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The Accelerated Implementation Of Smart Cities In Indonesia Post-Covid-19 Pandemic: Literature Review

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ABSTRACT

COVID-19 has been a catalyst for digital transformation in various sectors, including the implementation of smart cities. In Indonesia, efforts to implement smart cities had already been underway before COVID-19. Post-COVID-19, the adoption of technology and innovation has accelerated further. This study highlights the significant impact of the COVID-19 pandemic as a catalyst for digital transformation in smart cities in Indonesia. The importance of this study lies in providing an in-depth analysis of how the post-COVID-19 era has influenced the development of smart cities in Indonesia, from policy changes, technology adoption, to technological innovations. The objective of this research is to analyze the acceleration of smart city implementation in Indonesia post-COVID-19 pandemic using a structured literature review (SLR) approach. The research method employs bibliometric analysis, with articles collected from Scopus publication data, focusing on research trends after March 2020. The results of this study are expected to include the identification of key themes in the literature, including relevant government policies, innovations implemented, and comparisons between the development of smart cities in Indonesia and other countries. The research contributes strategically to the government and policymakers in addressing future challenges in building more efficient, inclusive, and sustainable smart cities.

Keywords: *Bibliometric Analysis, Covid-19, Digital Transformation, Smart Cities*

ABSTRAK

Covid-19 telah menjadi katalisator transformasi digital di berbagai sektor, termasuk dalam implementasi *smart city*. Di Indonesia, upaya implementasi *smart city* telah berlangsung sebelum COVID-19. Pasca COVID-19 semakin mempercepat adopsi teknologi dan inovasi. Penelitian ini menyoroti dampak signifikan dari pandemi COVID-19 sebagai katalisator untuk transformasi digital pada konteks implementasi *smart city* di Indonesia. Pentingnya penelitian ini untuk memberikan analisis mendalam pasca pandemi Covid-19 telah mempengaruhi perkembangan *smart city* di Indonesia, dari perubahan kebijakan, adopsi teknologi, hingga inovasi teknologi. Tujuan penelitian ini untuk menganalisis percepatan implementasi *smart city* di Indonesia pasca pandemi COVID-19 dengan pendekatan struktur literatur review (SLR). Metode penelitian ini menggunakan analisis bibliometrik, artikel dikumpulkan dari data publikasi Scopus dengan fokus tren penelitian setelah Maret 2020. Hasil penelitian ini diharapkan dapat mencakup identifikasi tema-tema utama dalam literature, termasuk kebijakan pemerintah yang relevan, inovasi yang diterapkan, serta perbandingan antara perkembangan *smart city* di Indonesia dan negara lain. Penelitian ini berkontribusi strategis bagi pemerintah dan pemangku kebijakan untuk menghadapi tantangan masa depan dalam pembangunan *smart city* yang lebih efisien, inklusif, dan berkelanjutan.

Keywords: *Analisis Bibliometrik, Covid-19, Transformasi Digital, Smart City*

Introduction

The Covid-19 pandemic has exacerbated the need for digital transformation, prompting governments and cities around the world, including Indonesia, to go digital. The covid-19 pandemic has had a major impact on all cities in the world to

form resilient cities (Lak et al., 2020). By integrating digitalization devices and IoT (*Internet of Things)* to reduce economic losses and public services due to the Covid-19 situation (Lea, 2017). The Covid-19 pandemic has made smart *city* transformation no longer an option but a necessity, especially to integrate digital infrastructure into city management to improve efficiency, inclusion, and quality of life (Au, 2020). In various countries around the world, the *concept of smart cities* has become one of the most prominent global shifts in recent decades. Implementation of *smart cities* as a form of achieving better city management by optimizing Information and Communication Technology (ICT) (Rachmawati, 2019).

Smart cities integrate communication and information technology with infrastructure to achieve efficiency, sustainability, and improve the quality of life of urban communities. Data and technologies used by *smart cities* such as transportation, energy, health, education, public safety, environment, and interaction with the government (Adenekan et al., 2024). COVID-19 has changed new lifestyles and restricted the physical movement of each individual to change behavior towards digital transformation (Arief Mulyono, 2022). *The smart city concept* is expected to be able to make the city more livable and improve the quality of life of the community with sustainable development (Treude, 2021). *Smart cities* create strong connections between technology and public services (Cooke, 2020). Collaboration between parties is needed with an innovative approach in utilizing technology and communication to realize sustainable development through *smart cities*. The implementation *of smart cities* is able to encourage the development of social infrastructure, urban management, and modern communication that results in sustainable growth for a better quality of life (Aiswarya et al., 2021). There are six interrelated components of smart city implementation, namely (1) *Smart governance*; (2) *Smart human resources*; (3) *Smart environment*; (4) *smart living*; (5) and *Smart Economy* (Rachmawati et al., 2020).

