SENJOp
http://senjop.ppj.unp.ac.id/index.php/senjop

Science and Environmental Journals for Postgraduate
Vol. 7 No. 1 (pp. 35-43) December 2024
p_ISSN 2655-5085
e_ISSN 2655-5239

Influence of Technology in Realizing Smart Cities: Systematic Literature Review

*Widian Nigrum, Elfitri Oktavia, Nurhasan Syah, Heldi, Indra Chatri

Master of Environmental Science, Postgraduate School – Universitas Negeri Padang
*E–mail: widiann@gmail.com

Received: 19 May. 2024, Revised: 10 Nov. 2024, Accepted: 30 Nov. 2024

ABSTRACT

This study examines the role of digital technology in realizing smart cities, aiming to identify its transformative potential in urban development. A systematic review methodology was applied, analyzing literature from 2019 to 2023 obtained from databases such as PubMed, Scopus, and Google Scholar, using PRISMA guidelines. The inclusion criteria focused on studies about the influence of technology in smart city development, with articles written in English or Indonesian, and restricted to original research.The review identified 3,000 articles, narrowed to five after screening for relevance and eligibility. The results highlight that digital transformation is fundamental to the smart city concept, facilitating efficiency, better resource management, and enhanced public services. For instance, implementing e-government in Sumenep Regency demonstrated how digital innovation fosters integrated governance, while Klaten Smart City showcased improvements in decision-making and operational efficiency. Digital technology enables interconnected systems, fostering collaborations among governments, private sectors, and communities.In conclusion, technology significantly reshapes urban landscapes, offering solutions for modern urban challenges such as resource allocation and citizen engagement. Smart city initiatives exemplify how digital transformation enhances urban living and sustainability, laying a foundation for future advancements.

KeyWords: *Smart City, Digital Transformation, E-Government, Urban Development, Sustainability*

INTRODUCTION

The concept of a smart city continues to evolve with advancements in technology. Initially a conceptual design, it has now materialized into functional urban models due to advancements in complex information systems (Anthopoulos et al., 2010). Developing a smart city requires careful consideration of key elements, including human resources, technology, and institutional frameworks (Taewoo et al., 2011). A smart city is not merely an object or a technological innovation but a process that creatively integrates multiple elements (Kurniawan et al., 2021). It is characterized by the use of intelligent computing technologies to enhance infrastructure and services such as administration, education, health, safety, transportation, and more. These components must function interconnectively, intelligently, and efficiently (Washburn et al., 2010). Giffinger et al. (2007) define a smart city as one that leads in economic, social, and environmental dimensions, supported by intelligent governance, mobility, and community life.

The smart city concept extends beyond devices to include systemic applications and governance structures. It aims to facilitate the swift and accurate dissemination of

information while managing resources efficiently (Hasibuan et al., 2019). Urbanization brings challenges like waste management, transportation, socio-economic issues, and public health. Simultaneously, modern societies demand comfort, accessible services, and well-designed public spaces (Suhendra, 2017). Consequently, the smart city model has emerged as a promising solution in various cities worldwide, including Indonesia. Cities like Jakarta, Bandung, and Surabaya are transitioning towards this concept through innovations like e-government and e-monitoring (Susanto et al., 2018).However, the definition of a smart city varies and continues to evolve. While initially addressing specific urban issues, the integration of information and communication technology (ICT) has driven broader transformations in governance and infrastructure (Amri, 2016). For instance, technological interventions like e-budgeting and e-procurement have significantly improved urban management in Indonesia's larger cities (Izzuddin, 2022).

Smart city development builds upon prior technological frameworks, addressing gaps and incorporating human and institutional dimensions (Gunawan et al., 2018). Key elements include fulfilling societal and economic needs, ensuring sustainability, fostering competitiveness, involving communities in planning, enhancing infrastructure, integrating technology, and prioritizing security (Saputro et al., 2019). However, the role of technology in smart cities is dual-faceted. While it offers transformative opportunities, misuse or inadequate safeguards can create vulnerabilities (Josept et al., 2019). Effective implementation relies not only on financial support and government policies but also on readiness in infrastructure and human resources (Azhari et al., 2024). This study focuses on analyzing the influence of technology in shaping successful smart cities, recognizing its pivotal role in addressing urban challenges.

