JURNAL BINA PRAJA
Journal of Home Affairs Governance

ARTICLE

A Review of the Surakarta Smart City Concept

Optimizing Transformation and Digital Services Based on Big Data and Real-Time Technology

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Abstract: Digital transformation and public facilities in city governance have become basic needs amidst the increasing complexity of public services and public demands for fast, transparent, and affordable services. Surakarta City, as a cultural city in the process of becoming a smart city, faces challenges in streamlining bureaucracy, improving residents' quality of life, and optimizing the use of real-time data. This study aims to identify and formulate a strategy for the Surakarta Smart City concept that focuses on the dimensions of smart governance, smart living, and smart society. The approach used integrates big data-based information technology and real-time technology. The research method uses literature studies from Scopus, Google Scholar, and Sinta. The research result showed that the current digital transformation in Surakarta has not optimally improved public services or access to information, nor has it accelerated responses to field conditions. The researchers recommend developing an integrative dashboard across sectors. Concretely, the smart city concept in Surakarta can be strengthened by: (1) the concept of adding public facilities such as the provision of public Wi-Fi in strategic city spaces, (2) optimizing the development of digital health services, (3) developing online-based population administration that can be accessed in real-time and responsively, and (4) implementing a real-time city monitoring system through the integration of CCTV and big data. These initiatives are considered capable of improving accessibility and quality of life and accelerating data-based decision-making. This research confirms that the success of a Smart City rests not only on technology, but also on collaborative governance, adaptive regulations, and community social readiness. Surakarta has great potential to become a model for a smart city based on culture and sustainable citizen participation.

Keywords: Smart City; Digital Transformation; Digital Services; Real-Time Technology.

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Citation: Ridwan, M., Sanjaya, Z. T., Pramitasari, T. A., & Setyono, P. (2025). A Review of the Surakarta Smart City Concept: Optimizing Transformation and Digital Services Based on Big Data and Real-Time Technology. *Jurnal Bina Praja, 17*(2). https://doi.org/10.21787/jbp.17.2025-2820

Submitted: 26 June 2025

Accepted: 13 July 2025

Published: 29 August 2025

1. Introduction

The rapid growth of Indonesian cities, including Surakarta, creates challenges in providing quality public services, managing infrastructure, and improving public welfare. Population growth, urbanization, and the complexity of urban life require local governments to respond with more efficient, inclusive, and sustainable governance (Handayani et al., 2021). Based on the report of Direktorat Jenderal Penataan Ruang Kementerian Pekerjaan Umum (2015), which emphasizes that issues such as declining quality of life, limited bureaucratic capacity, and service gaps are the main problems that must be addressed in urban development.

The Smart City concept is presented as a strategic solution based on Information and Communication Technology (ICT) to enhance city management efficiency, improve community quality of life, and maintain environmental sustainability (Purba et al., 2025). According to the report of Direktorat Jenderal Penataan Ruang Kementerian Pekerjaan Umum (2015), Smart City encompasses intelligent city management through the integration of technology to connect, monitor, and control resources effectively and efficiently. Smart City aims to improve citizens' quality of life by leveraging technology to enable efficient, transparent, and participatory management of city resources. According to Giffinger et al. (2007), Smart Cities can be classified based on six main dimensions, namely Smart Governance, Smart Economy, Smart Mobility, Smart Environment, Smart Living, and Smart People.

Figure 1. Indicators in Each Smart City Wheel

Key components of the Smart City concept related to city management and improving quality of life are smart governance, smart living, and smart society. Smart governance focuses on the digitalization of public services, the availability of affordable public facilities, and integrated government transparency. Smart living and society encompass the comfort and quality of life for the community through the provision of well-managed healthcare, education, housing, and public housing (Amallya et al., 2023; Sofa et al., 2023). In Indonesia, several large cities have already implemented the Smart City concept, such as Jakarta (Jakarta Kini or Jaki program) (Wijaya, 2024), Bandung (Wicaksono et al., 2021), Surabaya, and Makassar (Setiawan et al., 2024). Innovation in the smart city program is seen in the role of technology in facilitating access to services and increasing public participation in the city governance process (Anisa & Hidayat, 2023; Wahyudi et al., 2022).

The transformation of digital public services presents poses crucial challenges, requiring the system to interact directly, efficiently, and accountably between citizens and the government (Kristian et al., 2024). Many cities in Indonesia, including Surakarta, still face challenges in fully implementing this system,

particularly in digital literacy, infrastructure, and data integration across institutions. According to the report of Direktorat Jenderal Penataan Ruang Kementerian Pekerjaan Umum (2015), the importance of leveraging government big data and the Internet of Things (IoT) to support real-time monitoring of city conditions was further highlighted. This is achieved through command center systems, CCTV, city dashboards, and data-driven analytics, enabling the government to respond quickly and accurately to traffic, security, and environmental conditions.

Digital transformation in the public service sector is a crucial step toward creating an efficient, service-oriented bureaucracy. Service digitization includes implementing a government management information system, an app-based one-stop shop, and an integrated platform for public reporting and complaints (Albino et al., 2015). World Bank Group (2022) stated that the implementation of GovTech (Government Technology) encourages the transformation of public services that place citizens at the center. However, most cities in Indonesia are still at the "scattered" maturity level in the Ganesha Smart City Maturity Model (GSCMM), indicating that the smart city concept has not been fully implemented and is not fully integrated into urban governance. Smart city implementation is not only about the use of advanced technology, but also about creating responsive, collaborative governance that can address community needs in real time. Therefore, it is important to conduct an in-depth study of the implementation of smart cities in Surakarta City, especially in the aspects of public facilities and access, digital health administration services, and real-time city monitoring, to determine the extent of Surakarta City's readiness and maturity in becoming a smart and sustainable city.

