technological transformation in urban settings were included.
2. Recency: Emphasis was placed on recent publications (within the last ten years) to ensure the inclusion of the latest findings and trends.
3. Quality: Preference was given to high-impact journals, well-regarded conferences, and authoritative government and institutional reports.
4. Geographical Focus: Studies focusing on Indonesia or comparable contexts in Southeast Asia were prioritized to ensure contextual relevance.

2.2. Search Strategy

A systematic search was conducted using academic databases such as Google Scholar, JSTOR, IEEE Xplore, and ScienceDirect. Keywords used in the search included “smart city development,” “agile governance,” “dynamic governance,” “technological transformation,” “urban development in Indonesia,” and “public sector innovation.” Additionally, references from selected articles were cross-checked to identify further relevant studies.

2.3. Data Extraction and Analysis

Data extraction involved identifying and summarizing key findings, methodologies, and conclusions from each selected study. The extracted data were then categorized based on themes such as governance practices, technological challenges, community engagement, and outcomes of smart city initiatives. The analysis focused on:

1. Governance Practices: Evaluating how agile and dynamic governance models have been implemented in smart city projects.
2. Technological Challenges: Identifying technological barriers and solutions in smart city implementation.
3. Community Engagement: Assessing the role of public participation in the success of smart city initiatives.
4. Outcomes: Reviewing the impacts of smart city projects on urban development and quality of life.

2.4. Theoretical Frameworks

The analysis was guided by several theoretical frameworks:

1. Agile Governance Framework: Highsmith's principles of flexibility, adaptability, and collaboration in governance [7]
2. Organizational Change Theory: Bass & Riggio's transformational leadership and active participation concepts [9].
3. Organizational Learning Theory: Argyris & Schön's double-loop learning [10].
4. Participatory Democracy Theory: Fung's emphasis on citizen involvement in public decisionmaking [11].
5. Complex Systems Theory: Holland's concepts of adaptability and resilience in dynamic environments [12]

2.5. Critical Evaluation of Methodologies

The literature review methodology allowed for the integration of diverse studies. A key strength of this methodology was the ability to identify research gaps and highlight trends, adding depth to the understanding of smart city initiatives.

However, literature review is subject to certain limitations:

1. Availability of Data: Some relevant studies or government documents might not be accessible or available in the public domain.

2. Language Barriers: Research published in languages other than English and Indonesian may have been excluded.

3. Subjectivity in Selection: Despite systematic selection criteria, the choice of literature might still reflect some level of subjectivity.

Despite these limitations, the literature review provided a meaningful integration of findings across governance practices, highlighting areas for improvement. Future research should focus on employing longitudinal studies to track the progress of smart city initiatives over time, ensuring consistency in methodologies, and using comparative studies to derive best practices that can be transferred across different urban environments. This approach will enhance the development of more effective agile governance frameworks in smart cities.

3. Results and Discussion

3.1. The Role of Agile Governance in the Development of the Smart City

Agile governance, characterized by its principles of flexibility, adaptability, collaboration, and a focus on customer value, has enabled the local government to address various challenges more effectively [7]; [13]. Traditionally, government bureaucracies are known for their rigidity and hierarchical structures, which can impede swift decision-making and innovation [13]. However, the adoption of agile principles has created a shift towards a more collaborative and open culture. This change is evident in the way project teams engage with end-users and stakeholders, actively seeking feedback and iterating on solutions to better meet community needs. This aligns with the organizational change theory, which emphasizes the importance of transformational leadership and the active participation of all organizational members in the change process [9]. Agile governance has also proven to be a catalyst for innovation and continuous learning in smart city projects. By emphasizing iteration and feedback, agile governance encourages project teams to learn from their experiences, identify areas for improvement, and develop more effective solutions. This iterative approach is crucial in the dynamic context of smart city development, where technological advancements and changing user needs require constant adaptation [7]. This is in accordance with the organizational learning theory,

which highlights the role of double-loop learning in implementing innovation. Double-loop learning involves not only improving existing processes (single-loop learning) but also questioning and revising the underlying assumptions and frameworks [10].