METHODS

This research employs a systematic review methodology. According to Kitchenham (2004), a systematic review is a structured method used by researchers to identify, evaluate, and interpret relevant studies on a specific research focus. This approach involves comprehensively analyzing the content of selected articles in a systematic manner. The literature search was conducted in May 2024 using Pubmed.gov, Scopus, and Google Scholar as primary data sources. Additionally, the Publish or Perish application was utilized to facilitate the identification of relevant reference articles. The study focused on articles published between 2019 and 2023, encompassing research related to the influence of technology and smart cities. Keywords relevant to the topic were used without imposing language restrictions. Four inclusion criteria guided the selection process: (1) the research focused on technology's impact and smart city development, (2) the articles were written in either Indonesian or English, (3) the articles were original research (not reviews), and (4) the publication date fell within the last five years.

The literature collection process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. This process comprised four stages: identification, criteria assessment, eligibility, and screening. During the

identification stage, relevant articles were located through systematic searches. The screening stage involved evaluating the titles and abstracts to determine their relevance. In the eligibility stage, articles were assessed for their qualitative and quantitative contributions to this research. Finally, full-text reviews of the selected articles were conducted to ensure their suitability (Liberati et al., 2009). Data from the selected articles were synthesized without employing meta-analysis techniques, instead using the Synthesis Without Meta-analysis (SWiM) approach. This qualitative synthesis method enabled the collection of data, which was subsequently narrated descriptively. The approach provided an in-depth explanation of research findings, including the role of local wisdom among the Mentawai tribal community in mitigation efforts (Campbell et al., 2020).

RESULTS

A search for articles in the database yielded 3000 articles. Furthermore, due to irrelevant titles and duplicate article titles, 2749 articles were excluded, resulting in 251 articles. Then, the abstract is identified, whether it is in accordance with the research questions and objectives of the systematic review of the literature, and the articles used must meet the predetermined criteria and are suitable for use and synthesis qualitatively and quantitatively. So there were only 5 articles that could be used in the systematic review. The stages and process for selecting articles can be seen in Figure 1 below.

