

Assessing Smart City's Readiness in Semarang City for Sustainable Development

By:

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ABSTRACT: This study aims to analyze Semarang City's readiness to become a Smart City for sustainable development. This research employs qualitative analysis and utilizes secondary data from the mass media. The data were processed using Data Coding technique, Crosstab Queries, and Word Cloud Analysis. The result indicates that Semarang City has the potential for smart city development. It is supported by the implementation of flagship programs in Semarang City to achieve Smart City status, particularly in improving public services, creating a green environment, and fostering sustainable economic growth. Semarang City faces challenges such as inadequate supporting infrastructure for smart cities, disparities in technological know-how across society, and significant environmental challenges. Regarding implications, this study recommends that the municipal government undertake comprehensive development and training for the human resources involved in the Smart City initiative, in addition to providing technological outreach to the community to accelerate the Smart City initiative.

Keywords: Smart City, Sustainable Development, Social Welfare

ABSTRAK: : Penelitian ini bertujuan menganalisis kesiapan Kota Semarang menjadi Smart City di Kota Semarang untuk pembangunan berkelanjutan. Penelitian ini termasuk ke dalam penelitian kualitatif yang menggunakan data sekunder bersumber dari media massa. Data penelitian di olah dengan teknik Coding data, CrossTab Queryry and Word Cloud Analysis. Hasil penelitian menunjukkan bahwa Kota Semarang berpotensi untuk pengembangan kota pintar. Hal ini dibuktikan dengan telah berjalannya program-program unggulan di Kota Semarang sebagai upaya menuju Kota Pintar khususnya di bidang peningkatan pelayanan masyarakat, penciptaan lingkungan hijau dan pertumbuhan ekonomi berkelanjutan. Tantangan yang dihadapi Kota Semarang yaitu masih relatif rendahnya infrastruktur pendukung kota pintar, kesenjangan pengetahuan teknologi antar masyarakat dan tingginya isu lingkungan. Implikasi pada penelitian ini yaitu pemerintah kota perlu secara masif melakukan pembinaan dan pelatihan terhadap sumber daya manusia pelaksana dan penyuluhan teknologi kepada masyarakat sehingga dapat mencapai akselerasi terciptanya Smart City.

Kata Kunci: Kota Pintar, Pembangunan Berkelanjutan, Kesejahteraan Masyarakat

INTRODUCTION

A smart city is an integrated urban development concept designed to improve public well-being through the use of technology, inclusive government services, and public participation. Smart City concept reflects the readiness for strategic integration and transformation in urban communities. Angelidou, (2014) explain that smart city develop technological convenience, inclusive government services, and increasing public participation. Camero & Alba (2019) explain that a smart city is an effective scheme to encourage the creation of public welfare, providing convenience and comfort for the community in various fields.

In facing the challenges of urbanization by leveraging the power of digital technology to create efficient, inclusive, and sustainable governance, the Indonesian Government has established a smart city policy. Its main objectives are to improve the quality of life of the community through transparent public services, strengthen innovation-based economic competitiveness, and ensure environmental sustainability. Through six main elements—smart governance, smart branding, smart economy, smart living, smart society, and smart environment—this policy also supports the achievement of the Sustainable Development Goals, specifically SDG 9, SDG 11, and SDG 16. SDG 9 (Industry, Innovation, and Infrastructure) demands the development of quality infrastructure and innovation so that technology can be accessed equally, a core aspect of the smart city initiative that involves the digitalization of public services and the development of digital infrastructure (United Nations, 2025). SDG 11 (Sustainable Cities and Communities) aims to make cities inclusive, safe, resilient, and sustainable; Smart cities provide concrete guidelines through disaster risk mitigation systems, efficient public transportation, green open spaces, and participatory urban planning (UN-Habitat, 2023). Meanwhile, SDG 16 (Peace, Justice, and Strong Institutions) is closely linked to smart governance, which, through transparency, accountability, and increased public participation in local government decision-making, strengthens public trust in public institutions and institutional justice (United Nations, 2023; UNDP, 2025). Thus, smart city development is not merely urban modernization, but rather a strategic instrument for achieving a balance between innovation, quality of life, and equitable governance.