It is clear that in the wake of the Covid-19 pandemic, cities around the world are faced with new design challenges to make cities safer (Honey-Rosés et al., 2021). Covid-19 crisis has fundamentally changed the functioning of cities and the lives of urban communities (Martínez & Short, 2021). The COVID-19 pandemic has opened up opportunities to recognize and implement *smart city* technology to improve social welfare and manage crises due to the shift in human life activities towards digital (Megahed & Abdel-Kader, 2022). Society is required to adapt to new technologies and change a mindset that is more open to digitalization (Abusaada & Elshater, 2020). This is because soft infrastructure support is at the core of city planning in the digital and post-Covid-19 era (Sutriadi et al., 2023). During the COVID-19 pandemic, there are three areas that have experienced significant

changes in the use of ICT-based virtual spaces, namely: education, economy, and health (Rachmawati, et al., 2021).

From previous research, we have examined the implementation of smart cities in various cities in Indonesia, focusing more on the general aspects of implementation without specifically highlighting the acceleration that occurred after Covid-19. Before the Covid-19 pandemic (Santoso & Rahmadanita, 2020) analyzing smart city *research trends* in Bandung, it's just that it is not explicit to discuss the acceleration of post-pandemic implementation. In another study, the implementation *of smart cities* in Jakarta which focuses on the policies implemented, but does not discuss the acceleration of *smart cities* is carried out after the pandemic (Puji Syalianda & Kusumastuti, 2021). Around the same time (Nurdiassa et al., 2021) more broadly examines the implementation of *smart cities* in Makassar with world cities, but has not explored concrete strategies in accelerating the implementation of *smart cities* post-Covid-19. Further studies were carried out (Aditya, 2022) explore the use of the Tanggerang-LIVE application to improve public services during the pandemic, although it is still limited to aspects of citizen behavior and has not reviewed strategies to accelerate digital transformation on a wide scale. The most recent study was conducted when (Kurniawati, 2024) examine the resilience *of smart city-based cities* in Surabaya which is relevant to the acceleration of the implementation of *smart cities* post-Covid-19, but unfortunately the scope is more focused on resilience than the acceleration of its implementation. In contrast to (Lentera et al., 2024) in the same year but more highlighted the implementation of smart cities in Yogyakarta, but did not provide an in-depth analysis of the policy adaptations carried out to accelerate the implementation of smart cities after Covid-19. Although the study has helped to look at the implementation of smart cities from various aspects in several cities in Indonesia, it does not provide an overview of the acceleration of *smart city implementation* after Covid-19.

Knowing the acceleration of smart city implementation in Indonesia post-covid-19 is not only to update the smart city implementation literature, but also to remember that covid-19 has driven faster digital transformation in various sectors, including public services, mobilization, and urban governance. Furthermore, this research is important to understand that multi-sector policies, technologies, and collaborations can be optimized to accelerate the adoption of a sustainable and inclusive smart city concept post-Covid 19. Thus, this study intends to contribute to identifying and analyzing the acceleration of smart city implementation in Indonesia post-COVID-19 pandemic with a literature review approach with a focus on mapping trends and developments in smart city research post-Covid-19 Indonesia. Therefore, we seek to understand the patterns and factors underlying the

adoption of smart technologies in urban management and provide empirical information that is useful for planning and decision-making at the local government level, especially in the context of accelerating urban digitalization in Indonesia post-Covid-19. Based on the gap in previous research, the main question raised is how the acceleration of smart city implementation in Indonesia after Covid-19 is reflected in the literature trends, as well as what factors affect it.

Research Methods

The research uses a qualitative approach with the Systematic Literature Review (SLR) research technique in presenting data using bibliometric statistics. This literature review reviews research published in the period 2020 to 2024 which is very relevant in examining the development of *smart city* implementation in Indonesia after Covid-19. In 2020 as the beginning of a global crisis, including Indonesia, faced Covid-19. In the 2020 period, many cities began to implement emergency programs with the use of smart technology in dealing with Covid-19. Meanwhile, in 2021 – 2024 as a post-pandemic period, many cities in Indonesia will continue and accelerate the implementation of *smart cities.*

To guide the article review process, the formulation of research questions was carried out to achieve the research objective of analyzing the acceleration of *smart city* implementation in Indonesia after Covid-19 using the PICOS question framework. The formulation of the research question was obtained, namely how to apply ICT and policies in encouraging the acceleration of *smart city development* in Indonesia after Covid-19? After obtaining the formulation of the research question, it is followed by the determination of criteria to determine the selected and excluded research articles. The search process uses the Scopus database with keywords such as "ICT" OR "*digital technology*" OR "ICT" *AND* "*Policy*" OR "*governance*" *AND* "*smart city*" *AND* "*Indonesia*" *AND* "*post-covid-19*" *AND* "*acceleration*" *OR* "*development*". The use of multiple keywords is necessary to limit the number of articles identified, as a single keyword generates multiple article results.