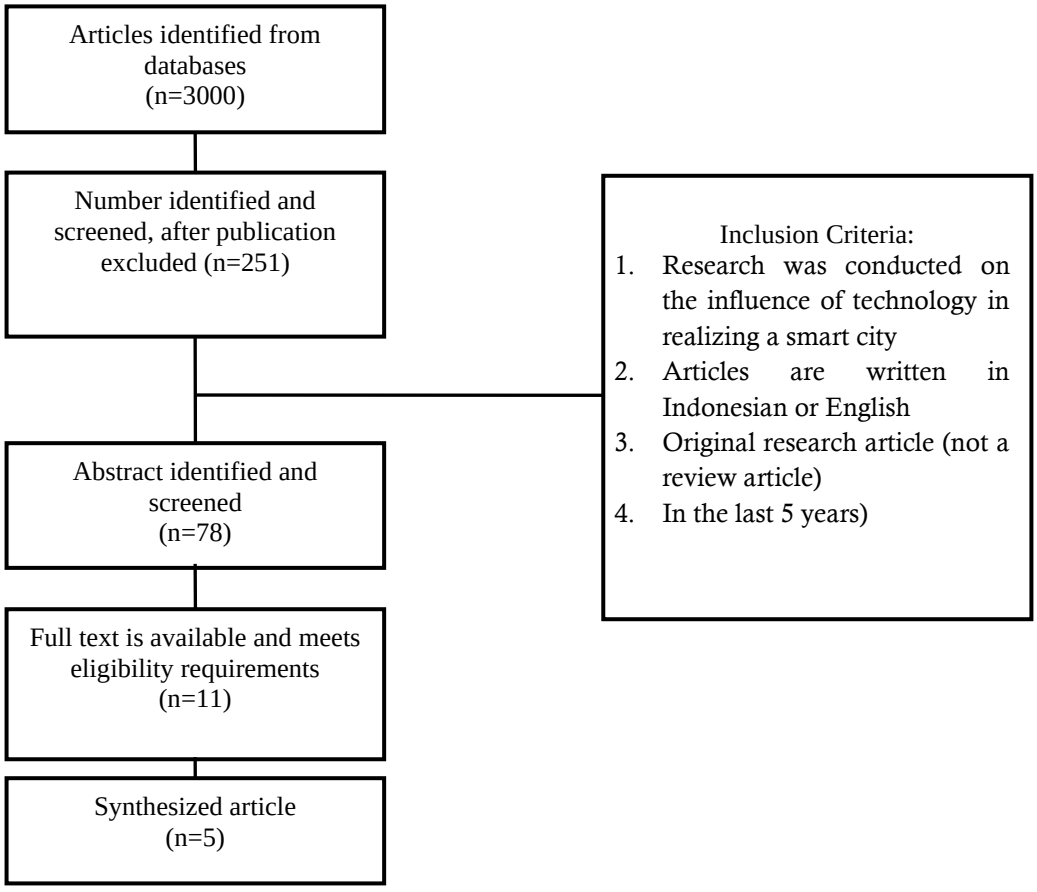

Figure 1. Article selection process.

The five studies deemed systematically feasible are research that uses qualitative and descriptive methods, although the study entitled Technological Disruption in the Smart Society Concept with the Construction of the Society 5.0 Concept uses a literature review design using a qualitative approach, the researcher still includes it in the article to be synthesized. This is because, based on the method used in this research, there is a search for data that discusses technology in the development of smart cities. A summary of the data from this research can be seen in Table 1 below.

Table 1. Summary description of data from included studies

Title	Author/Year	Method	Results
The Influence of Implementing E-Government on Smart City Development in Sumenep Regency	(Alfiyah, 2019)	The research was carried out using an explanatory descriptive method, where descriptive is a method of researching a condition, an object and an event that is occurring in the present.	Based on the research results, the implementation of e-government that occurred in Sumenep Regency through g-online became a pioneer in the birth of integrated government using electronic-based systems. This was then continued with the development of smart cities as a response to the rapid development of e-commerce.government in the region. The foundations for smart city development cannot be separated from the functions and provisions that exist in e-government. So it can be said that the development of a smart city in Sumenep Regency cannot be separated from the influence of implementing e-government in regional government.
Implementation of the Jakarta Smart City Policy in Realizing Smart Governance in the DKI Jakarta Provincial Government	(Rahmadani & Handoyo, 2022)	This study is qualitative research. The research setting was carried out in the Jakarta Smart City Management Unit which is located in the City Hall Building of DKI Jakarta Province. Data collection techniques use interview and documentation techniques. Testing the validity of the research data used is source triangulation. The data analysis technique in this research uses a data analysis technique model which consists of data collection, data reduction, data display, as well as verification and confirmation of conclusions.	Based on the research results, the implications of Jakarta Smart City in realizing Smart Governance for the DKI Jakarta Government are the development of a single data system that is integrated, up to date and valid for policy formulation (data driven policy), integrating all communication channels.complaints into the CRM (Citizen Relationship Management) system and there is an integrated citizen administration service system.
Technological Disruption in the Smart Society Concept with the	(Kurniawan & Andiyan, 2021)	This research uses a qualitative approach and literature review in analyzing the application of	In terms of the goals built into the SDGs, the role of technology and artificial intelligence (AI) in building collaborative spaces

Construction of the Society 5.0 Concept		the Society 5.0 concept to smart society components.	through the virtual world is very possible as a solution to develop digital communities with the support of historical data on organizational activities that are already available to produce comprehensive information. This space can be a form of improving the quality of community interaction both physically and virtually.
The AMO Concept in the Application of Ghrm Realizes Health Digitalization in a Smart City Environment	(Syaefuddina, et al., 2022)	The type used in this research is research with a combination of using a qualitative approach.	The features in the InDimensia Mobile App will of course continue to be improved and updated along with the growth of consumers who use it and the data continues to be analyzed through the AI process so that they can find out the latest trends that are consumers' needs and desires, thereby increasing the functionality and utility of the InDimensia Mobile App application. The public's readiness for the smart city concept which is part of Society 5.0 has been felt, but it needs to be socialized again among the community to explain the essence of a smart city.
Digital Transformation in Realizing Klaten Smart City	(Seta et al., 2023)	The type used in this research is qualitative research.	From the results of this research, we can conclude that Klaten has been successful in applying digital technology to build a city that is smarter and more responsive to the needs of its residents. This research also shows how digital technology can be an important tool in developing the Smart City concept in other regions with similar contexts.

