

CHALLENGES AND OPPORTUNITIES: ASSESSING SMART CITY READINESS IN MAGELANG CITY FOR SUSTAINABLE CHANGE

Eny Boedi Orbawati¹, Irsyad Muhammad²

¹Department of Public Administration, Faculty of Social and Political Sciences, Universitas Tidar

²Faculty of Economics and Business Master of Economics,
Universitas Jenderal Soedirman, Indonesia

E-mail: enyorbawati@untidar.ac.id, Irsyadmuhammad649@gmail.com

ABSTRACT

This study aims to analyze the extent to which technological infrastructure, digital governance, and community participation can support the implementation of the Smart City concept in Magelang City. The research method used is included in the category of qualitative approaches that describe findings through online media. The data sources for this study are online news media, social media and journals related to the research by exploring the breadth of technological infrastructure and digital governance. The analysis technique uses the NVivo 12 plus data processing application, a computer-aided qualitative document analysis tool. Their tools are easy to use and can process words and explore word frequencies, attributes, and cases from big data. The results of the study show that Magelang City has great potential to become a sustainable smart city through the application of the smart city concept. Infrastructure support and local government commitment are the basis for utilizing technology and innovation to improve the quality of life of its citizens. Focusing on digital connectivity, green energy implementation, city security, and community participation are key strategies. Despite facing challenges in indicators such as smart mobility, smart economy, and smart environment, concrete efforts can be seen through the Smart Magelang Application initiative. The results of the analysis also reflect careful planning in the 2021-2026 RPJMD. Thus, Magelang City has great potential to become an efficient, innovative, and sustainable smart city.

Keywords: Smart City Readiness, Sustainable Change, Magelang City, Challenges And Opportunities

TANTANGAN DAN PELUANG: MENILAI KESIAPAN SMART CITY DI KOTA MAGELANG UNTUK PERUBAHAN BERKELANJUTAN

ABSTRAK

Penelitian ini bertujuan untuk menganalisis sejauh mana infrastruktur teknologi, tata kelola digital, dan partisipasi masyarakat dapat mendukung implementasi konsep Smart City di Kota Magelang. Metode penelitian ini termasuk dalam kategori pendekatan kualitatif yang menggambarkan temuan melalui media online. Sumber data untuk penelitian ini adalah media berita online, media sosial dan jurnal yang terkait dengan penelitian dengan mengeksplorasi luasnya infrastruktur teknologi dan tata kelola digital. Teknik analisis menggunakan aplikasi pengolahan data NVivo 12 plus, alat analisis dokumen kualitatif berbantuan komputer. Alat mereka mudah digunakan dan dapat memproses kata dan menjelajahi frekuensi kata, atribut, dan kasus dari big data. Hasil penelitian menunjukkan bahwa Kota Magelang memiliki potensi besar untuk menjadi kota pintar yang berkelanjutan melalui penerapan konsep kota pintar. Dukungan infrastruktur dan komitmen pemerintah daerah menjadi dasar untuk memanfaatkan teknologi dan inovasi untuk meningkatkan kualitas hidup warganya. Berfokus pada konektivitas digital, implementasi energi hijau, keamanan kota, dan partisipasi masyarakat adalah strategi utama. Meski menghadapi tantangan dalam indikator seperti smart mobility, smart economy, dan smart environment, upaya konkret dapat dilihat melalui inisiatif Smart Magelang Application. Hasil analisis juga mencerminkan perencanaan yang matang dalam RPJMD 2021-2026. Dengan demikian, Kota Magelang memiliki potensi besar untuk menjadi smart city yang efisien, inovatif, dan berkelanjutan.