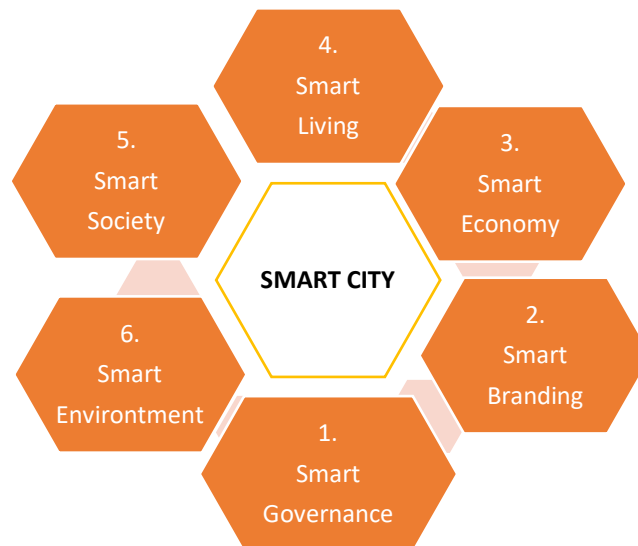
One of the cities designated as a Smart City is Semarang. The Ministry of Communication and Information (2018) designated Semarang City as one of the cities with a priority for smart city development. Semarang is one of the fifth largest metropolitan cities after Jakarta, Medan, Surabaya, and Bandung. However, Semarang City experiences problems with minimal infrastructure and city facilities, so that services for the community are not optimal. This condition is evidenced by the low level of road construction and drainage systems, making Semarang City prone to flooding. Based on data from the Central Statistics Agency of Semarang City (2025), it is known that the condition of roads in good condition is 305 kilometers, or 36 percent of the total length of roads in Semarang City. In addition, access to digitalization in Semarang City is still relatively low. This condition is evidenced by the still low digital literacy rate, which stands at 60 percent, especially among MSMEs (Semarang City Cooperatives and Micro Enterprises Office, 2024). On the other hand, in 2013, the Semarang City Government launched a reform in public services. This was done to increase public trust in the local government and improve community welfare, in accordance with its vision of "Semarang: A Great City of Trade and Services Towards a More Prosperous Society," supported by the slogan "*Semarang Hebat*." However, the implementation of smart cities has not been fully optimized. Therefore, research on smart city readiness in Semarang, one of Indonesia's metropolitan areas with limited infrastructure and digitalization capacity, is urgently needed.

The technical systems theory approach is the primary theory in Smart City development. This theory explains the strong interaction between the role of government and technology in creating a Smart City. The Smart City concept also emphasizes the importance of community participation in regional development (Lom & Pribyl, 2021; Zhai & Gao, 2024). Smart City is one of the basic concepts that transform the order of urban life. This concept is used to improve efficiency in the fields of transportation, energy, health, education, and government, as well as creating a sustainable environment, thereby creating connectivity in urban communities. Digital transformation is one of the supporting components of Smart City development and encourages sustainable development

(Mortaheb & Jankowski, 2023; Gracias et al., 2023; Kwilinski, 2023). The Ministry of Communication and Information (2017) explains that there are six important elements used in Smart City development, including (1) Smart Governance, (2) Smart Branding, (3) Smart Economy, (4) Smart Living, (5) Smart Society, and (6) Smart Environment. Based on the explanation above, Semarang City has been designated as a priority for smart city development. However, to realize this development, several elements must be met. Therefore, this study was specifically conducted to analyze Semarang City's readiness to become a Smart City by optimizing its opportunities and minimizing the challenges. This study also provides policy recommendations to accelerate implementation in Semarang City through technology-based inclusive development.