Influence of Technology

Regarding the influence of technology in realizing a smart city, we can start with information technology or information services to the community with a smarter, technology-based concept. This digital technology can be applied to build cities that are smarter and more responsive to people's needs. For example, the implementation of e-government that occurred in Sumenep Regency through g-online became a pioneer in the birth of integrated government using electronic-based systems. This was then continued with the development of smart cities as a response to the rapid development of e-government in the regions (Alfiyah, 2019).

Digital innovation and technology change, replace, or complement existing standards in certain companies, ecosystems, and sectors. This process of change is called "digital

transformation". Technology and digitalization affect all aspects of human life. Digital transformation is very important for businesses and government institutions that depend on information technology systems, strategies and human resources. To improve organizational performance and public services in the public sector, information technology is also widely used (Khalida et al., 2023).

Digital transformation is an important part of the smart city concept because it has great potential to improve efficiency, quality of life and various aspects of urban life. This digital transformation includes the integration of various urban systems and services through ICT, enabling more efficient resource management, better decision making and more efficient shipping. Digital technology allows cities to provide services that are more suited to the needs of their citizens and provides a platform for innovation and collaboration with the private sector, educational institutions and the general public to overcome various problems (Setyasih, 2022). Technology and digital play an important role in changing the urban landscape in digital transformation. Digital transformation such as Klaten Smart City refers to the use of digital technology to integrate various urban aspects. With the help of digital technology, data collection, analysis and use become more efficient. The results of implementing Klaten Smart City with digital transformation are better decision making, operational efficiency and better quality of public services. Klaten Smart City can achieve a higher level of innovation and provide significant benefits to its residents by utilizing this technology. With careful and targeted implementation of digital transformation, Klaten Smart City will become an inspiring example of how modern technology can change the quality of life of its citizens, increase the efficiency of public services, and create a more sustainable urban environment. This transformation will not only bring short-term benefits, but also create a solid foundation for a brighter and more innovative future for Klaten and its residents (Seta et al., 2023).

Smart Cities

Increasingly advanced technological developments have created a change in the 'smart' concept which is not only applied to various devices, but to various systems or settings. One of them that is being implemented recently is the smart city concept as an application of e-governance. This concept, called a smart city, is a concept that prioritizes a smart city structure that can play a role in making it easier for people to get information accurately and quickly (Kurniasih et al., 2020).

By definition, a smart city is a city that can manage all resources effectively and efficiently in solving various challenges, using innovative, integrated and sustainable solutions. This management is solely to improve the quality of life of city residents. From this definition, the characteristics of solutions in a Smart city are in the form of new, integrated thinking, between government and non-government institutions, responsive to city problems and solutions designed to be sustainable solutions, not just temporary solutions (Ilmananda et al., 2022).

The Smart City concept emerged as a demand for the need to build a city identity that is livable, safe, comfortable, green, climate and disaster resilient, based on physical character,

economic excellence, local culture, competitive, technology and IT based. The aim of implementing Smart City is to be able to form and implement a city that is safe, comfortable, controlled and makes access easier for its citizens as well as strengthening the city's competitiveness in economic, social and technological terms. So it can be explained that the aim of the Smart City implementation strategy is to support the city in the social (security), economic (competitiveness), technological and environmental (comfort) dimensions. Or more generally, based on the United Nation, it can be said that the goal of a Smart City is to form a sustainable city (economic, social, environmental). In general, the implementation of the smart city concept has also begun to run with the support of applications that continue to develop so as to create a creative environment in the field of technology, as a good first step towards a smart city (Conoras et al., 2018).

CONCLUSIONS

In conclusion, this research highlights that digital technology serves as a fundamental tool in developing smarter and more responsive cities that cater effectively to community needs. Digital innovation has the capacity to transform, enhance, or even replace existing standards within various industries, ecosystems, and sectors. The integration of digital transformation is a pivotal element in the smart city concept, offering immense potential to improve efficiency, elevate the quality of life, and optimize diverse urban functions. Furthermore, the role of technology and digital advancements is critical in reshaping the urban landscape, driving significant changes, and enabling cities to adapt to the demands of modern urbanization.

REFERENCES

Alfiyah, NI (2019). The Influence of Implementing e-Government on Smart City Development in Sumenep Regency. *Journal of Social and Political Science Innovation*, 1(2), 88-95.

Amri, A. (2016). Analysis of the use of information and communication technology in supporting the realization of Makassar as a "smart city". KAREBA: *Journal of Communication Sciences*, 431-445.