Kata kunci: Kesiapan Smart City, Perubahan Berkelanjutan, Kota Magelang, Tantangan Dan Peluang

INTRODUCTION

Smart City readiness reflects urban transformation that integrates technology, inclusive governance, and community participation to address the complexity of urban challenges (Vaishya et al., 2020). In Indonesia, this concept has been adopted in the 2020–2024 National Medium-Term Development Plan (RPJMN), focusing on 100 priority cities, including Magelang (Ministry of

National Development Planning/Bappenas, 2021). Data from the Central Statistics Agency (BPS) of Magelang City (2022) shows an annual population growth of 1.2%, accompanied by increased demand for public services and pressure on infrastructure. However, the 2022 Indonesian Smart City Index (IKCI) placed Magelang at 45 out of 98 cities, with a score of 54.3/100, indicating a gap in technology and community participation (Ministry of Communication and Information, 2022).

Based on a report by the Magelang City Communication and Information Service (2023), fiber optic internet network coverage has only reached 65% of urban areas, while suburban areas still depend on 4G networks with unstable signal quality. In addition, the digital literacy level of the people of Magelang is at 58%, lower than the national average (65%) (Ministry of Communication and Information, 2023). In the transportation sector, congestion in the city center has increased by 20% in the last three years due to the growth of private vehicles that are not balanced by road expansion (Magelang Transportation Agency, 2023). Meanwhile, the implementation of e-government is still limited to basic administrative services, such as ID card management and licensing, without cross-sector data integration (Diskominfo Magelang, 2023).

The readiness of Smart Cities is not only assessed from technological infrastructure, but also from governance, economic, environmental, and socio-cultural dimensions (Angelidou et al., 2021). Previous research tended to focus on technical aspects (Misra et al., 2022), but lacked local contexts such as the linkage of Javanese culture with technology adoption (Wibowo & Santoso, 2023). In addition, studies on Smart Cities in Indonesia still rarely integrate sustainability frameworks such as the Sustainable Development Goals (SDGs), even though this concept has become a global reference in urban development (UN-Habitat, 2021).

This study adopts the framework of the Smart City Maturity Model by Giffinger et al. (2020), which includes six dimensions: (1) smart economy, (2) smart mobility, (3) smart environment, (4) smart society, (5) smart living, and (6) smart governance. This framework is complemented by the Social-Technical Systems Theory approach (Geels, 2022) to analyze the interaction between technology, policies, and social values in Magelang. Thus, this study answers the theoretical gap by combining technological and socio-cultural perspectives.

This research updates the Smart City discourse by integrating primary data from government agencies, such as the Annual Report of the Magelang City PUPR Office (2023) on infrastructure projects, as well as secondary data from IKCI and BPS. In addition, field findings show that 70% of MSMEs in Magelang have not utilized digital platforms, indicating the need for specific policy interventions (Magelang Cooperatives and MSMEs Office, 2023). With a qualitative approach, this study not only identifies gaps, but also formulates adaptive models that are appropriate to the local context.

This research aims to see the opportunities and challenges of Magelang City in adopting the Smart City concept through a multidimensional analysis that includes technological infrastructure, digital governance, community participation, and environmental sustainability. This research is also carried out to provide evidence-based policy

recommendations to accelerate the transformation of Magelang towards a competitive and inclusive city.

METHOD

This research is based on a qualitative approach to explain the findings through online media. The method in this study aims to be able to describe the data obtained systematically, concretely and carefully regarding the facts contained in the news information text by the media. The source of data for this study is online news media. Data was obtained using the N capture feature on the Nvivo 12 plus, where the N capture feature is a web browser extension developed to capture web content in the form of website content, social media and other document content such as scientific articles. The analysis of the Nvivo 12 plus uses the crosstab query analysis feature. This feature is to see the percentage of news data that has been manually encoded using the NVivo 12 plus feature. Next, the author uses Word cloud analysis to see words or concepts that often appear in the research file to visualize and collect data/words that have similarities and differences.

The researchers analyzed five online news outlets. There are five news media that were selected as representatives in reporting on the Readiness of Smart Cities in Magelang City. The five news media are Kompas.com, CNN Indonesia, Tribun.com, detik.com, and Sindo News.com. The next stage of data analysis can be seen in Figure 2 below.