Furthermore, the literatures highlights the significant role of agile governance in enhancing community participation in smart city development. Through various mechanisms such as discussion forums, online surveys, and community workshops, the public is actively involved in the decision-making process. This participatory approach ensures that the solutions developed are closely aligned with the needs and aspirations of the community, thereby enhancing the legitimacy and acceptance of smart city initiatives [13]. This aligns with participatory democracy theory, which underscores the importance of citizen involvement in public decision-making processes [11]. Agile governance, by facilitating such participation, strengthens the democratic process and builds trust between the government and the community [14] Agile governance also provides a robust framework for managing the complexities and uncertainties associated with smart city projects. The principles of iteration and feedback allow local governments to respond quickly to changes and adjust their plans accordingly. This adaptability is crucial in the context of smart city development, where unforeseen challenges and rapidly evolving technologies are common [15]. This aspect of agile governance aligns with complex systems theory, which emphasizes the importance of adaptability and resilience in managing dynamic and unpredictable environments [12].

3.2. Goverment Master Plans in Smart City Development

The Indonesian government's initiative to build a smart city is outlined in Presidential Regulation Number 63 of 2022 [16]. This regulation provides a comprehensive master plan focusing on six priority systems, as explained below:

3.2.1. Urban Systems

The urban system aims to enhance asset and facility management, ensuring efficiency and sustainability. Smart water management is crucial due to global water scarcity, improving technology to monitor and control water distribution [17]; [18]. Smart energy management focuses on sustainable energy sources, integrating data accumulation and advanced technologies. Additionally, smart waste management uses IoT-based systems to improve waste management and sustainability [19]

3.2.2. Safety and Security

The safety and security system includes preparing security apparatus at various levels, disaster recovery services, correctional institutions, and rehabilitation centers. It also encompasses a public complaint system, smart lighting, and smart security measures, including surveillance technologies like CCTV and drones to enhance public safety [20]

3.2.3. Livability and Urban Life

Smart cities prioritize livability through digital health services, pandemic management, urban comfort technologies, and affordable housing. These initiatives integrate technology to improve health services, manage pandemics, and promote sustainable living [21].

Additionally, smart villages and public cemeteries are part of the urban housing system, aiming to revitalize communities and ensure comprehensive urban development.

3.2.4. Government Services

The government service system includes electronic public services, e-libraries, broadband internet access, and e-participation to encourage public involvement in governance [22]. Digitized cultural records, internet in public spaces, data-based urban planning, and ecitizenship further support government services, implementing transparency and community engagement.

3.2.5. Environment and Sustainability

The environment and sustainability priorities involve monitoring environmental quality, smart emergency management, and promoting renewable energy. These initiatives aim to reduce pollution, enhance ecological resilience, and support disaster preparedness [23]; [24]. A conducive city setting, integrating environmental and sustainable practices, is essential for smart city development [25].

3.2.6. Access and Mobility

Access and mobility focus on smart traffic management, public transport systems, and smart parking management. These systems aim to enhance urban mobility, reduce traffic violations, and support demographic changes in the new capital [26]; [27].

3.3. National Programs and Urban Development in Indonesia

Indonesia's national urban development programs reflect a multifaceted approach to enhancing urban resilience, sustainability, and governance. Through technical assistance, resilient city initiatives, green city projects, and urban nexus programs, the government aims to address the complex challenges of urbanization. These programs, implemented with the support of local governments and development partners, emphasize the importance of integrated planning, innovative financing, and community involvement to create livable, sustainable, and resilient urban environments across the country [28]

3.3.1. Technical Assistance Program

The Technical Assistance Program is designed to support local governments in Indonesia by collaborating with urban development partners. This program is implemented in several cities, including: "Banda Aceh, Balikpapan, Denpasar, Palembang, Tangerang, Surakarta, Yogyakarta, Semarang, Palu, Probolinggo, Kupang, and Surabaya". Its main activities focus on providing technical assistance to prepare technical documents for city infrastructure programs and linking these programs to alternative financing options. The aim is to enhance the technical capacity of local governments, ensuring they can effectively manage and execute urban development projects with sustainable financial backing [28]. Resilient City Program.