The gap in research regarding previous discussions on smart cities in Surakarta remains very limited, with minimal integration of several basic aspects of smart cities. The concept and novelty of this research formulate an adaptive strategy that is easily accessible to the public, actual, and accountable. The adaptive strategy is a digital transformation based on big data and real-time technology to realize Surakarta Smart City by integrating three main dimensions: smart governance, smart living, and smart society. Smart governance focuses on the addition of public facilities (wi-fi corners), and government transparency, as well as Smart Living and smart society, optimization of public services that emphasize improving the quality of life, comfort, and security of city residents.

2. Methods

The method used in compiling this article is a literature review, which includes a synthesis of previous studies and analytical references as the primary focus of the research. The goal is to provide an in-depth understanding of the "Surakarta Smart City concept," with an emphasis on optimizing digital transformation, big data, and real-time services.

Data collection was conducted through a search of scientific sources, including journal articles, conference proceedings, academic books, government reports, regional policy documents, and official publications on Smart City Surakarta published between 2018 and 2025. These sources were obtained through scientific databases such as Google Scholar, Scopus, and SINTA, as well as government documents accessed through the official websites of Surakarta City and the Ministry of Communication and Informatics. A Boolean search strategy was used to capture all relevant studies by combining the following keywords: ("smart city" OR "smart governance" OR "smart living" OR "smart society") AND ("Surakarta" OR "Solo city" OR "Indonesia") AND ("digital services" OR "digital transformation").

The literature selection process used inclusion criteria covering topics such as digital governance, big data infrastructure, real-time public service systems, smart living, smart governance, and smart society. Exclusion criteria included unverified sources and publications that were substantively irrelevant. Data analysis was conducted through several systematic steps. First, all selected literature was compiled into a matrix to record key information, including publication year, topic, methods, and key findings. Second, researchers conducted an in-depth reading of each source to understand its content (data familiarization). This was followed by a coding process that highlighted key issues related to Smart City Surakarta, including big data, real-time services, digital governance, and public service development.

These codes were then grouped into several main themes: digital transformation, improving the quality of public services, utilizing data for decision-making, and challenges in technology implementation. Next, comparisons across the literature were made to identify common patterns, differences, and emerging gaps. Findings from scientific articles were then cross-checked with government policy documents to enhance accuracy. The final stage was to synthesize the results, summarizing all the information into a comprehensive understanding of the conditions, opportunities, and recommended strategies for developing Smart City Surakarta.

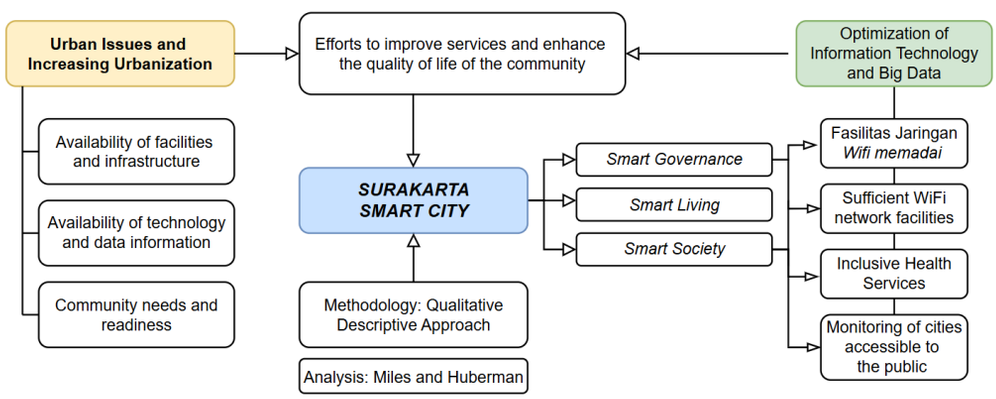

Figure 2. Research Thinking Framework

3. Results and Discussion

3.1. The Development of Smart City Research in Indonesia

A Boolean search of scientific literature from 2018 to 2025 yielded 448 publications on smart cities in Indonesia. Furthermore, regarding the research focus in Surakarta or Solo, seven international scientific journals (Scopus) were found. The data was processed using VOSviewer software to identify trends and gaps in previous research.

The VOSviewer visualization results showed that research on Smart Cities in Indonesia is dominated by keyword clusters such as smart governance, smart living, smart society, e-government, information systems, and citizen participation, with the network centered around the terms “smart city” and “Indonesia.” However, no studies were found specifically focusing on Smart City implementation in Surakarta, suggesting that scientific research on optimizing digital transformation in this city remains relatively limited compared to other major cities, such as Jakarta. The bibliometric map also shows that Smart City development is heavily influenced by the integration of big data technologies, real-time monitoring, and digital applications, which are directly related to Surakarta’s need to strengthen city governance, improve public service quality, and enhance citizen participation.