Data collection using the PRISMA model for systematic review and meta-analysis (Moher et al., 2009). There were 2,213 articles identified in Scopus. There were 2,011 articles published because they did not comply with screening and did not have complete online access. In the initial review, articles were screened to determine the articles needed based on year, keywords, and abstracts for relevance to the research question, and 202 articles were included in the review process, 157 articles were excluded because they did not have a full-text review. The remaining 45 articles were included in the full text review process. After evaluating the quality of the articles, a total of 26 articles were selected for review in the study.

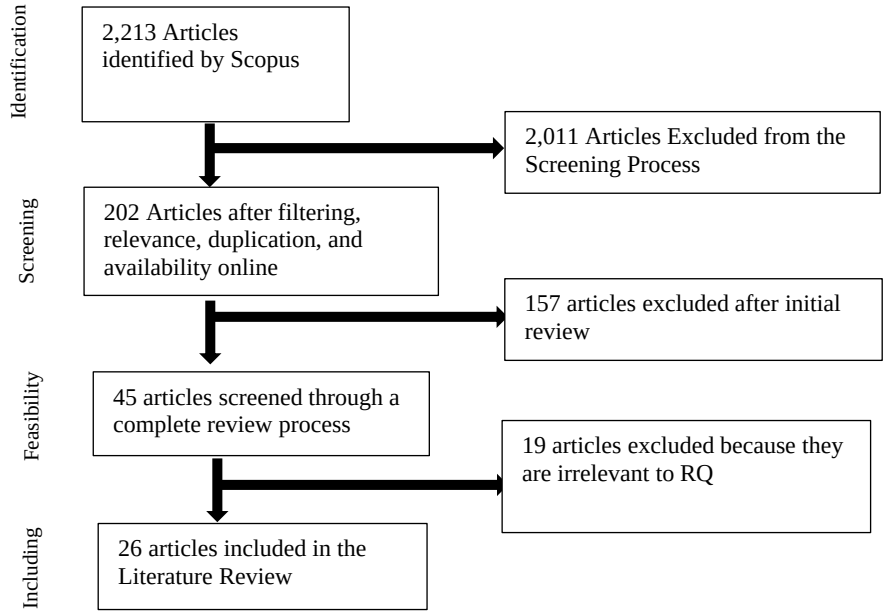

Figure 1: PRISMA 4 Article Screening Process Phase Flow Diagram (Moher et al., 2009)
Source: Data processed by authors, 2025

Results and discussion

The implementation of smart cities in Indonesia has accelerated significantly during and after the Covid-19 pandemic. Its implementation is also in line with existing challenges with a number of risks that need to be anticipated so that smart city transformation remains inclusive and sustainable. The digitization and remote accessibility of smart city infrastructure increases the risk of cyberattacks, data breaches, and privacy concerns (Sharif & Pokharel, 2022) On the other hand, the inability of organizations to cooperate and policy barriers can slow or paralyze smart city implementation efforts (Habibzadeh et al., 2019). Additionally, incorporating learnings from the COVID-19 pandemic into urban planning can help create an environment that is better prepared for future outbreaks. This includes redesigning urban spaces to reduce the risk of transmission and the implementation of non-pharmaceutical interventions (Zhou, 2024).

There is a significant digital divide in Indonesia, with digital transformation centers concentrated in Java, while the eastern region lags behind (Jaya et al., 2024). This gap is caused by unequal access to digital infrastructure, skills, and economic opportunities. The lack of digital skills is a major obstacle to inclusion in smart city initiatives. Many marginalized communities lack the digital literacy necessary to fully engage with digital platforms and services (Priyadharma, 2024). In terms of sustainability, the application of smart technologies such as IoT, AI, and big data can result in significant cost savings and increased ROI. For example, the implementation of a smart grid can reduce energy consumption by up to 20%, resulting in substantial cost savings (Gavade, 2024). Therefore, it is necessary to consider financial sustainability with public-private partnership schemes. Public-

private partnerships are becoming essential to finance smart city projects, especially given the significant financial investment required (Almarri & Boussabaine, 2023) These partnerships help reduce budget constraints and distribute financial risk between public and private entities. However, the success of public-private partnerships depends on factors that determine success such as partnerships and collaborations, financial sustainability, and effective governance (Ju et al., 2023).

Taking into account the risks, challenges and sustainability that arise in the implementation of smart cities after the Covid-19 pandemic in Indonesia, literature search needs to be carried out in a targeted manner. To ensure that these issues are accommodated in the literature search process, the combination of keywords can be seen in Table 1.

Table 1. Keywords: *Literature Review:* Accelerating the Implementation of *Smart Cities* in Indonesia Post-COVID-19 Pandemic

TIK	***Policy***	***Smart City***	**Indonesia**	***Post Covid-19***	***Acceleration***
OR	*OR*				*OR*
Digital Technology	*Governance*				*Development*
OR					
ICT					

Source: Data processed by author, 2025

Table 1 represents the complete boolean search string used in the article search process in the Scopus database. The keywords in the abstract and article information section only show a summary of the main terms, while the keyword combinations in Table 1 reflect the actual search details.