The Resilient City Program, also a collaboration between local governments and urban development partners, aims to bolster the resilience of urban areas against various risks. This program is active in cities such as: "Palembang, Palu, Balikpapan, Denpasar, and Pontianak". Key activities under this program include risk zoning to identify and mitigate potential hazards, urban upgrading investments to improve infrastructure and housing, and urban ecosystem rehabilitation to restore and maintain natural environments within urban settings. These initiatives are essential for preparing cities

to withstand and quickly recover from environmental, social, and economic shocks [28].
Green City Program

The Green City Program targets the development of environmentally sustainable urban areas. Implemented in cities like “Medan, Batam, Malang, and Kendari”, this program involves the creation of green city action plans, the development of innovative financing mechanisms to support green initiatives, the establishment of urban management partnerships, and the execution of small-scale pilot projects. These activities are geared towards promoting sustainable urban practices, reducing environmental impacts, and enhancing the quality of urban life through green infrastructure and policies [28].

3.3.2. Urban Nexus Program

The Urban Nexus Program is focused on integrating various urban sectors to create synergies and efficiencies. This program is operational in “Pekanbaru and Tanjung Pinang”, where it provides technical advice to municipal governments and planning officers. It also involves the implementation of nexus initiatives that combine different urban sectors, such as water, energy, and food systems, to optimize resource use and enhance sustainability. Furthermore, the program emphasizes feeding local experiences into a regional dialogue and learning platform, providing knowledge exchange and collaboration across regions to maximize the potential for effective urban development actions [28]

3.4. Review of Smart City Development in Indonesia

The review of the impact of agile and dynamic governance on Smart City development in Indonesia reveals diverse challenges and successes across various cities, each illustrating the crucial role that flexible and adaptive governance models play in urban innovation. In Indonesia, a total of 25 cities and regencies became pioneers of smart cities in 2017 [29]

Research on various Indonesian cities highlights the diverse challenges and successes in implementing Smart City initiatives. In Surabaya, efforts span smart governance, living, and environment, but face hurdles in citizen technology adoption and infrastructure [30]. Jakarta’s readiness for Smart City adoption underscores the importance of legal frameworks and public acceptance for comprehensive implementation

Figure 1: 25 Pioneers of Smart City in Indonesia. Source: (IndonesiaBaik.id, 2017).

[31]. Similarly, Smart Cities in Sumatra are in early development, hindered by resource shortages and limited support, yet hold potential for enhancing public services and governance [32]. Bandung's Smart City implementation contends with communication and infrastructure challenges but has strategies to optimize public services and integrate smart initiatives into regional plans [33] Malang reveals disparities in internet access and infrastructure, necessitating a focus on basic services, community capacity, and sustainability [34]. In Tanjung Pinang, significant obstacles such as technological illiteracy, lack of IT skills, and inadequate infrastructure require strategic collaboration and comprehensive solutions [35] Jakarta's initiative, though successful in improving ICT accessibility and connectivity, needs further citizen and government support [36].

Denpasar supports its Smart City initiatives through the implementation of Smart Infrastructure, utilizing AI for traffic monitoring and management [37]. Yogyakarta's Smart City applications have positively impacted public services, particularly in mobility, environment, and governance [38] Bekasi's Smart City implementation emphasizes the need for effective communication strategies and public participation [39]. Finally, studies in Bandung highlight the importance of policy advocacy and collaboration for efficient Smart City governance [40], while another study on Bandung showcases successful involvement of SMEs in smart economy strategies [41]

Table 1: Review of Smart City Development in Indonesia.