Rani et al., (2022) explains that Smart Cities play a crucial role in shaping economic and social development in urban communities. Sustainable development is crucial because it relates to many important aspects. The Smart City concept integrates key aspects such as governance, transportation, agriculture, education, and health with a technology base (Ahad et al., 2020; Campisi et al., 2021). That is enables people to have a better quality of life because access to information is available easily and quickly in digital technology (León & Rosen, 2020; Nesti, 2020). Based on previous research, this study specifically aims to identify the readiness for Smart City implementation in Semarang. This study also identifies the achievements of the Smart City concept implemented by the Semarang City government and analyzes the challenges faced by Semarang City in implementing Smart City, ensuring optimal implementation of the Smart City concept.

The Semarang City Government has implemented the practical use of information technology through the Smart City concept. The Smart City concept offers an alternative solution to address urban challenges. This is because Smart Cities support inclusive integration between the community and the government. This allows the government to more easily manage and control the aspirations of urban residents (Paiva et al., 2021; Toli & Murtagh, 2020). Smart City implementation will be easier if the government clearly understands the key indicators that must be met within the Smart City concept. The following are six indicators that must be met to assess a region's readiness to become a Smart City.



Source: Citasia Center for Smart Nation (CCSN), 2023

Figure 1. Smart City Indicators

The Ministry of Communication and Information (2017) explains that there are six indicators used to assess a city's readiness to become a Smart City, as follows:

- a) Smart Governance focuses on smart city governance, which is used to assess local government governance. Smart Governance enables local governments to transform traditional bureaucratic

- action patterns into faster, more effective, and more efficient ones. There are three main pillars of smart governance: public service, efficient bureaucratic management, and efficient public policy.
- b) Smart Branding focuses on innovations implemented by regions in marketing their regions, thereby increasing regional competitiveness through three main elements: tourism, business, and city image. Smart Branding encourages regions to utilize local potential to attract local community participation and investors, thus accelerating regional development.
 - c) Smart Economy focuses on creating a regional economic ecosystem by optimizing leading digital-based economic sectors. There are three important elements in Smart Economy: creating an industrial climate, improving community welfare, and establishing digital financial transactions.
 - d) Smart Living focuses on ensuring a decent standard of living for the community. There are three important elements in Smart Living, namely the suitability of lifestyle patterns, the suitability of health quality, and the suitability of transportation modes.
 - e) Smart Society focuses on human interactions that have shifted toward a socio-technical ecosystem where the physical and virtual dimensions of urban life are increasingly intertwined. Interactions between citizens are becoming stronger and more seamless through technological mediation. Three elements are focused on in Smart Society: creating an efficient society, building an efficient learning ecosystem, and implementing a public security system.
 - f) Smart Environment focuses on regional governance with a good, responsible, and sustainable environment.

METHODS

This study is a qualitative study to explain the achievements and challenges of Semarang's Smart City. The data used were sourced from mass media news such as *kompas.com*, *detik.com*, and *rri.com*. Ministry of Communication and Information (2017) explains that there are indicators used to assess Semarang's readiness to become a Smart City, namely the achievement of implementation. smart governance, smart branding, smart economy, smart living, smart society, dan smart environment .

The data were analyzed using N-vivo 12 Plus, which allows word-based data processing to determine Semarang's Smart City achievements. In addition, N-Vivo 12 Plus can provide visualizations in the form of charts related to the challenges faced by Semarang in implementing Smart City. The data were analyzed in several stages, as follows:

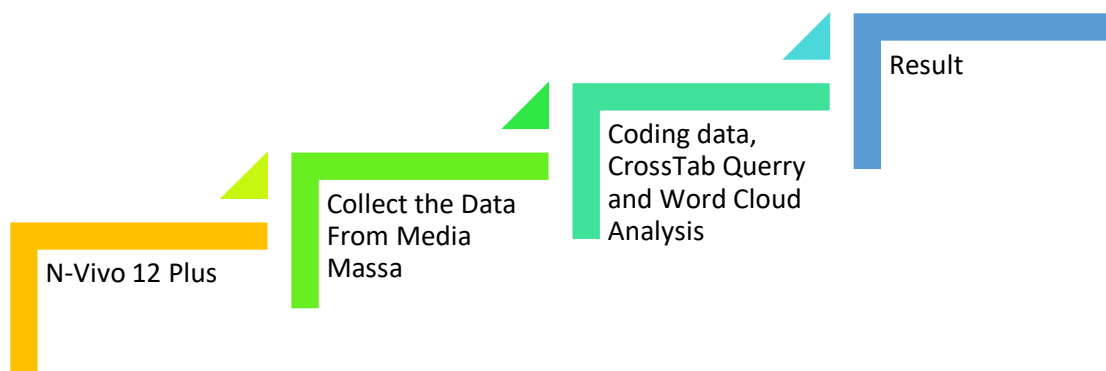


Figure 2. Data Analysis Technique

Based on Figure 2, the initial stage of this research was data collection through mass media. The collected data was then organized using several codes and analyzed using QrossTab Query and Word Cloud to obtain the research results.

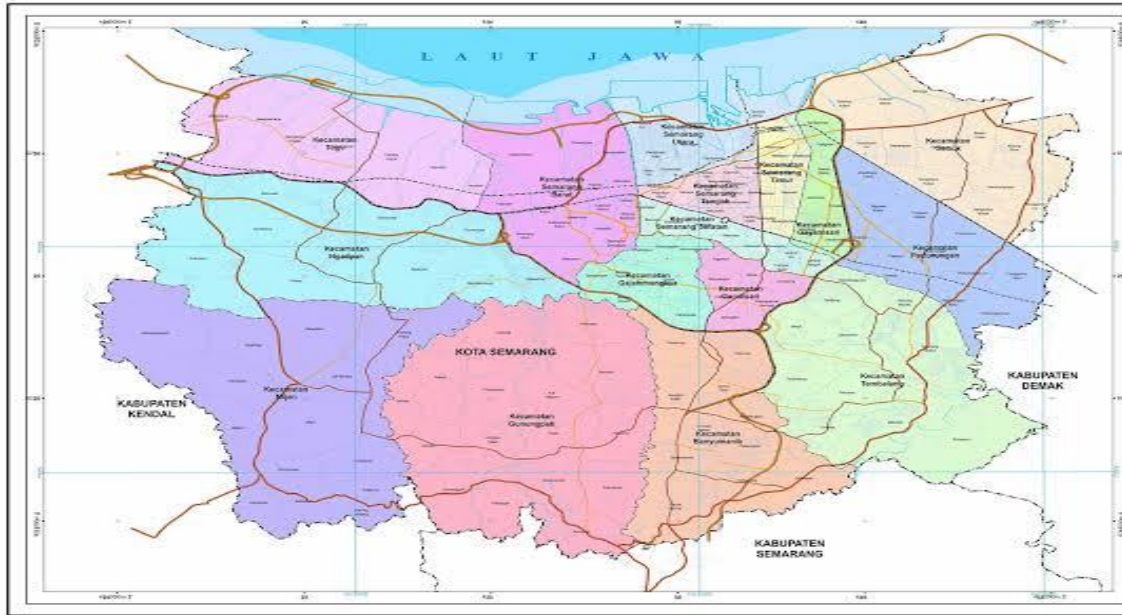
RESULTS AND DISCUSSIONS

Semarang is one of the cities with the potential for Smart City development. Readiness for implementing the Smart City concept in Semarang is measured using several indicators. These indicators are Smart Governance, Smart Branding, Smart Economy, Smart Living, Smart Society, and

Smart Environment. Based on this explanation, the Semarang City Government is striving to implement the Smart City concept through flagship programs such as SiMenTel, Lapor Hendi, Simperda, and SIPU. These flagship programs are concrete actions of the Semarang City Government in supporting the implementation of the Smart City concept. Semarang City is being formed into an integrated city in the aspects of economy, governance, society, and also the environment. Based on the results of the N-Vivo analysis, the following are some research findings.

Semarang's Readiness to Become a Smart City

Semarang is a strategic city in Central Java, situated along the economic crossroads of Java Island. Furthermore, Semarang is the capital city of Central Java Province and a center of regional economic growth. Administratively, Semarang consists of 16 sub-districts, detailed in Figure 3.