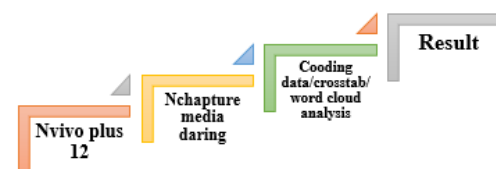


Figure 1. Data Analysis Techniques

Source: Processed by Authors, 2024

The data that has been collected is then analyzed using the Ncapture feature on the Nvivo 12 plus. where the N capture feature is a web browser extension developed to capture web content in the form of website content, social media, and other document content such as scientific articles. The analysis of the Nvivo 12 plus uses the crosstab query analysis feature. This feature is to see the percentage of news data that has been manually encoded using the N Vivo 12 plus feature. Furthermore, the author uses Word cloud analysis to visualize words or concepts that often appear in data sets generated from collective data/words that have similarities and differences.

RESULTS AND DISCUSSION

Magelang City's readiness to implement smart city

Magelang City is one of the cities in Central Java Province. Located on the main Semarang-Yogyakarta route, Magelang City has a strategic position. Its strategic location has caused Magelang City to grow into a regional economic and tourism node, especially in Central Java. This is a potential attraction for the City of Magelang and is one of the strengths that will continue to be developed.

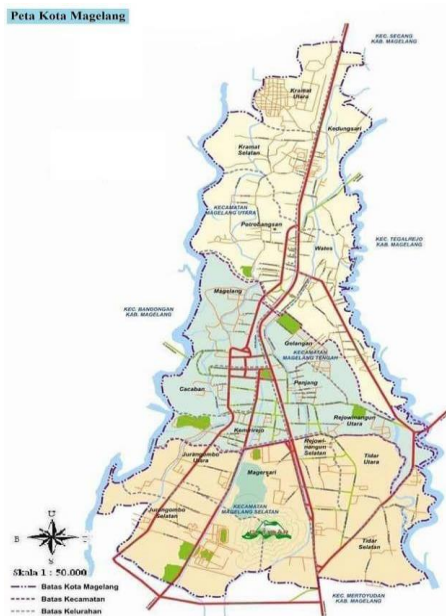


Figure 2. Magelang City Map

Source: BPS Magelang City, 2023

As a city with a strategic position, Magelang City has been developed into a trade, service, and industrial area. The high level of accessibility makes the mobility of goods, services and people very easy to do in Magelang City. Furthermore, Magelang City is also a transit city for various sectors, as mentioned previously. Ease of access in Magelang City has caused the growth of trade, service and industrial areas to be very fast. The rapid growth of Magelang City as a city of trade, services and industry has had an impact on the high number of residents living in Magelang City (Wyasa Wijayamukti et al., 2018).

The Magelang City Government has made various efforts to overcome existing problems while increasing the potential of the region. One of the methods taken by the City of Magelang is by adopting information and communication technology. This is done because information and communication technology has been proven to be able to properly solve existing urban problems by increasing effectiveness and efficiency in activities for city residents (Rakhmat et al., 2022). Apart from that, information and communication technology can also make it easier for local governments to control, evaluate, and supervise various things that happen in their area. Therefore, community involvement in

managing their area can be increased through information and communication technology.

The use of information and communication technology carried out by the Magelang City government was then framed in the Smart City concept. The Smart City concept is a concept that prioritizes smart city management, which can play a role in making it easier for people to get information accurately and quickly. It is hoped that the application of the Smart City concept can improve community welfare, increase the security and comfort of residents, and make cities more effective and efficient, especially in dealing with various problems (Elanda et al., 2021). Achieving the Smart City title requires the development of intelligent infrastructure and the use of information technology to collect and analyze data that will be useful for the government, community, and local businesses. Becoming a Smart City also means having to continue to innovate and develop in a better way. Apart from capital investment, innovative and efficient methods are needed to identify the needs of people who live, work, or even visit Magelang Regency. In the current technological era, a new approach is needed by utilizing innovative information technology and smart infrastructure. It needs to be understood that if these changes are good, we need to improve standards and quality rather than maintaining the traditional approach.