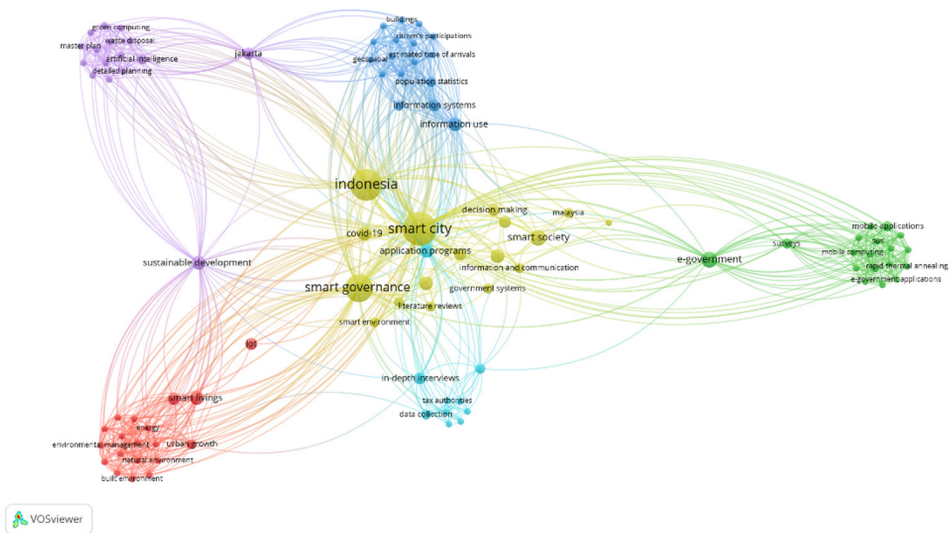

Figure 3. Network Visualization of Smart City Research in Indonesia

Related to research on the Surakarta smart city concept, the smart governance cluster emphasizes the importance of utilizing data for government services and digital decision-making. The smart living cluster demonstrates the relevance of using IoT and real-time monitoring to improve environmental quality and citizen comfort. Meanwhile, the smart society cluster emphasizes the role of citizen participation and the use of population data as a basis for more responsive social services.

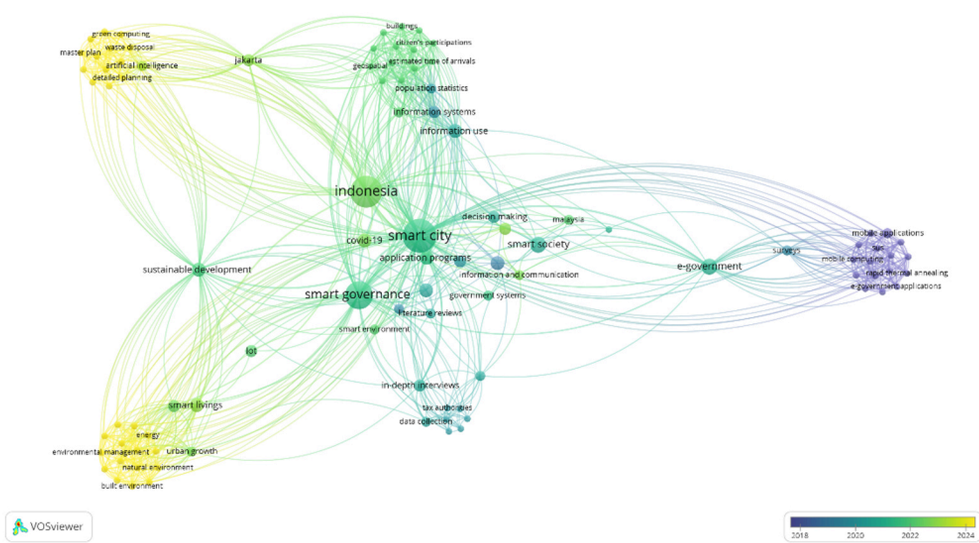

Figure 4. Overlay Visualization of VOSviewer Smart City Research in Indonesia 2018–2025

The VOSviewer overlay visualization displays the temporal dynamics of Smart City research in Indonesia through color gradients representing publication years. Core clusters such as smart cities, smart governance, e-government, and information systems are dominated by blue to green, indicating that these topics have long been a focus of the literature since 2018–2021. Meanwhile, yellow nodes, encompassing artificial intelligence, green computing, environmental management, urban growth, and smart living, indicate research areas experiencing increased attention in 2022–

2024, particularly related to the integration of the latest technologies in city management and public services.

This visualization also shows that Jakarta is the research location most frequently appearing in recent publications, while topics related to Surakarta do not appear as a prominent cluster. This indicates that studies on Smart City implementation in Surakarta are still limited and have not received much attention in previous research. These findings reinforce the urgency of research focused on optimizing digital transformation in Surakarta, particularly in the development of smart governance, smart living, and smart society by optimizing digital services/digital transformation and real-time technology.

3.2. Development Conditions of Surakarta City

Surakarta is one of 100 cities participating in the Movement Towards a Smart City program initiated by the Ministry of Communication and Informatics (Kominfo). Surakarta boasts a rich historical heritage with strong cultural and social strength. The current smart city development program, which involves digital transformation in Surakarta, seeks to balance cultural preservation and technological innovation.

The development of Information and Communication Technology (ICT) in Surakarta City has resulted in various applications implemented across all regional government agencies and related institutions, with the primary goal of improving work efficiency and the quality of public services. Although several obstacles remain in using these applications, improvements and innovation efforts are ongoing. This initiative is part of the Surakarta City Government's commitment to align with other cities/regencies that have successfully integrated ICT into their public service systems to become smart cities. As a manifestation of its seriousness in realizing the smart city concept, the government has currently formulated a Smart City Feasibility Study (2017–2021) and an ICT Masterplan (2016–2019) as guidelines for the city's digital development (Rahmawati & Nugroho, 2023).

According to Kertati (2020), the Public Satisfaction Survey (SKM) conducted by local governments annually has an average score of 70-80. This is evidenced by the questionnaire regarding the high demand for IT-based (digital) services, reaching 77.78%. However, in reality, not all public services have adopted information technology-based systems. Some services are still performed manually, requiring direct interaction between the applicant and staff. The high demand for digital services means that many people still cannot benefit from them, especially vulnerable groups, those with low socioeconomic status, the elderly, and those who lack adequate facilities or skills in using information technology (Herawati & Djunaedi, 2020). Even though they are aware of the transformation in the service system, the limitations they have make it difficult for them to utilize digital services optimally (Kertati, 2020).