Then, a search query is used to find and combine keywords relevant to research topics that accelerate the implementation of smart cities in Indonesia after the Covid-19 pandemic. The use *of the word OR* to expand search results so that it can include more related topics, such as technology, information and technology (ICT), policies, or accelerating the development of *smart cities* in Indonesia. From the search query, researchers can obtain relevant articles to analyze how the pandemic can accelerate or affect the development of smart cities in Indonesia.

Table 2. Inclusion and Exclusion Criteria for Accelerating *the Implementation of Smart Cities* in Indonesia Post-COVID-19 Pandemic

Population	**Cities in Indonesia (Provinces, other administrative regions)**	**Not discussing smart cities during Covid-19 and after Covid-19**
Intervention	The use of ICT, policy, digitalization, data analysis.	It does not discuss the use of ICT or public policies that refer to smart cities.
Comparison	Discuss cities/regions that have implemented smart cities with those that have not.	It does not discuss cities/regions that implement ICT policies & *smart cities.*
Result	Ecological sustainability, socio-economic resilience, benefits of technology to society, efficiency and effectiveness.	Not presenting results relevant to accelerating *smart city implementation*
Design Studies	Descriptive studies, statistical analysis, meta-analysis, and case studies relevant to the theme.	*RCTs, Randomised controlled trials, cross-sectional studies, mixed methods design, grounded theory design, school-based surveys, Retrospective studies, qualitative studies, quasi-experimental designs.*
Year of publication	2020 - 2024	Under 2020
Language	United Kingdom and Indonesia	Other than English and Indonesian
Journal Type	Articel	In addition to the article

Source: Data processed by authors, 2025

The number of articles published from 2020 to 2024 based on keyword searches in the Scopus database shows that the publication of articles on the topics of smart city implementation, information, and communication technology and public policy during the Covid-19 pandemic to post-pandemic in Indonesia increased significantly from 2020 to its peak in 2023, while in 2024 it decreased. This shows that there has been an increase in interest in *smart city research* related to the Covid-19 pandemic in the last 4 years.

Table 3. The process of searching literature sources by keywords in the Scopus database.

Search Stage	Number of Articles
Initial article (all keywords)	2.213
Filtered articles (relevance and duplication)	202
Full text articles available	45
Selected articles for review	26**Search Stage**

Source: Data processed by authors, 2025

After searching for a list of references and research articles, the author uses the "VOS Viewer" program as the main analysis method of data analysis to visualize bibliometric information network data. The title and abstract are selected where the keywords will be visible. When forming a bibliometric map, use binner calculations. Thus, keywords form thematic groups. In the bibliometric network visualization below, clusters are marked with different colors, the size of each keyword is determined by the indicator of the strength of the total relationship between concepts, the link strength of the searched keyword with other keywords, and reflected on the connecting line between two separate keywords (Jan Van Eck & Waltman, 2022).

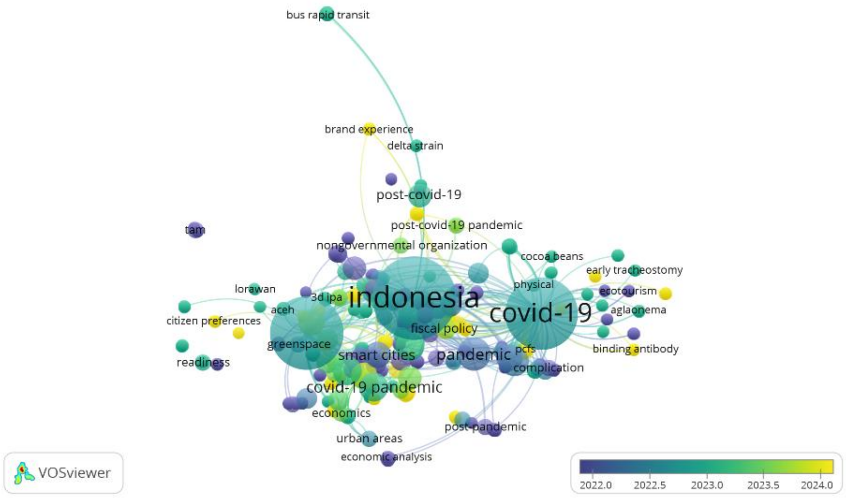

Figure 2. Bibliometric Map of the Search for *Smart City* Implementation Post-Covid-19 (Based on Grouping 2020 – 2024)
Source: Primary data processed, 2025

Figure 2 shows the relationship between keywords and color gradation based on the year of publication. The largest nodes are "Indonesia", "Covid-19 pandemic", and "smart cities", which show that the four keywords are the center of attention of the research. The strong relationship between the four keywords confirms that Covid-19 is the starting point for accelerating the implementation of

smart cities in Indonesia. Color gradation also shows the temporal dynamics of the year, where in early 2022, research more discussed the pandemic as a crisis, while in 2023-2024 new keywords such as "post-covid-19", "post-pandemic", and "ecotourism" began to appear. This means that there is a shift in research focus from the crisis response to the recovery and sustainable development phase, especially by highlighting technology, governance, and innovation in certain sectors such as digital tourism.