Source: Semarang City Central Statistics Agency, 2022

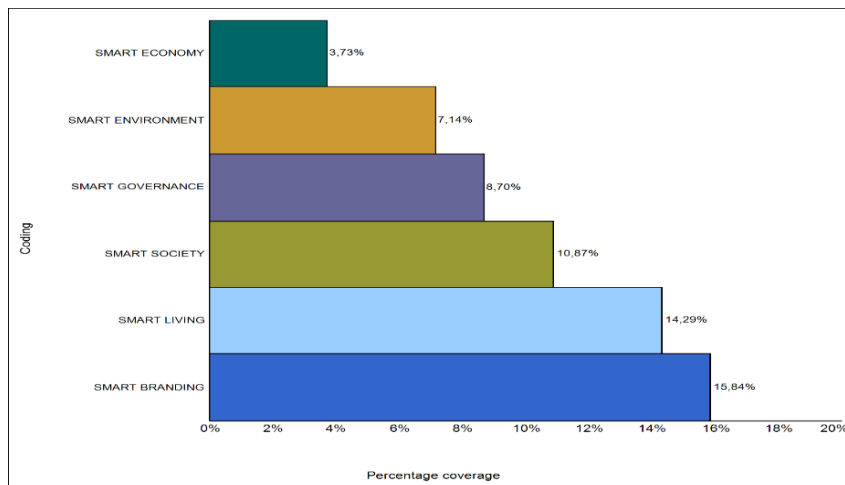
Figure 3. Map of Semarang City

According to Figure 3, Semarang City borders Demak Regency to the east, Semarang Regency to the south, Kendal Regency to the west, and the Java Sea to the north. Its strategic location makes trade and industry a key sector in Semarang City, offering strong potential for continued development (Prajanti et al., 2021). Ease of access is a crucial supporting component, facilitating economic activity and population mobility (Fatimah et al., 2020). The Semarang City Government, through its flagship programs, strives to optimize its economic potential. One such flagship program is the adoption of technology and communications. Communications technology is a key sector that can support the development of economic potential and minimize societal problems (Ahad et al., 2020). Lai et al. (2020) explain that technology and communications can effectively create economic efficiency, sustainable economic development, and improve the quality of life for urban communities. Furthermore, technology and communications facilitate the monitoring and evaluation of city governments' work programs. This is because public input is responded to more quickly through the use of technology and communications (Benites & Simões, 2021; Nesti, 2020).

Sun et al., (2020) explain that Smart Cities can be an alternative solution used by governments to improve the quality of life of the community, sustain development, and encourage inclusive economic growth. Mishra & Singh, (2023) also explain that Smart Cities encourage comprehensive urban development. The Smart City concept supports effective transportation, efficient use of agricultural technology, and education. Therefore, collaboration between various stakeholders is necessary to create a Smart City.

Semarang City's Opportunities as a Smart City

Based on the results of the N-Vivo Plus analysis, the opportunities for Semarang city as a Smart City can be identified, as shown in Figure 4.



Source : N-Vivo Plus, 2025

Figure 4. Semarang's Opportunities as a Smart City

Based on Figure 4, it is known that there are six indicators that have been implemented in the implementation of Semarang City's readiness to become a Smart City. Smart Branding has the highest percentage (15.84%), followed by Smart Living (14.29%), Smart Society (10.87%), Smart Governance (8.70%), Smart Environment (7.14%), and Smart Economy (3.73%). The results of this coding analysis represent the intensity of Semarang City's readiness to adopt technology to accelerate Smart City implementation. The Semarang City Government's concrete efforts to become a Smart City are implemented through the creation of flagship programs integrated with the use of technology. The Semarang City Government has designed several Smart City acceleration programs, as follows (pemkot.semarang.go.id):

The intensity of the Smart Branding indicator coding results showed 15.84%. This is the highest percentage of Smart Branding compared to other indicators. The Semarang City Government is striving to build Smart Branding, which is implemented through the development of the Telecommunication Tower Information System (*SIMenTel*). *SIMenTel* was developed to facilitate public access to information on telecommunications tower locations and free Wi-Fi in Semarang City, enabling fast internet access. Furthermore, *SIMenTel* can enhance regional competitiveness through technological development. Aprinta et al., (2024) explain that Smart Branding can attract visitors from outside the region to invest, thereby increasing global competitiveness.