Challenges in developing e-government include limited numbers and competencies of Human Resources (HR) and the need for infrastructure improvements. Surakarta City has 38 applications with regional government agencies, but integration efforts between systems are still underway with the Communication and Information Agency. The applications and websites used by Regional Government Agencies are generally in good condition, but updates are irregular and not evenly distributed. This can be seen from the latest history of news/topics presented. Surakarta has 6 official portals for the Surakarta regional government: Solodata, the official website (surakarta.go.id), PPID Surakarta, INTIP (geospatial), BPS Surakarta, and BKPSDM Portal (personnel). The Communication

and Information Agency (Kominfo) have prepared a plan to develop information systems supporting Smart City through the Surakarta City ICT Masterplan. Currently, approximately 58.54% of Regional Government Agencies in Surakarta City have websites, while the remaining 41.46% do not have one (Kertati, 2020).

Public facilities in Surakarta City already have various types of facilities and data related to technology and information, such as CCTV data, electricity and water usage, Wi-Fi networks, open complaints, data management, transparency, and access systems. This data relates to social life and is needed to improve service quality. However, the utilization of this data is still not optimal and is still in the form of a dataset that is not updated regularly on the relevant websites and has not yet been widely collaborated across government agencies (Herawati & Djunaedi, 2020).

Table 1. Data on Facilities and Services of Surakarta City

No.	Data/Facilities	Development	Suggestions/Evaluation
1	CCTV	• According to reports, the Surakarta Transportation Agency manages 166 CCTV cameras across various parts of the city. • Regarding the implementation of e-Ticling (E-TLE), 66 CCTV cameras are reportedly monitored by the Surakarta Police Traffic Unit through the Traffic Management Center (TMC). • The web-based Solo Traffic Information System displays CCTV footage at various corners of the city (roads) periodically, not in real time.	Developing a gadget-based information and visualization system that presents real-time city condition data, such as traffic, weather, and road damage with a user-friendly display, as well as notification features.
2	Wi-Fi Network	• Surakarta has free Wi-Fi in public spaces and certain government-owned office areas. • There has been no public evaluation report regarding the total number of public Wi-Fi networks.	Expand Wi-Fi and public space beyond government offices to allow public use. Suggestions include expanding Wi-Fi to public locations, such as bus stops, city corners, and strategic/tourist locations.
3	The Batik Solo Trans Bus Stop/ Public Space/Public Facility	• The Batik Solo Trans (BST) bus is the main public mass transportation in Surakarta. • According to research, there are 72 BST bus stops in Surakarta: 34 covered, 10 open, and 28 public. • Solo Technopark (Solo Science and Technology Area) has been upgraded as a public space and innovation center. • Surakarta City Hall functions as a public space for arts events and public meetings.	Many Batik Solo Trans bus stops are uncomfortable and not all are disability-friendly. Bus schedule and route information is not yet digitally integrated. Suggestions include integrating BST data into the Solo Smart City app. Creative public spaces are active, but community utilization is still limited. Add facilities such as charging stations, high-bandwidth Wi-Fi, and outdoor working spaces.
4	City Related Data Information	• Surakarta developed a website-based government data information system in the form of Solo Data (solodata.surakarta.go.id) which has a data set of 2559 spread across 11 sectoral study groups and 37 Regional Device Organizations. • The official page of the Surakarta City Government (surakarta.go.id) contains public services, planning documents (RPJMD, RKPD), and data downloads. • There are 6 official portals of the Surakarta regional government: Solodata, official website (surakarta.go.id), PPID Surakarta, INTIP (geospatial), BPS Surakarta, BKPSDM Portal (personnel)	There are many information websites available in the city government to report information, but they are not widely accessed by the public because most of them are not updated continuously.
5	Public Service	• Services related to education, health and population administration facilities are available at regional offices and many require direct access to the relevant parties. • The Surakarta PPID report mentioned an increase in the efficiency of public complaints through the ULAS (Surakarta Complaints Service Unit) application and the WhatsApp channel “Lapor Mas Wali”	Providing information and easy, gadget-based access to each region/sub-district to ensure fast and accurate service. Providing organized access to complaint services.

Source: *Various Research Sources, Official Website of the Surakarta City Government/Department, Author’s Data Analysis. 2025.*

Based on the conditions in Table 1, it is necessary to provide adaptive strategies and concrete, integrated concepts for the government/agencies to utilize this data to realize a sustainable smart city. The goal is to improve the quality and comfort of life for the residents of Surakarta City.

An integrative, adaptive solution, the Surakarta Smart City concept innovation encompasses smart governance, smart living, and smart society components. This integration optimizes digital transformation (digital services) connectivity based on Big Data, which is then processed and used in real time by the public and service providers. The implementation of a Smart City is not only about the use of advanced technology, but also about creating responsive, collaborative governance that can address public needs in real time. Therefore, this concept requires cross-sector involvement: government, the private sector, academia, and civil society. A smart city can adopt technological innovation without neglecting inclusivity and long-term sustainability. The following is the Surakarta Smart City concept implemented for this purpose (Figure 5).