Author(s)	City	Key Findings
(Amalia et al., 2023)	Surabaya	Implementation of Smart City in Surabaya has been implemented in various aspects like smart governance, smart living, and smart environment. Challenges include technology adoption by citizens and infrastructure.
(Putra, 2019)	Jakarta	Investigated Jakarta's readiness for Smart City adoption, focusing on comprehensive implementation across all life aspects. Emphasized the importance of legal frameworks and public acceptance.
(Gunawan, 2023)	Sumatera	Smart Cities in Sumatra are in early development, facing challenges like limited government and community support and resource shortages, yet hold potential for improving public services and urban governance.
(Wahyudi et al., 2022)	Bandung	The implementation of Smart City in Bandung faces challenges like communication and infrastructure but has strategies in place to overcome these, including optimizing public service programs and integrating smart city initiatives into regional development plans.
(Fefta et al., 2023)	Malang	The study on Malang City reveals disparities in internet access and infrastructure, suggesting that Smart City development should prioritize basic urban services, community capacity, and sustainability.
(Damayanti et al., 2024)	Tanjung Pinang	The study identifies major obstacles, such as technological illiteracy, lack of IT skills, suboptimal infrastructure, and insufficient funding, requiring strategic collaboration and comprehensive solutions.
(Purba & Jayadi, 2023)	Jakarta	Jakarta's Smart City initiative has been successfully implemented in the term of accessibility, connectivity, and the use of ICT. However, requiring further improvements and support from citizens and government.
(Paramitha & I Nyoman Mahayasa Adiputra, 2022)	Denpasar	Implementation of Smart Infrastructure in Denpasar to support Smart City initiatives, utilizing AI for traffic monitoring and management.
(Aisyahh et al., 2020)	Yogyakarta	Examined the impact of Smart City applications on public services in Yogyakarta, focusing on various aspects including mobility, environment, and governance.
(Widodo & Permatasari, 2020)	Bekasi	Evaluated Smart City implementation in Bekasi, focusing on communication strategies and public participation to enhance service delivery and urban management.
(Septiarika, 2020)	Bandung	This study highlighting how policy advocacy and collaboration between the municipalities promote efficient and innovative Smart City governance.
(Agni et al., 2021)	Jakarta	Evaluated the implementation of Smart Mobility in Jakarta, identifying readiness levels and necessary improvements in public transportation systems.
(Oktriastra, 2020)	Pontianak	This study highlights issues like application integration, resource mapping, infrastructure, public awareness, collaboration, and information security. So, proposing strategies such as collaborating with private and academic sectors and enhancing security for effective development.
(Wahid & Amalia, 2020)	Tangerang Selatan	Tangerang Selatan's initial implementation of the smart city program, aiming to enhance efficiency and public services through technology integration, faces challenges in public awareness and communication, limiting its effectiveness.

Table 1: Continued.

Author(s)	City	Key Findings
(Wahyuni Arsyad et al., 2022)	Samarinda	The success of Samarinda's lies on effective communication in implementing the Smart Economy pillar, which aims to create a digital ecosystem supporting adaptive economic activities and transforming behaviors and mindsets towards a sustainable economy.
(Yahya & Sudarmo, 2022)	Surakarta	Surakarta collaborates with stakeholders through the EPPSON program to enhance local revenue and public convenience, with effective collaboration following Ansell and Gash's model, though improvements in information sharing are needed.
(Cahyadani & Djunaedi, 2022)	Sukoharjo	This study address rural issues, demonstrating the commitment to smart city development influenced by geographical, social, cultural, natural resources, and
		infrastructure factors.
(Pramesti et al., 2020)	Surabaya, Malang	Compared the Smart People indicator in Surabaya and Malang, noting that Surabaya has innovative and creative networks while Malang is still developing.
(Pangestu & Anggraini, 2022)	Serang	The study highlights the lack of specific regulations, insufficient budget, and a shortage of IT experts as major obstacles. Data showed that more support from the local government and increased public participation are crucial for the optimal development of smart city initiatives in Serang.
(Husna & Syaodih, 2022)	Bogor	Assessed the performance and expectations of Smart Governance in Bogor using Importance Performance Analysis (IPA). Found a gap between government performance and community expectations.
(Wahyuni et al., 2021)	Semarang	This study highlights improvements in public services through initiatives like smart living, smart environment, smart mobility, good governance, intelligent people, and an innovative economy.
(Umam & Mafruhat, 2022)	Bandung	This study found that the city's strategies have effectively involved many SMEs, improving Bandung's image and government support to enhance competitiveness.