The second-highest coding intensity indicator was the Smart Living indicator, with a percentage value of 14.29%. The Semarang City Government is implementing Smart Living through the Universal Health Coverage Program, a health insurance program provided by the Semarang City Government. This program aims to provide Semarang residents with access to quality healthcare without financial constraints. This program is designed to support the effectiveness of the city government's free healthcare services (Kusuma et al., 2025).

The coding result intensity with the third highest percentage is the Smart Society indicator with a percentage of 10.87%. Smart Society is implemented through the "Lapor Hendi" programme, which provides opportunities for the public to submit complaints and aspirations, and communicate directly with the Semarang City Government. Kurniawan, (2020) explains that this concept is implemented to optimize the quality of community interaction with the local government.

The intensity of Smart Governance coding results was relatively low, at 8.70%. This achievement indicates that the Smart Governance concept has not been optimally integrated. Smart Governance is implemented through two flagship programs: the Regional Planning Management Information System (*SIMPERDA*) and *Lapor Semar*. *SIMPERDA* was launched to build a planning system using e-Government

media for regional planning, thereby accelerating the achievement of a Smart City (Yoga et al., 2025). Furthermore, *Lapor Semar* is the official public service complaint channel for Semarang City, promoting transparency in the implementation of local government policies.

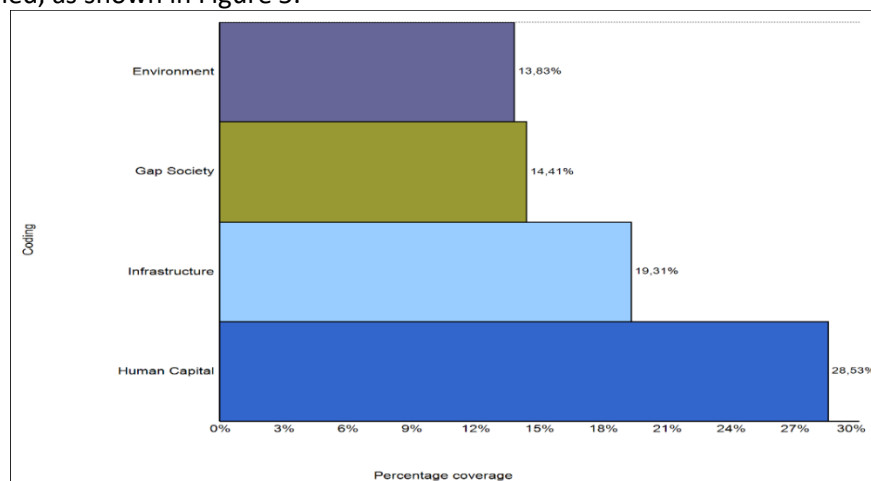
The Smart Environment coding intensity was 7.14%. This indicates that the Smart Environment program has not been optimally implemented. Smart Environment is a crucial indicator whose implementation must be optimal because it relates to environmental sustainability. Smart Environment in Semarang City is implemented through the Smart Infrastructure Public Works (*SIPU*) application development program to support the processes and performance of the Public Works Department. Smart Environment encourages the creation of a sustainable environment through efficient implementation and environmental sustainability. Smart Environment achievements are expected to improve public health and environmental quality (Marques et al., 2020; Nurlukman & Basit, 2023).

The Smart Economy coding intensity showed the lowest percentage compared to other indicators, at 3.73%. This achievement indicates that the Smart Economy concept has not been optimally implemented. A Smart Economy integrates the use of technology into economic activities, creating a sustainable economy. In Semarang City, Smart Economy is implemented through the creation of a regional economic ecosystem by optimizing leading digital-based economic sectors (Razmjoo et al., 2021). The Semarang City Government developed the Semarang Creative Gallery to encourage MSMEs and develop *Kampung Jamu* as a Thematic Village. More specifically, the following outlines the implementation of Semarang's Smart City support program. This program develops an economic network based on collaboration between economic activities, thereby improving the community's economy (Arsyad et al., 2022).