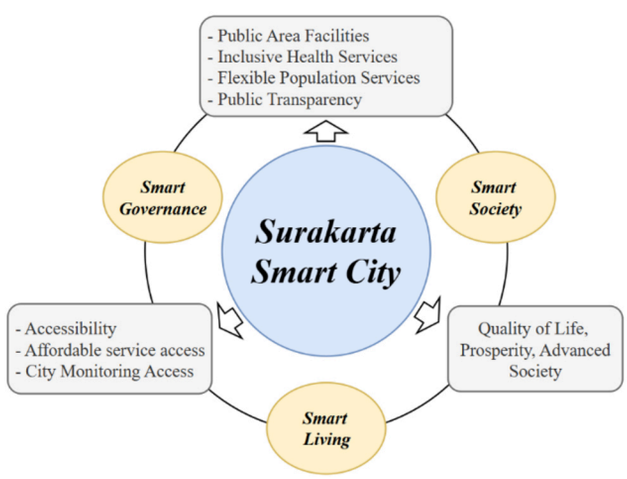

Figure 5. The Concept of Surakarta Smart City

3.3. Smart Living: Optimizing Public Wi-Fi Facilities & Public Space

One concept supporting the implementation of Surakarta Smart City is the optimization and equitable provision of more Wi-Fi corner facilities and public spaces. These facilities are often found in government offices and certain agencies and are only accessible to certain groups. Therefore, it is necessary to add more access and facilities in strategic areas so that the general public can use them. The development of additional Wi-Fi corner access can be integrated with existing public transportation facilities (Batik Solo Trans and BST Feeder) in Surakarta City. Based on the database, integration between the transportation and information technology agencies will greatly facilitate collaboration in increasing Wi-Fi facilities and public spaces.

The integration of public facilities in Surakarta City needs to be directed at strengthening the smart mobility ecosystem and digital public services. One strategic step is to connect the corridors and bus stops of Batik Solo Trans (BST) with free public Wi-Fi. Currently, the public Wi-Fi network in Surakarta remains concentrated in several public spaces, such as parks, the City Hall, and MSME areas. Meanwhile, BST bus stops, which are the daily mobility hubs for residents, still lack internet access. However, BST has various bus stops (permanent, portable, and semi-enclosed), which could make it the city's main digital node network. By providing free Wi-Fi at BST bus stops, passengers can easily access real-time information on bus

schedules, routes, and locations, and support the use of the Solo Smart City application. This integration also opens up opportunities for the digitalization of other public services, such as cashless payments, bus stop condition reporting, and rapid dissemination of city information. In addition to improving the comfort and efficiency of citizen mobility, the Wi-Fi network on BST routes also strengthens digital inclusion for students, workers, and MSME communities that rely on public transportation.

This aligns with the smart living concept in Jakarta, with the provision of the JAKI app. The JAKI app provides tangible support for the daily needs of Jakarta residents through various features that facilitate access to information and public services. Research shows that this app provides essential services such as air quality checks, public Wi-Fi location information, access to social assistance, and healthcare services by providing various information and services on one platform, JAKI helps residents live a more comfortable, safe, and connected life, thus supporting the realization of the smart living concept in daily activities.

These facilities can be provided at BST bus stops, stations, terminals, city corners, and strategic tourist spots. Additional facilities can be integrated across the Information Technology Agency, the Transportation Agency, and network providers to ensure equitable distribution of public facilities (Wijaya, 2024). The concept of an integrated application based on data and information technology owned by the government is shown in Figure 6 and Figure 7.

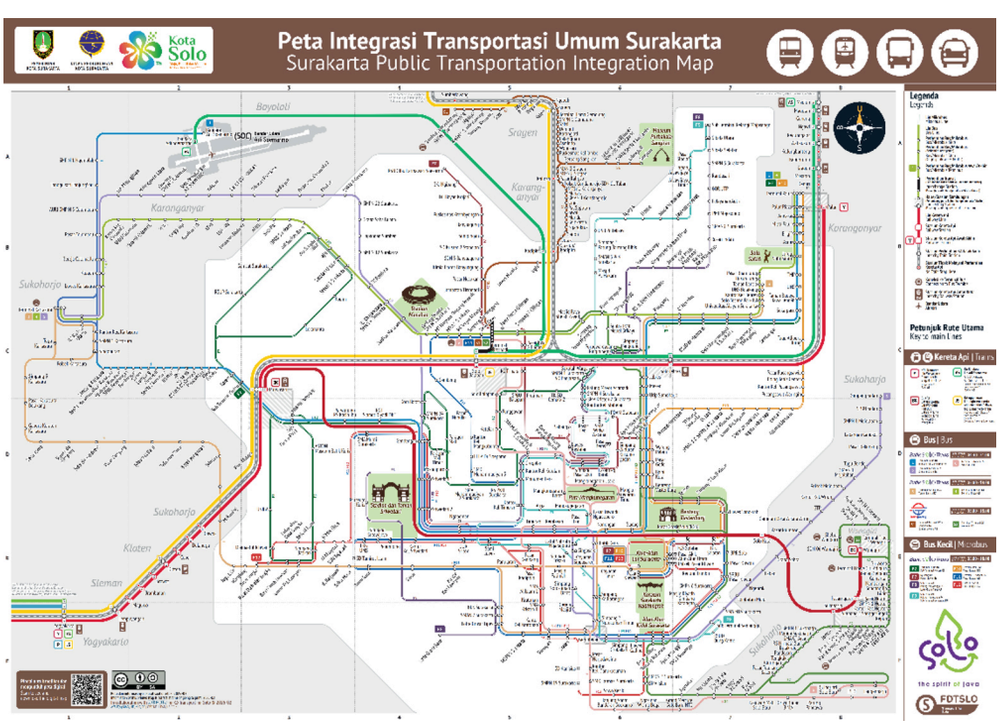

Figure 6. Map of Surakarta Public Transportation Integration

In recent years, various cities in Indonesia have demonstrated rapid progress in implementing technology to improve the quality of public services and become pilot projects for the smart city concept. Initiatives like E-Sumsel demonstrate how the use of ICT can strengthen bureaucratic transparency and accountability (Mislawaty et al., 2022). Jambi City, as part of the 100 Smart Cities Program, has become a model in improving the quality of life of its people, including program support for the elderly (Saadah & Agustiyara, 2024).