Figure 3. Search for bibliometric maps by keyword
Source: Primary data processed, 2025

Figure 3 represents the results of the bibliometric analysis with the grouping of keywords that form several main thematic klister. The largest nodes, namely "Indonesia" and "Covid-19", indicate that both are the main focus in the literature regarding the acceleration of smart city implementation. The red cluster connects the keywords "pandemic", "smart cities", and "fiscal policy", meaning that smart cities are understood not only as technological innovations, but also as public policy instruments in responding to crises. The blue cluster focuses on "Covid-19 pandemic", "economics" and "urban areas", showing the attention of the literature on the pandemic economy and the role of digitalization in strengthening urban resilience. The yellow cluster shows the relationship between "post-covid-19", "NGOs", and "governance" which emphasizes the importance of multi-stakeholder collaboration and adaptive governance in the recovery phase. While small nodes such as "ecotourism" and "greenspace" show specific applied fields that are beginning to develop, highlighting the dimensions of environmental sustainability and technology-based tourism.

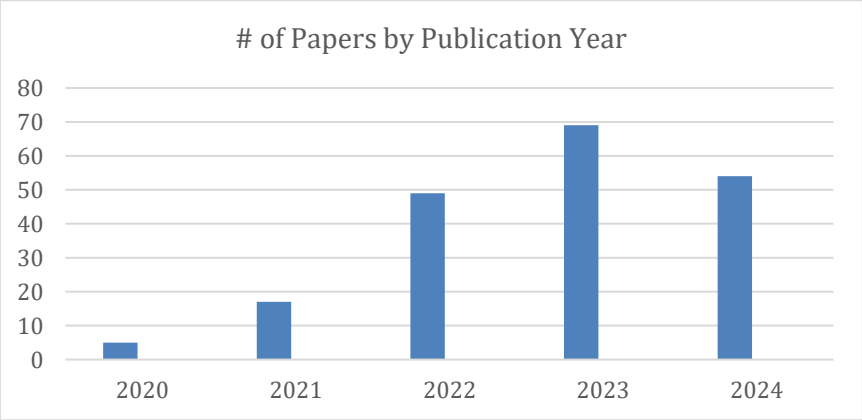

Figure 4. Number of articles in the Structured Literature Review by Year 2020-2024
Source: Primary data processed, 2025

Figure 4 shows the distribution of the number of articles published each year (2020-2024) based on Scopus search results. There has been a significant increase since 2020 and reached its peak in 2023. Then it will decline in 2024. This pattern shows a trend of academic interest in the topic of accelerating the implementation of smart cities in Indonesia after Covid-19.

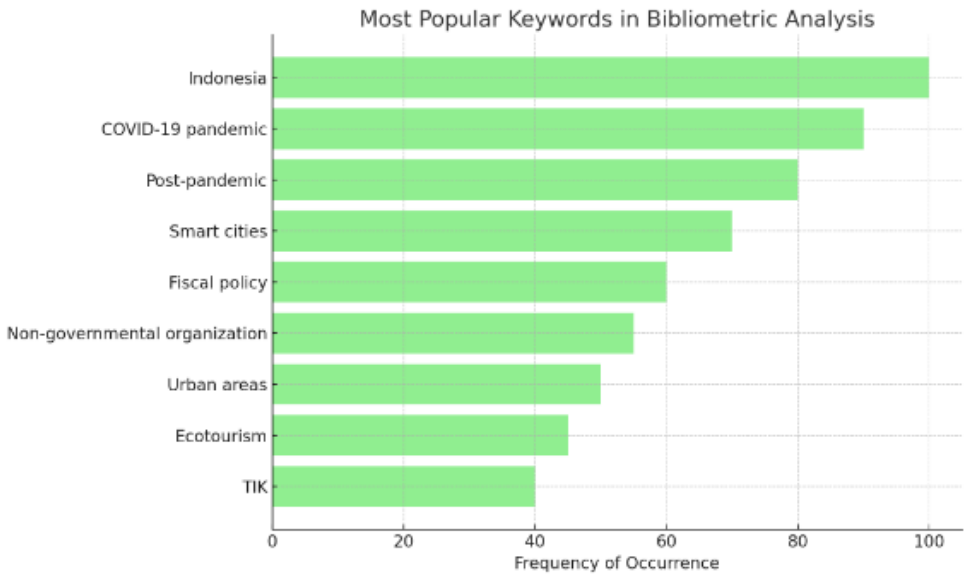

Figure 5. Frequency of Keywords Generated from Accelerating Smart *City Implementation* in Indonesia Collected
Source: Primary data processed, 2025