3.5. Application of Theoretical Frameworks to the Review of Smart City in Indonesia Agile Governance Framework (Highsmith, 2004)

The Agile Governance Framework is characterized by flexibility, adaptability, and collaboration, which are crucial for overcoming the complex challenges faced by Indonesian cities in smart city development. In Surabaya, agile governance is seen in efforts to optimize public services through community engagement, addressing issues like citizen technology adoption. Jakarta's implementation emphasizes the importance of public acceptance, which reflects a flexible approach to addressing legal and societal barriers. Bandung's strategies to integrate smart city initiatives into regional plans also align with

the adaptive nature of agile governance, demonstrating the ability to iterate and improve governance models based on stakeholder feedback.

3.5.1. Organizational Change Theory (Bass & Riggio, 2005)

Bass and Riggio's Organizational Change Theory emphasizes transformational leadership and active participation, which are evident in Jakarta, Bandung, and Surakarta. Jakarta's adoption of smart city initiatives involved the leadership setting a clear vision for smart mobility and public services, emphasizing the role of community participation in this transformation. In Bandung, transformational leadership is seen in policy advocacy and efforts to collaborate with municipalities, demonstrating active participation by both government leaders and community stakeholders. Surakarta's collaboration through the EPPSON program reflects an effort to enhance local revenue and public convenience, which requires strong leadership and active stakeholder involvement.

3.5.2. Organizational Learning Theory (Argyris & Schön, 1997)

Argyris & Schön's double-loop learning highlights the importance of questioning and revising underlying assumptions. In Malang, the review indicates disparities in infrastructure and internet access, suggesting that initial assumptions about urban readiness need to be revised. This requires double-loop learning to reassess priorities, such as focusing on basic urban services and community capacity before implementing advanced smart technologies. Bandung's strategy of involving SMEs to improve competitiveness also demonstrates doubleloop learning, where the city has adapted its economic strategies based on feedback and changing needs to implement sustainable urban development.

3.5.3. Participatory Democracy Theory (Fung & Wright, 2001)

Fung & Wright Participatory Democracy Theory emphasizes citizen involvement in public decision-making. The review findings in Bekasi and Denpasar highlight how effective smart city implementation depends on public participation. Bekasi's efforts to enhance urban management through communication strategies align with this theory, ensuring that citizens are actively involved in the development process. Denpasar's use of AI for traffic monitoring also indicates a participatory approach where public engagement in infrastructure initiatives helps in fine-tuning technology solutions for effective traffic

management. This type of engagement helps ensure that smart city initiatives are relevant and responsive to the needs of the community.

3.5.4. Complex Systems Theory (Holland, 1996)

Complex Systems Theory deals with adaptability and resilience in managing dynamic environments. Indonesian cities like Sumatra, which are in the early stages of smart city development, face challenges related to limited government support and resource shortages. Complex systems thinking can help these cities manage the unpredictability of development processes by focusing on building resilient systems. Tanjung Pinang, facing significant infrastructure and technological illiteracy challenges, requires a complex systems approach to build resilience through comprehensive solutions, such as targeted capacity-building initiatives. Bandung's communication and infrastructure challenges also require a systems approach that allows for iteration, flexibility, and resilience in the face of evolving urban dynamics.

3.5.5. Integrated Analysis

The review reveals the need for a synergistic approach that integrates these frameworks:

- Agile governance provides the foundation for rapid adaptation and iterative improvements across different cities, from Surabaya to Bandung.
- Transformational leadership and active participation are key for cities like Jakarta and Surakarta, enabling them to implement strategic changes and implement community involvement.
- Double-loop learning is crucial for cities like Malang and Bandung, where initial strategies need revision to align with the evolving landscape of urban challenges.
- Citizen participation plays a critical role in cities like Bekasi and Denpasar, ensuring that smart city initiatives are not only technologically driven but also community-focused.
- Finally, a complex systems approach is needed for cities like Sumatra and Tanjung Pinang to build resilience amidst infrastructural and technological limitations.