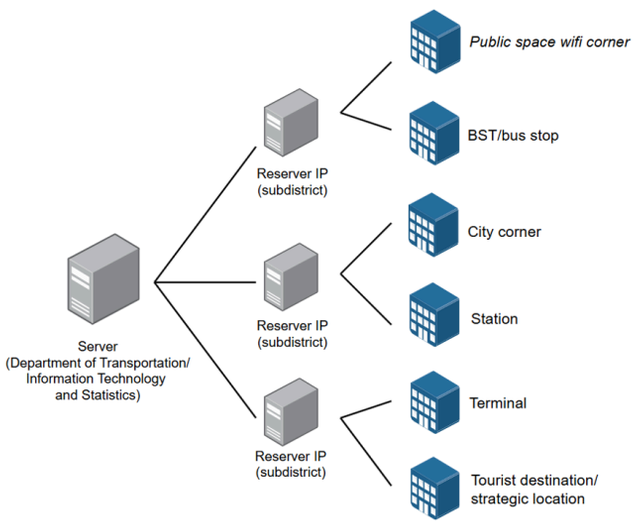

Figure 7. Integrated Concept of Implementing Optimal Distribution of Wi-Fi Corner and Public Space Facilities

A challenge to implementing the smart city concept is low public understanding. For example, in South Tangerang, digitalization across various regions is driving a shift toward more efficient and responsive public services. This transformation is reinforced by e-governance innovations and systems such as the Village Information System (SI Desa), which helps simplify data management and improve the effectiveness of local services (Budiantoro et al., 2023). Efforts to increase digital literacy and adapt cross-sector policies also demonstrate the government's commitment to aligning technology implementation with community needs (Zainudin, 2025).

Overall, the integration of BST lines with public Wi-Fi is a strategic step to expand the coverage of Surakarta's digital infrastructure, improve the quality of transportation services, and strengthen the transformation towards a smart city based on real-time data and technology.

3.4. Smart Living: Optimizing Public Health Services

Digitalization in the healthcare sector is a crucial element of the Surakarta Smart City program. Digital-based healthcare services enable the public to obtain information, access medical services, and manage healthcare administration quickly, efficiently, and sustainably. Healthcare services are no longer limited by time and space; instead, they can be provided in real time and in an integrated manner, through digital devices, from anywhere and at any time.

Patients can register for services at the nearest community health center or hospital online through a website or app. This time-based queuing system minimizes physical queues and expedites on-site service processes. Virtual doctor consultations (telemedicine) are being implemented to facilitate patients in obtaining initial medical advice without having to visit a healthcare facility in person. This mechanism can be integrated and optimized through the Surakarta Regional Health Information System (SIKDA), which integrates health data across various healthcare facilities in the Surakarta region, both government and private. The implementation of SIKDA aims to improve the quality of healthcare services by ensuring the availability of accurate and timely data and information for healthcare workers and the public. The innovation flow in the digitalization process in online and real-time health services can be seen in Figure 8.

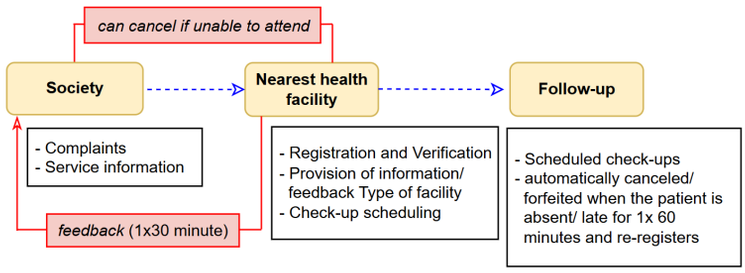

Figure 8. Real-Time Digital Healthcare Service Flow

The working principle of this healthcare service is connectivity between healthcare facilities through an integrated, one-way information system. Like having an official contact person (CP) for each, every community health center, hospital, and private clinic can be digitally interconnected. In practice, when a patient comes to a community health center and requires services not available there, staff can immediately refer the patient to a partner hospital registered in the system, complete with digitized medical data. This process speeds up referrals, reduces duplicate examinations, and improves the effectiveness of patient care. This system integration benefits the Health Office as the system manager (Anisa & Hidayat, 2023).

The study entitled “Smart City Achievement through Implementation of Digital Health Services in Handling COVID-19 in Indonesia” by Rohmah et al. (2023) shows that digital health services, particularly telemedicine, are effective in mitigating the impact of geographic and physical barriers to access to healthcare. However, this practice is more prevalent in western and central Indonesia, while it remains limited in the eastern region. Determining factors include digital literacy, internet signal quality, regulations, local government policies, and health information systems.

Another study, “Digital Transformation of Health Services in Indonesia through the Utilization of Artificial Intelligence, Big Data, and Telemedicine,” using a systematic literature review with bibliometric analysis, confirms that AI, big data, and telemedicine have significant potential to address disparities in healthcare access, particularly in remote areas. However, this study also found that the main challenges hindering the optimization of public healthcare services are unequal digital infrastructure, public digital literacy, regulations that are not fully supportive, and issues of patient data privacy and security.