In the ongoing era of digital transformation, the Smart Province or Smart City concept is a significant challenge and opportunity for regions that want to achieve optimal levels of progress and prosperity. Before entering the implementation phase of this concept, a region needs to understand and evaluate its readiness to become a smart region. Several main elements factor into the readiness of smart regions, involving aspects such as natural potential, regional structure, infrastructure, superstructure, and culture. A comprehensive evaluation of these factors is a strategic first step in building a solid foundation for realizing the Smart City vision (Mukti & Arge Winanta, 2019).

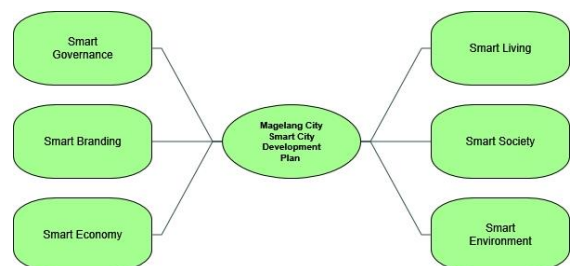


Figure 3. Magelang City Smart City Development Plan

Source: Modified with Nvivo 12 Plus, 2024

Figure 2. Explains the Smart City Development Plan for Magelang City implemented to achieve 6 Smart Dimensions including: (1) Smart Governance, Magelang City tries to improve the quality of services to the community and the quality of government apparatus based on the use of

technology through the flagship Magelang Smart City (Magesty) program. Smart Government is the main key to forming a Smart City. The Government, as part of the fundamentals of a country, has the task of forming a paradigm or view for society about a better life.

(2) Smart Branding, the target of Smart Branding for Magelang City is directed at increasing the activity of the tourism sector in Magelang City. Apart from being related to tourism, the target of Smart Branding for Magelang City is to create the face of Magelang City through the Magelang Cantik program.

(3) Smart Economy, Magelang City's Smart Economy targets include several things, such as economic equality, increasing infrastructure distribution, as well as revitalizing the creative economy. This is manifested in the flagship program of the Mayor and Deputy Mayor of Magelang. Namely, Magelang is cool and majesty. (4) Smart Living, accelerating the development of urban infrastructure for equitable development and economic development in order to create community welfare, as well as realizing consistency in the use of Spatial and Regional Planning (RT RW), which is realized with the flagship program of Learning Centers, picking up sick and healthy, snacking and drinking coffee with.

(5) Smart Society, encouraging Magelang City to become a safe and comfortable city. The targets include the realization of a "nyawiji" and disciplined society as well as creating a safe and comfortable community environment, in accordance with the superior programs of the wheels, mas banya and programs. (6) Smart Environment, improving a healthy, comfortable ecosystem, supporting the continuity of life. The smart environment target is directed at encouraging sustainable development in accordance with the mandate of the Sustainable Development Goals; the appropriate program is Beautiful Magelang.

Implementing a smart city in an area can be a solution to overcoming problems that exist in urban areas. The implementation of smart cities also does not only focus on efforts to improve technology and information, but also improves various aspects. Therefore, with the existence of a smart city, development and development in an area can be more efficient and effective, both for society, Government, and even the environment. There needs to be a commitment from both the city government as policymakers and the community as the parties involved to work together to create a smart city in their city.

Opportunities for the city of Magelang to implement a sustainable smart city

Magelang City has great potential to become a sustainable smart city. With infrastructure support and local government commitment, Magelang can utilize technology and innovation to improve the

quality of life of its citizens. One important aspect of realizing a smart city is adequate digital connectivity. Magelang can optimize telecommunications and internet infrastructure to provide easy and fast access to the public, as well as support efficient public services. Apart from that, implementing green energy and intelligent resource management can be a focus for making Magelang a sustainable city (Nurauliana et al., 2018). By utilizing renewable energy sources, such as solar panels or environmentally friendly waste management systems, Magelang can reduce its carbon footprint and create a cleaner and healthier environment.

Another important aspect is the use of technology to improve city security. Implementing smart security systems, including camera surveillance and intelligent data analysis, can help reduce crime rates and provide residents with a sense of security. In addition, Magelang can develop intelligent transportation systems, such as technology-based public transportation and efficient traffic management, to reduce congestion and exhaust emissions (Aplikasi et al., 2022).