Based on the analysis, it was found that the six indicators used to assess Semarang City's readiness as a Smart City, namely Smart Branding, Smart Living, Smart Society, Smart Governance, Smart Environment, and Smart Economy, have not yet been optimally implemented. Overall, the percentage of coding intensity that emerged from the six indicators was 60.57%. However, when viewed individually, the coding intensity that emerged in data processing was still relatively low. Even for three indicators, namely Smart Governance, Smart Environment, and Smart Economy, it did not reach 10%. The Semarang City Government needs to optimize its flagship programs in its implementation so that Semarang City is better prepared to become a Smart City.

Semarang City's Challenges as a Smart City

Based on the results of the N-Vivo Plus analysis, the challenges for Semarang city as a Smart City can be identified, as shown in Figure 5.



Source : N-Vivo Plus, 2025

Figure 5. Semarang's Challenges as a Smart City

Based on Figure 5, Semarang City faces several challenges in its quest to become a Smart City, including:

Low human resources (28.53%). This is due to the lack of skilled experts in information and communication technology (ICT) and the lack of information and technology-related training for implementing staff. The quality of human resources is a crucial component in accelerating Smart City implementation. This is because human resources play a crucial role in Smart City implementation. Through human resources, a city can achieve intelligent and independent development (Campisi et al., 2021; Xiao & Xie, 2021).

Infrastructure availability (19.31%) is not evenly distributed in Semarang City. A basic requirement for creating a Smart City in developing countries is the availability of evenly distributed infrastructure (Bhattacharya et al., 2020; Yermachenko et al., 2023). Strielkowski et al., (2020) & Talebkhah et al., (2021) explain that infrastructure readiness accelerates a region's path to Smart City status. Adequate infrastructure encourages more effective and efficient community activities and can reduce excessive energy use. Research by Yoshimura et al., (2022) also shows that adequate infrastructure has been proven to accelerate inclusive economic growth.

The gap in technology knowledge among communities (14.41%) slows down the process of community adaptation to technology use. Chen & Chan, (2023) explain that public knowledge of technology can facilitate the implementation of Smart Cities. Public mastery of technology can encourage active participation in regional development and improve transparency in government implementation. Therefore, public knowledge of technology can indirectly improve their quality of life (Oliveira et al., 2020).

Environmental issues (13.83%) are one aspect slowing Smart City implementation in Semarang. Bıyık et al., (2021) & Nižetić et al., (2023) explain that Smart Cities not only focus on explicit development achievements but must also consider environmental conditions. Low air pollution and inefficient resource use must also be achieved by Smart Cities. Smart City also supports the development of a city that is supported by the use of renewable resources so that it can achieve sustainable economic growth and development (Song et al., 2023; Xu et al., 2022).

CONCLUSIONS

Based on research, Semarang City has the potential to develop a Smart City. This is indicated by concrete efforts implemented in the Semarang City Government's flagship programs. However, based on the coding intensity results, each program, reflecting the readiness indicators for the Smart City Concept, remains relatively low. This phenomenon indicates that Semarang is not yet ready to become a Smart City and still faces several fundamental challenges. This is demonstrated by the flagship programs implemented by the Semarang City Government to support Smart City development. However, Semarang City faces challenges related to human resource readiness, limited infrastructure availability, a gap in public knowledge of technology, and a high level of environmental issues, all of which can hinder the development of a Smart City.

The findings of this study imply that the Government needs to conduct extensive development and training for human resources and provide technology outreach to the community to accelerate the development of a Smart City. Furthermore, the government can procure infrastructure to support Smart City development, such as the addition of fiber optic cables to facilitate communication within the region. The government, the private sector, and the community must also work together to mitigate the high level of environmental issues. The Semarang City Government needs to optimize the availability of renewable energy to minimize environmental problems.

Smart city development is the key to achieving sustainable urban growth. By integrating technology, policy innovation, and multi-stakeholder collaboration, cities can enhance service efficiency, reduce environmental impact, and strengthen socio-economic resilience. A smart city is not merely an option, but a strategic necessity to secure an inclusive, resilient, and green urban future.

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