3.6. Technological Challenges in Smart City Implementation

The technological challenges in implementing Smart City initiatives in Indonesia are multifaceted and require a comprehensive understanding of various aspects. One primary challenge is the lack of adequate technological infrastructure to support the Smart City concept, as highlighted by a study on Pontianak, which identified insufficient infrastructure as a significant obstacle [42]. This underscores the need for substantial investment in developing the technological infrastructure to support various smart services across Indonesian cities. Additionally, data security and privacy issues pose significant challenges as Smart City initiatives collect data from multiple sources, making them potential targets for cyber-attacks. The importance of prioritizing data protection and privacy in Smart City implementations is emphasized by a study on the Smart City Dynamic Dashboard, which highlighted the critical role of security in developing Smart City applications [43]

Another significant issue is the integration of various applications and systems used within the Smart City environment. Ensuring interoperability between different platforms and technologies is vital for smooth and efficient data flow, as emphasized by a study on multiapplication collaboration within the Smart City context [44] The limitation of human resources with technological expertise poses a challenge, as identified in a study on the readiness of governments to realize Smart City initiatives, which revealed the lack of high-quality human resources as a major obstacle [45]. Developing human resource capacity in the technology sector is crucial to overcoming this challenge. Additionally, community technology adoption is critical for the success of Smart City implementation. A study on the relationship between age, information technology usage, and work experience highlighted the importance of social factors in technology adoption [46]. Therefore, a participatory approach and public education about the benefits of technology in the Smart City context are essential to overcoming these challenges.

3.7. Sustainability in the Implementation of Smart City in Indonesia

The aspect of sustainability in the implementation of Smart City initiatives is crucial for ensuring the long-term viability of urban development. One significant consideration is the factors influencing the sustainability index of cities, as highlighted in a study on Jakarta's sustainability index [47]. Addressing urban challenges such as

dependence on the environment and community efforts to meet basic needs is essential for aligning environmental, economic, and social well-being with urban growth [47] Moreover, sustainability involves the management of natural resources and the environment, as shown in an analysis of the COVID-19 pandemic's impact on the sustainability of small and medium-sized enterprises [48]. Business sustainability is often presented in an integrated manner, combining economic, social, and environmental aspects due to their interrelated nature. Balancing these three pillars—social, economic, and environmental—is vital [49].

E-Government plays a significant role in building Society 5.0, where collaboration is key to implementing innovation and sustainability in products or services [50]. Integrating sustainability into every policy and program is essential. Additionally, evaluating waste management performance in relation to environmental sustainability is crucial for urban areas [51]. The importance of sustainability is also evident in the implementation of the Zero Waste City program in Depok to achieve a Smart Environment. Selecting materials based on green criteria and environmentally friendly properties ensures the sustainability of the materials used. Sustainable waste management in an area involves descriptive analysis to understand the factors influencing sustainability. In the context of sustainable development, empowering communities and involving them in urban development is essential. Evaluating communication and digital literacy among Jakarta residents in implementing Society 5.0 highlights the importance of community participation in ensuring the sustainability of Smart City programs. Sustainable management of coral reef resources in conservation areas also focuses on ensuring the sustainability of natural resources [52]

3.8. Implementations of the Findings for Policy, Practice, and Future Research in the Context of Agile and Dynamic Governance in Smart Cities

3.8.1. Policy Implications

The findings of this review highlight the importance of adaptable and context-specific policy frameworks for the successful implementation of smart city initiatives in Indonesia. Cities like Jakarta and Bandung have benefited from policies that emphasize agile governance and community involvement, suggesting that national and local governments should prioritize policies that promote flexibility, iterative improvements, and public

participation. Policies that encourage the use of agile governance principles can better manage the complexities of urban innovation, allowing cities to respond rapidly to emerging challenges and opportunities.

A key policy framework that supports smart city development is the Presidential Regulation No. 63 of 2022, which details a comprehensive master plan for smart cities through six key systems: urban systems, safety and security, livability and urban life, government services, environment and sustainability, and access and mobility. This regulation provides a strategic framework that municipalities can use to guide the development of smart cities, ensuring that various aspects of urban life are addressed in an integrated manner. Effective implementation of this regulation requires alignment with agile governance principles to ensure adaptability and responsiveness to the unique challenges faced by each city.