In figure 5, it is dominated by the keywords "Indonesia" and "Covid-19". The keyword "Indonesia" occupies the top position which shows that most of the research related to smart cities post-Covid-a9 does focus on the Indonesian context. Then the keywords "Covid-19 Pandemic" and "Post Pandemic" confirm that the pandemic is positioned as a key variable in academic discussions about accelerating digitalization and smart city implementation. Meanwhile, the keywords "Smart cities", "TIK", and "Urban areas" indicate that information technology, digital infrastructure, and urban governance are important focuses in the literature. The relationship between smart cities and TIK shows that the acceleration of smart cities is largely determined by the readiness of technological infrastructure.

It can be seen that the keywords "Fiscal Policy" and "Non-Government Organization (NGO)" highlight that fiscal policy and collaboration with the non-government sector are factors that are raised quite strongly that support the acceleration of smart cities not only in terms of technology, but also how public policies and non-state actors play a role. The emergence of the keyword "Ecotourism" is interesting because it shows that there is a study that shows that the topic of smart cities in Indonesia after Covid-19 also widens in the digital tourism sector, especially in economic recovery.

Discussion

The thematic analysis identified three main variables related to the implementation of smart cities after Covid-19, namely (policies, ICT, and the Covid-19 pandemic). This contribution is presented in the following image:

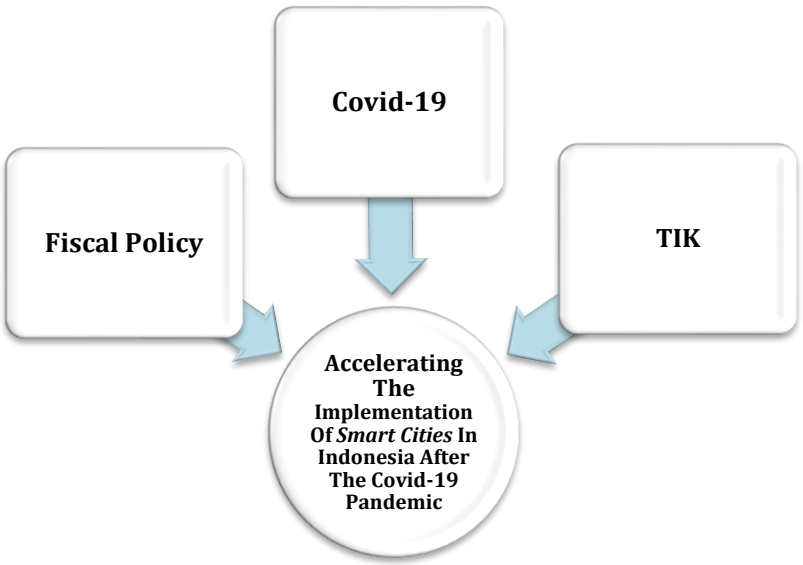

Figure 6. The relationship between variables and the acceleration of smart city implementation post-Covid-19 in Indonesia
Source: Data processed by authors, 2025

In figure 6, how the three main variables, namely Covid-19, fiscal policy, and ICT, interact with each other and simultaneously accelerate the implementation of smart cities in Indonesia after the Covid-19 pandemic. These three variables do not work separately, but form an ecosystem that influences each other in the process of urban digital transformation. Covid-19 has played a role as the most significant trigger for the acceleration of smart cities. The pandemic has created an urgent need for the government to change the pattern of public services, health systems, education, and governance to continue to function in pandemic conditions. The Covid-19 situation has encouraged widespread digital adaptation, accelerating the adoption of e-government systems, online learning, and community monitoring applications.

Then there is fiscal policy which is a supporting instrument that allows the central and regional governments to provide funding for digital infrastructure. This fiscal support ensures that the acceleration of digitalization does not stop as a temporary response during the pandemic, but also continues as a long-term development agenda. The role of technology and information (ICT) is the main motor that operationalizes the acceleration of smart city implementation. Technologies such as the Internet of Things, big data analytics, cloud computing, and artificial intelligence provide the technical foundation for building faster, responsive, and data-driven public services.

1.1 Accelerating the Implementation of *Smart City* Post-Covid-19 in Indonesia

The Impact of the Covid-19 Pandemic on the Acceleration of Digitalization and Smart *City Adaptation*

The COVID-19 pandemic has prompted cities in Indonesia to immediately change services to the community to be more effective by utilizing technology. The acceleration of the development of smart city approaches is related to policies that lead to the era of the Industrial Revolution 4.0 where technologies such as IoT, AI, and big data are very important in handling the pandemic. In this paper, smart city policies in Indonesia are considered as a means to modernize city offerings through the use of technology. Central and local governments are working together to incorporate these technologies into the management of transportation, education, health, and other services in an urgent response during the pandemic (Ilmiah et al., 2022).