In healthcare, JAKI has proven its ability to support the government’s response during the COVID-19 pandemic through its vaccine registration feature, which saw a 120.5% increase in usage, demonstrating the technology’s effectiveness in accelerating public access to healthcare. In administrative services, the integration of various population services and public complaints through the Laporwarga feature has made it easier for citizens to report issues such as damaged roads, garbage, or service disruptions, with 94.4% of these issues successfully addressed by the government (This strengthens transparency, accountability, and responsiveness of the bureaucracy, while also demonstrating a shift to data-driven governance).

3.5. Smart Governance: Optimization of Public Administration

Digital public service transformation is a strategic step to increase bureaucratic efficiency, accelerate service delivery, and strengthen government accountability to the public. Key strategies in this transformation include digitizing administrative processes, integrating data between agencies, and developing user-centered service platforms. Local governments such as Surakarta City can adopt the Government as a

Platform (GaaP) approach, in which digital services serve not only as administrative tools but also as collaborative ecosystems that connect various stakeholders, including the public, the private sector, and educational institutions. This is supported by the development of integrated service applications, online queuing systems, and real-time service performance monitoring dashboards. According to Nugroho and Fitriani (2021), the success of digital transformation in the public sector is determined by three main factors: adequate technological infrastructure, human resource capabilities, and public trust in digital systems. Meanwhile, a study by Wicaksono et al. (2021) shows that digitizing public services can reduce service times by up to 60% and increase public satisfaction with access to public information. In the context of a smart city, this strategy aligns with the principles of smart governance, which emphasize transparency, participation, and efficiency in technology-based governance.

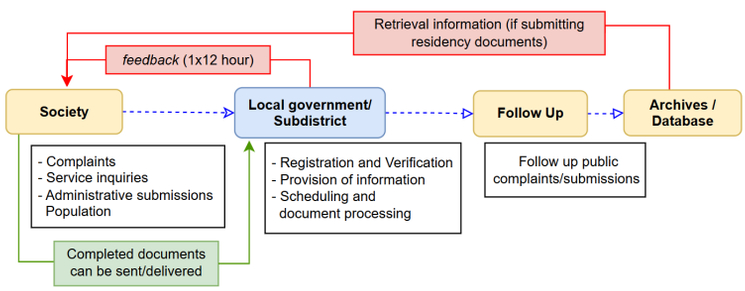

Figure 9. Flow of Population Administrative Services or Complaints

The public service mechanism in the figure shows an integrated flow between the public and the local government. The process begins with the public submitting complaints, service inquiries, or administrative requests. All requests are forwarded to the sub-district government for registration, verification, and document processing. The next stage is followed up by the relevant unit, which is then documented in an archive system or database. Once processing is complete, the government provides feedback to the public with a maximum response time of 1 x 12 hours. For population administration services, a document retrieval mechanism is also available. This flow ensures faster, more transparent, and accountable public services.

Research by Priyowidodo et al. (2024) examined digital transformation in Surabaya, encompassing people, technology, processes, and public services. The results showed that the digitalization of public services has supported bureaucratic efficiency and eased access to information, although active public engagement still needs improvement. Meanwhile, Evellinda (2023) conducted a descriptive analysis of the success of smart governance in Indonesia and found that the main obstacles lie in technological infrastructure, public digital literacy, and institutional coordination, which impact the speed and ease of digital public services.

Bolívar and Meijer (2016) emphasize that effective smart governance requires synergy between information technology, adaptive internal governance, and active public participation. OECD (2023) also underscores the importance of data governance in smart cities to ensure real-time public services. However, without robust data infrastructure and secure data-sharing policies, real-time access cannot be fully realized. Furthermore, a study by Sulistyaningsih et al. (2023) found that smart city policies in Indonesia remain sectoral and not yet nationally integrated, making it difficult to create a seamless, fast, and accessible public service system.

Technological developments supporting public reporting services in Indonesian smart cities have shown significant progress, particularly through digital platforms designed to increase transparency and citizen participation. The Jakarta Kini (JAKI) application is a notable example, serving as an integrated public service platform that enables the public to access various government services while providing effective feedback (Wijaya, 2024). JAKI's presence not only strengthens transparency but also encourages citizen involvement in evaluating public services. This provides public agencies with better insight into service performance, thereby enhancing government accountability and responsiveness to public needs (Rofi et al., 2021). Furthermore, JAKI reflects Jakarta's commitment to strengthening digital governance to create a more connected and informed society.

Similar initiatives are also developing in other regions. The digitization of tax and levy reporting systems in cities like Pangkalpinang demonstrates local government efforts to optimize public services through technology (Rahmadoni et al., 2022). The system utilizes information and communication technology (ICT) to simplify the collection and reporting process, thereby improving operational efficiency and encouraging taxpayer compliance (Karya et al., 2024). This step is not only crucial for increasing regional revenue but also provides a clearer framework for citizens to understand and fulfill their fiscal obligations. Overall, these digital innovations underscore the shift toward increasingly integrated public service platforms in Indonesia's smart cities, with the principles of transparency and public participation remaining the foundations of effective governance (Tukina, 2020).

3.6. Smart Society: Crowd Monitoring and Public Safety

The use of big data is a key foundation for realizing a responsive smart city. The Surakarta government has begun integrating CCTV, environmental sensors, and an IoT-based traffic monitoring system connected to the city's command center. This strategy aims to provide real-time information on weather conditions, traffic congestion, and emergency events. This strategy reflects a data-driven governance approach, in which government policies and operational actions are informed by accurate, up-to-date data analysis. By integrating various data sources, including traffic sensors, data from public service applications, and public input through online complaint channels, the government can develop predictive patterns for potential traffic disruptions, crowd concentrations, or potential environmental disasters such as floods or fires.