Additionally, the review points to the need for policies that address infrastructural and digital literacy disparities, as observed in cities like Malang and Tanjung Pinang. Policymakers should allocate resources to improve fundamental infrastructure and digital education, ensuring that all citizens are equipped to engage with and benefit from smart city technologies. Legal frameworks that encourage collaboration between municipalities, private sectors, and academic institutions are also vital for overcoming resource constraints and providing comprehensive smart city solutions. Implications for Practice

The practical implications of this review emphasize the need for a collaborative, communitydriven approach to smart city development. Cities like Bekasi and Denpasar demonstrate that effective communication strategies and citizen involvement are essential for the successful implementation of smart technologies. Municipalities should therefore invest in public education initiatives that raise awareness about the benefits of smart technologies and actively involve citizens in decision-making processes. This can lead to increased public acceptance and engagement, which is crucial for the long-term sustainability of smart city projects.

Practitioners should also adopt an agile project management approach that allows for continuous feedback and iterative improvements. For instance, the challenges faced by Sumatra in the early stages of smart city development highlight the need for an adaptive, resilient approach to urban governance. Practitioners should incorporate mechanisms for feedback and learning that allow cities to adapt strategies based on evolving urban dynamics and stakeholder needs. This would involve using double-loop learning

processes to not only refine existing practices but also rethink underlying assumptions and strategic priorities. Moreover, cities should implement transformational leadership to drive change. The involvement of leaders who set clear visions and actively engage stakeholders—as seen in Jakarta—can implement a culture of innovation and collaboration. Training programs that equip local government officials with transformational leadership skills could thus be beneficial in advancing the smart city agenda.

3.8.2. Implications for Future Research

The findings reveal several areas for future research that could further enhance the understanding and effectiveness of agile governance in smart cities.

1. First, there is a clear need for longitudinal studies that track the progress of smart city initiatives over time. Such studies would provide valuable insights into the long-term impacts of agile and dynamic governance practices, allowing researchers to assess which strategies lead to sustainable improvements in urban quality of life.

2. Future research should also focus on the development of comparative studies across different cities or regions to understand how context-specific factors influence the success or failure of smart city initiatives. Comparative research could highlight best practices that can be adapted and transferred across cities with similar challenges. This would be particularly beneficial for cities in the early stages of smart city implementation, like Sumatra and Tanjung Pinang, which could learn from the successes and challenges faced by more developed cities such as Bandung and Jakarta.

3. Methodological consistency in future research is crucial for improving the reliability of findings. Many of the reviewed studies employed varied methodological approaches, making direct comparisons challenging. Standardizing methodologies, such as employing robust sampling techniques in quantitative studies or adopting mixedmethods approaches with clear integration strategies, could enhance the comparability and generalizability of future research findings.

4. Future research should explore the role of private sector and academic collaboration in overcoming resource shortages and enhancing technological capabilities. Studies focusing on how public-private partnerships can support smart city development, particularly in resource-constrained environments, would provide

valuable insights for policymakers and practitioners looking to implement comprehensive urban development.

4. Conclusion

The development of smart cities in Indonesia, driven by advancements in ICT, addresses urban challenges like traffic congestion, pollution, and social inequality through agile and dynamic governance. This study highlights the importance of flexible and collaborative governance principles, which facilitate continuous improvement, innovation, and community engagement in smart city projects. Agile governance ensures that solutions align with community needs via discussion forums, surveys, and workshops, enhancing legitimacy and acceptance. Presidential Regulation No. 63 of 2022 outlines Indonesia's strategy, focusing on urban systems, safety, livability, government services, sustainability, and mobility to create efficient urban environments. Despite significant challenges such as investment needs, data security, system integration, and tech sector human resource development, a participatory approach and public education are crucial. Case studies from cities like Surabaya, Jakarta, and Bandung demonstrate that agile governance can lead to successful smart city implementations, while cities like Medan, Yogyakarta, and Denpasar emphasize the need for adaptive strategies to effectively engage communities and integrate technology

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