In another study, five major cities in Indonesia, namely Jakarta, Bandung, Makassar, Surabaya, and Semarang, were observed to see how the pandemic event gave rise to various digital innovations aimed at developing smart cities. These cities are launching new digital services to residents that allow them to receive public services while still adhering to health protocols. This includes innovations

such as contact management systems, integration of health information systems using m-heath applications and geospatial technology as well as real-time *e-government service applications* (Rachmawati, Mei, et al., 2021; Rachmawati, Sari, et al., 2021).

The COVID-19 pandemic accelerated the use of digital technology in the health, transportation, and education sectors (Pratama et al., 2023). Digital healthcare, a fundamental element of smart living, has taken root at various levels across the country with more significant coverage in the West and Central regions than in the Central and Eastern regions (Rohmah et al., 2023). There is also evidence to support the use of technology during the COVID-19 period and this is why the concept of smart cities is important when there are global challenges in service delivery in public and urban management systems in Indonesia. Technological change is not the only force driven by the pandemic, but also a shift in digital culture in Indonesia. The study underscores that for better or worse, the pandemic has conditioned people to rely on technological innovation as an integral part of their daily lives. This change in digital culture is crucial because smart cities depend on educated people, who expect the use of technology to permeate society. Due to the pandemic, there has also been a change in people's behavior as they embrace technological advancements in various fields such as *telecommuting*, learning internet-based, and *telehealth* (Arianto, 2021). This means that a city can offer electronic services such as online tax payments, smart transportation systems, population reporting applications, which should be easier for the public to assimilate, due to its digital exposure to the public during the Covid-19 period.

Digital tourism is free from excessive physical engagement, which is difficult to maintain during the coronavirus pandemic. BUMDesa has been used as a means of supporting the economy and activities in many villages during the pandemic and has also started to implement technology-based services on demand (Nuraini et al., 2021). The development of these smart villages must be understood as a very important adaptation that allows for faster internalization of technology in rural areas and also contributes to a more self-reliant economy during the pandemic. The development of smart villages also accelerates the development of smart cities throughout Indonesia because smart cities cannot stand alone without integrated areas around them that can support the entire smart ecosystem.

1.2 Government Policy and Governance in Smart *City Implementation*

Developed countries such as Japan, Singapore, and South Korea have made significant progress in smart city development projects driven by information and communication technology (ICT). This progress has reached rural areas. However, it is different from Indonesia, especially after the COVID-19 crisis. The Indonesian

government needs to review the transformation of the bureaucracy for effective policies and good governance. Realizing a sustainable *smart city* in Indonesia, especially after the COVID-19 pandemic is very important. This policy should integrate social, economic, and environmental aspects in the sustainable context of development goals as the planning and implementation of a comprehensive smart city concept (Widiyastuti et al., 2021). This is in line with the public policy theory that the framework determines the direction of the country's development. Good governance will be able to make fair and transparent regulations to realize *a sustainable smart city*. It is imperative for the government to design and formulate policies and prepare the means and infrastructure for the creation of smart cities. If this has been achieved, it will make a smart and intelligent society (Yoga & Ardhana, 2024).

Broad and inclusive policies and participation with a good bureaucracy will improve the efficiency of public services and channel technological creativity. On the other hand, a sustainable framework will be useful to ensure that smart city initiatives go beyond technology focus and consider social and environmental consequences. In this regard, it is necessary to stipulate that sustainable governance and urban resilience planning include climate change adaptation measures and disaster risk reduction strategies, which are more relevant for post-pandemic (Ni'mah et al., 2021). Local government policy decisions need to emphasize a participatory approach in policymaking to ensure that community needs are met, especially in technology-based development programs (Aminudin et al., 2023).

Like public management policies in evaluating the feasibility of implementing smart city projects in Malang, East Java, that policymakers must consider aspects such as the fulfillment of basic urban services, community capacity building, and the use of cost-effectiveness analysis that can lead to more appropriate investment decisions (Fefta et al., 2023). Empirical evidence that smart cities can become more efficient when government as a policy spearhead can play an important role in managing existing crises such as in dealing with the COVID-19 emergency situation (Pratama et al., 2023). The future of the city can be determined by the government as a policymaker and the person who regulates governance. In the process of developing *smart cities* in Indonesia's capital, technology and urban governance are important elements in the smart city development process (Rachmawati, Reinhart, et al., 2024). The success of the implementation of *smart cities* in Indonesia is highly dependent on integrated policies and good governance as well as the active participation of all stakeholders in efforts to accelerate smart cities in cities and even rural areas in Indonesia.