Community involvement is also the key to success in realizing a smart city. The Government can encourage active participation by citizens in decision making through digital platforms, as well as provide education about the benefits and ways to use technology for city sustainability. By considering these aspects, Magelang has a great opportunity to become a sustainable smart city, creating a more efficient, innovative and environmentally friendly environment for its residents.

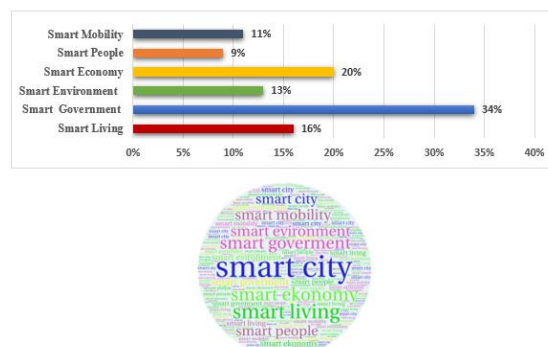


Figure 3. Opportunities for readiness to implement smart cities in Magelang City based on smart city indicators

Source: processed using Nvivo12, 2024

Based on the graph above, we can observe that of the six indicators applied in smart city readiness in the city of Magelang, smart government has the highest percentage, namely 34%. Then followed by smart economics, namely 20%. The 3rd least chance of readiness to implement a smart city in the city of Malang is a smart environment, namely 13%. Meanwhile, based on word cloud analysis, the word that appears the most is "smart city," then the second most frequent word is "smart government."

Proving the opportunity for the readiness of the smart city concept in Magelang City is the provision of information through the Smart Magelang Application. This innovation involves the active role of the community and the Magelang City Government. This application not only aims to monitor public interest in using technology that supports the smart city program but also to identify weaknesses in the implementation of public services provided by this application to its developers. The main function of the Smart Magelang Application is to provide citizens with ease in accessing information and public services via digital platforms. Public interest in using this application reflects the level of acceptance and usefulness of the application in everyday life. By involving the community in the application development process, the Magelang City Government can better respond to the needs and expectations of residents (Miftah Irfandha et al., 2020).

Therefore, in the planning and implementation of the Smart City program in Magelang City, there are visible efforts to harmonize various aspects of community life through the application of smart city concepts. This planning has been included in the RPJMD (Regional et al. Plan) of Magelang City for 2021-2026. Even though it is still in the development stage, careful planning and full support from the Government can be a solid foundation for creating an ideal smart city.

Magelang city's challenges in implementing a sustainable smart city

In the journey towards transformation into a sustainable smart city, the City of Magelang faces a number of challenges that need to be examined in depth. One crucial aspect is infrastructure integration, which combines transportation, energy and information technology systems. This obstacle requires careful planning to create an efficient and environmentally friendly environment. The next challenge arises from the level of public awareness of technology and sustainability. Education and outreach need to be improved so that people can adopt changes more effectively, understand the benefits of technology, and implement it with an awareness of environmental sustainability. Cybersecurity and data protection are also major concerns, considering the importance of maintaining system and information integrity (Wyasa Wijayamukti et al., 2018).

These various aspects have a direct impact on aspects of the city's economic sustainability. An environmentally friendly and sustainable economic development strategy requires active involvement from the Government, private sector and society. Close collaboration is needed to create an ecosystem that supports balanced and sustainable economic growth. In the context of public services, other challenges arise from the integration of health service systems, education and public administration (Rakhmat et al., 2022). Efforts are needed to

improve efficiency and service quality through the application of technology in data management and policy analysis. Overall, achieving the vision of Magelang City as a sustainable smart city requires strong synergy and collaboration between all stakeholders. With a deep understanding of these challenges, Magelang City has the potential to become an example of successful implementation of the smart city concept, providing maximum benefits for its people.