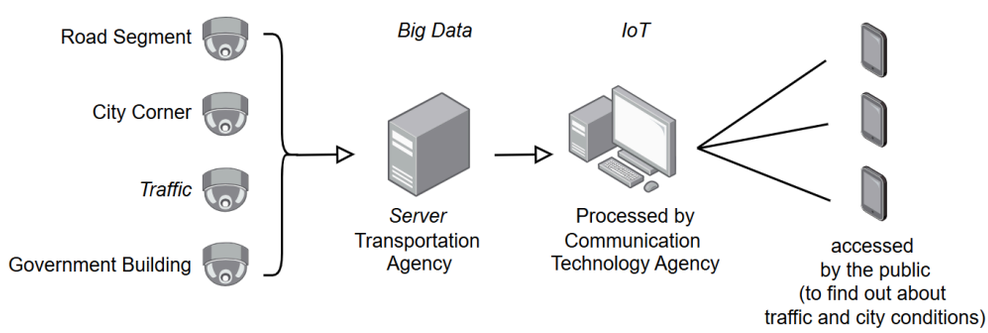

Figure 10. Concept of Implementing Gadget-Based City Monitoring Access

One strategic benefit of this system is the increased response time of relevant agencies, such as the Transportation Agency or the Fire Department, in handling incidents in the field. For example, if a vehicle buildup or traffic accident occurs, the system will automatically send a signal to the responsible officer to take immediate action. Furthermore, data collected from various points in the city can be used to

analyze resident travel patterns, peak traffic hours, and the effectiveness of public transportation modes such as Batik Solo Trans (BST) and Feeder BST, thus making city transportation planning more efficient. The city of Surakarta is also working to develop an integrated big data-based dashboard that allows officials and the public to openly monitor visual data in the form of graphs, digital maps, and early warnings. The use of big data in city monitoring systems also faces several challenges. Among these are the need for reliable technological infrastructure and the availability of professionals capable of managing and analyzing large-scale data. Therefore, strong integration between collaborators and support from each sub-district are required for its implementation.

The Smart Society aspect in the Blora Regency case study is reflected in collaborative efforts between the government and the community to monitor crowds and maintain public space security. The revitalization of strategic areas such as Blora Square, Tirtonadi Park, and Jalan Pemuda is equipped with smart lighting and lighting elements that increase visibility and facilitate monitoring of public activities at night. In addition to physical infrastructure, the government utilizes the Dolan Blora application and social media channels to create a platform for reporting on field conditions, allowing the public to provide information regarding crowds, potential disturbances, or complaints in real time.

The involvement of residents and local communities in providing regular feedback creates a crowd-based monitoring mechanism, strengthening the community's role as part of the city's oversight system. This approach makes the city safer, more orderly, and more adaptive to crowd dynamics. It also demonstrates how Blora is building a smart society through the integration of technology, active public spaces, and citizen participation (Sofie & Rachmawati, 2024).

The Smart Society aspect in the JAKI case study is reflected in the crowd- and public-safety monitoring mechanism, which involves active citizen participation through the LaporWarga feature. This feature allows residents to report various situations in their neighborhoods, such as noise, damaged public facilities, piles of garbage, and even security disturbances. Research data shows that up to 94.4% of citizen reports are successfully followed up on, demonstrating the effectiveness of this reporting system as a community-based monitoring tool. This citizen involvement strengthens social surveillance, a key characteristic of a smart society: a community that is active, adaptive, and responsive to environmental issues (Wijaya, 2024). In addition to manual reports from residents, the local government also leverages integrations with partners, such as transportation providers, digital platforms, and CCTV operators, to support monitoring of public mobility and activities in Jakarta.

This collaboration helps the government monitor community movement patterns, crowding points, and potential security risks in dense urban areas. This integration also accelerates the government's response to emergencies or disruptions to public services. Overall, JAKI's integrated reporting system builds a smart society ecosystem that promotes collaboration among the government, citizens, and the private sector to maintain security and monitor crowd dynamics. Based on citizen participation, Jakarta has successfully developed a public oversight mechanism that is more inclusive, rapid, and adaptive to the needs of a large city (Wijaya, 2024).

4. Conclusion

The concept of developing Surakarta Smart City, which aims to improve the quality of life, comfort, and security of the community, requires a comprehensive adaptive

strategy. The dimensions of a smart city that support this policy include smart governance, smart living, and a smart society. The results of the study are to formulate several adaptive policy strategies, including: (1) Provision of Wi-Fi facilities and public spaces, (2) Optimization of health services, (3) Optimization of public administration, and (4) Real-time city monitoring. The addition of public facilities such as Wi-Fi corners and public spaces (public discussion rooms) at strategic points in the city supports the creation of a comfortable, safe, and inclusive environment. This is due to the comfort and connectedness of citizens in productive public spaces. Digitalization of public services, such as population administration and health services. Implementing an online queuing system, application-based service access, and information transparency are the main strategies to increase service efficiency and accountability to the community. The goal is for the public to access them easily and in an accountable and inclusive manner. The use of big data and a real-time city monitoring system by integrating traffic, crowd, and environmental condition monitoring technology can make Surakarta City have the government's ability to be responsive to city dynamics. Real-time big data analysis supports faster, more targeted, and evidence-based policy making).

Acknowledgments

The author would like to thank the Surakarta City Government, the Surakarta City Government Data Information and Communication Service, the Head of the Community Health Center and Health Services, who were willing to share data/information to compile the article to realize Surakarta Smart City.

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