1.3 The Role of Information and Communication Technology (ICT) in Encouraging Smart Cities

Digital technology has become the basis because it facilitates the development of an effective and efficient smart city while adequately addressing the problems and needs of the community and the urban environment. ICTs, particularly in the form of IoT, AI, cloud computing, and big data, have been used in building smart cities. Many countries and recently also in several major cities in Indonesia have implemented technology to accelerate *smart cities*. Information and Communication Technology (ICT) plays a fundamental role in accelerating the implementation of *the smart city* concept in post-COVID-19 Indonesia. This is reinforced from the literature reviewed. ICT is able to accommodate urban management systems such as transportation, health, education, and public safety. For example, the application of IoT and big data enables *real-time* data collection and analysis that improves decision-making processes in city management (Kurniawan, 2021; Erlinnawati & Purwanto, 2024; Wibowo et al., 2024).

ICT in smart cities plays an important role in improving people's quality of life by increasing access to public services effectively. ICT-based application systems also play an important role in the implementation of government programs such as *e-health, e-education, and e-governance* that help people access information and services more quickly and transparently. A review of the relevant literature shows that collaboration between the private sector and government is a key factor determining the success of smart city projects. Many local governments in big cities such as Makassar, Batu, Bandung have collaborated with technology companies to develop digital infrastructure and implement ICT-based platforms (Hardi & Gohwong, 2020a; Samsiar Ilmananda et al., 2022; Wulandari & Munawaroh, 2020). This collaboration helps accelerate the development of infrastructure related to smart cities—especially digital public service delivery systems, such as water, electricity, and waste management systems, that are based on IoT. It also allows local governments to reduce costs by outsourcing less skilled tasks to companies that are competent in the field of technology (Wahyudi et al., 2022).

The efforts made by the Batu City Government in developing ICT infrastructure are in line with the government's goal to build a smart city, where the application of information and communication technology (ICT) helps improve the provision of public services during the pandemic (Hardi & Gohwong, 2020b)(Rachmawati, Mei, et al., 2021; Rachmawati, Sari, et al., 2021). Then in Tangerang City, the space allocation that combines GIS-based applications in the smart city development plan and the "Tangerang Live" smart city application mainly focuses on improving the provision of public services (Wibowo et al., 2022)(Ramadhan et al., 2019). Although it has great potential, the literature also

shows challenges in the application of ICT in smart cities, especially in Indonesia which has large variations in infrastructure readiness. According to the study by Rahmawati et al., obstacles such as limited internet networks in urban areas and lack of technological infrastructure in small cities can slow down the implementation *of smart cities* evenly (Rachmawati, Ghiffari, et al., 2024). The lack of access to high-speed internet networks, especially 5G networks, reduces the ability of local governments to optimally adopt IoT and big data-based technologies. The role of Information and Communication Technology (ICT) in accelerating the implementation of *smart cities* in Indonesia is very felt. Digital technology and IoT networks have great potential to develop efficient and responsive public services and improve the living standards of urban citizens.

Conclusion

This study confirms that the acceleration of *smart city implementation* in Indonesia has significant implications for urban resilience, urban governance effectiveness, and economic sustainability. Accelerating the implementation of *smart cities* in Indonesia requires a holistic approach that integrates public policy, digital technology, and socio-economic contexts. The findings of the study show that multi-actor collaboration, increasing people's digital literacy, and strengthening digital infrastructure are key factors in realizing a smart city that is inclusive, sustainable, and resilient in the face of crises. The implications of this study also underline the need to strengthen data-based policies and community participation to support urban digital transformation. However, this study has limitations, especially the limitations of empirical data, namely the implementation of *smart cities* in rural and remote areas. Thus, further studies with wider scope and longitudinal data are still needed to provide a more comprehensive picture.

Recommendations

Based on the findings of the study, accelerating the implementation of *smart cities* in post-COVID-19 Indonesia requires an integrated policy strategy. First, central and local governments need to develop data-driven roadmaps (evidence-based policies) for smart city acceleration that are aligned with the six pillars of smart cities, accompanied by public participation forums to ensure policy inclusivity. Second, the expansion of digital infrastructure, especially 4G/5G networks to remote areas, must be accompanied by the development of integrated public service platforms and the strengthening of cybersecurity. Third, increasing the capacity of human resources through mass digital literacy programs and technical training for regional officials is essential to maximize the use of IoT, big data, and AI. Fourth, strategic collaboration between the government, the private

sector, universities, and local startups must be facilitated to develop sector-specific innovations, such as *smart health* (telemedicine and electronic medical records), *smart mobility* (real-time application-based public transportation), smart tourism (AR/VR and digital reservations), and *smart villages* to strengthen rural economies. This targeted and collaborative implementation is expected to create an *inclusive, resilient, and sustainable* smart city ecosystem.

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This research is expected to have a good impact on the development of *smart city applications* academically and practically in Indonesia. The authors believe that this idea has the potential to be the cornerstone of further research in the future.

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