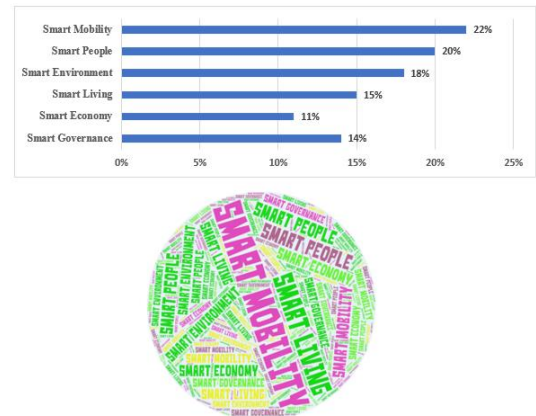


Figure 4. Challenges of implementing smart cities in the city of Magelang based on smart city indicators

Source: processed using Nvivo12, 2024

Analysis of the graph shows that smart mobility is the indicator that faces the highest challenges in smart city readiness in Magelang City, with a percentage of 22%. This indicates that there are complexities and obstacles in developing an efficient and sustainable transportation system, as well as possible infrastructure constraints that need further attention. Followed by the smart economy with a percentage of 20%, challenges related to developing a smart and sustainable economy are also a significant focus. There is a need for an innovative economic development strategy to maximize regional potential and encourage sustainable economic growth. The lowest challenge is faced by the smart environment, with a percentage of 11%. However, it is important to remember that the success of smart city implementation also depends on environmental conservation efforts and wise management of natural resources.

In the word cloud analysis, the keyword "smart mobility" dominates, indicating that the issue of mobility is receiving primary attention in the context of smart city readiness in Magelang City. Then, "smart people" became the second keyword, showing the important role of skilled and involved people in realizing the smart city concept. Therefore, developing strategies that focus on mobility and community participation is the key to overcoming challenges and achieving success in implementing a smart city in Magelang City (Elanda et al., 2021).

The data above shows that the challenges in implementing the smart city concept in Magelang City include a number of aspects that can be

identified based on smart city indicators. First, in the Smart Governance aspect, there are obstacles related to the integration of government systems that still need to be improved, such as coordination between agencies and the use of information technology to increase administrative efficiency. The Smart Economy aspect is also a challenge, where there is a need for sustainable economic development and increased business readiness for technology. Close cooperation between the Government and the private sector is needed to create an innovative and competitive business environment (Mukti & Arge Winanta, 2019). In achieving Smart Living, the need for affordable housing and infrastructure that supports people's quality of life is the focus. The provision of effective health and education services and the integration of technology into them are also challenges that need to be overcome. The Smart Environment aspect faces challenges related to managing natural resources and mitigating environmental impacts. Efforts are needed to implement environmentally friendly solutions and manage waste efficiently to support environmental sustainability. In achieving Smart People, it is necessary to pay attention to people's education and skills in facing the digital era. Socialization of the benefits of technology and increasing digital literacy are the keys to creating an engaged and technologically skilled society. Finally, in the Smart Mobility aspect, obstacles related to transportation infrastructure and connectivity that still need to be optimal are a challenge. It is necessary to develop an efficient and environmentally friendly transportation system to minimize congestion and facilitate people's mobility. By overcoming these challenges, Magelang City can accelerate its journey towards status as a sustainable smart city, provide maximum benefits to its citizens, and increase its competitiveness at the national level (Aplikasi et al., 2022).

CONCLUSION

Based on this research, Magelang City has significant potential to implement a sustainable Smart City concept with infrastructure support, government commitment, and community participation. However, various challenges still need to be overcome, such as infrastructure integration, the level of people's digital literacy, and economic and environmental sustainability. The findings of this study confirm that the readiness of Smart City in Magelang is more prominent in the aspect of Smart Governance, while the biggest challenge lies in Smart Mobility. Therefore, a collaborative approach between the government, the private sector, and the community is the main key in accelerating the transformation of smart cities. For further research, further exploration is needed on strategies to increase digital literacy and the application of innovative technology in urban resource

management so that Magelang can realize the vision of an inclusive and sustainable Smart City.

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