Anthopoulos, L., & Fitsilis, P. (2010, July). From digital to ubiquitous cities: Defining a common architecture for urban development. In 2010 sixth international conference on intelligent environments. 301-306.

Azhari, M., & Sutabri, T. (2024). Smart City Analysis Using the Smart Society 5.0 Concept in Electronic Policing. *Digital Transformation Technology*, 4(1), 138-146.

Campbell, M., McKenzie, J.E., Sowden, A., Katikireddi, S.V., Brennan, S.E., Ellis, S., Hartmann-Boyce, J., Ryan, R., Shepperd, S., Thomas, J., Welch , V., & Thomson,

H. (2020). Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. *British Medical Journal*, 368, 1359–1364.

Conoras, MEB, & Hikmawati, NK (2018). Smart City Opportunities and Challenges for Awakened, Independent and Prosperous Papua. 2018 National Conference on Information Systems (KNSI).

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovi, N., & Meijers, E. (2007). Smart Cities: Ranking of European Medium-Sized Cities. Vienna University of Technology.

Gunawan, H., & Lynawati, L. (2018). Analysis of Purwokerto City's "Smart City" Technology Acceptance Using the Technology Acceptance Model (TAM). 2018 *National Conference on Information Systems* (KNSI).

Hasibuan, A., & Sulaiman, OK (2019). Smart city, the concept of an intelligent city as an alternative solution to district/city urban problems, in large cities in North Sumatra Province. *Engineering Main Bulletin*, 14(2), 127-135.

Izzuddin, F.N. (2022). Smart City Concept in Sustainable Development. Citizen: Indonesian *Multidisciplinary Scientific Journal*, 2(3), 376-382.

Joseph N. Pelton, Indu B. Singh (2019). *Smart Cities of Today and Tomorrow*: *Better Technology*, Infrastructure and Society.

Khalida, W., & Ridwan, M. (2023). Digital Transformation in Public Services: The Role of Electronic Archives in the General Bureau of the Governor of North Sumatra. Monetary: *Journal of Economics and Finance*, 1(4), 31-40.

Kitchenham, B. (2004). Procedures for Performing Systematic Reviews. Keele University.

Kurniasih, Y., & Wismaningtyas, TA (2020). Smart City Magelang City: Changes in Regional Government Management in the Implementation of Electronic Governance. JIAP (*Journal of Public Administration*), 8(2), 356-367.

Kurniawan, MA, & Andiyan, A. (2021). Technological Disruption in the Smart Society Concept with the Construction of the Society 5.0 Concept. *Archicentre Architectural Journal*, 4(2), 103–110.

Liberati, A., Altman, D.G., Tetzlaff, J., Mulrow, C., Gøtzsche, P.C., Ioannidis, J.P.A., Clarke, M., Devereaux, P.J., Kleijnen, J., & Moher, D. (2009). The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *PLoS Medicine*, 6(7).

Ramadhani, MA, & Handoyo, E. (2022). Implementation of the Jakarta Smart City Policy in Realizing Smart Governance in the DKI Jakarta Provincial Government. Unnes, *Political Science Journal*, 6(2), 42-47.

Saputro, WT, & Darminto, BP (2019). Study of Smart City: Paradigms, Opportunities, Problems in Purworejo Regency. INTEK: *Journal of Informatics and Information Technology*, 2(1), 1-9.

Seta, HJ., Suharto, DG., & Setyowati, K. . (2024). Digital Transformation in Realizing Klaten Smart City. National Conference on Applied Business, Education, &Amp; Technology (*NCABET*), 3(1), 669–679.

Setyasih, ET (2022). Digital Transformation of Regional Government in the Era of Society 5.0: Case Study in West Java Province. PAPATUNG J. Science Adm. *Public, Government and Polit*, 5(3), 59-66.

Suhartono, I & Sina, I. 2020. Smart People in Smart City Analysis of Human Resources in the Context of Realizing a Smart City of South Tangerang. *GENIUS*. Vol. 3, no. 2, 1-5.

Suhendra, A. (2017). Regional Government Readiness in Realizing Smart Cities in Bandung and Surabaya. Metrics of Renewal: *Journal of Policy Innovation*, 1(1), 1-9.

Susanto, TD, Samopa, EF, & Wibowo, RP (2018, October). Government Resource Planning (GRP): Potential and Challenges in Indonesia. In National Seminar on Information and Communication Technology (*SEMNASTIC*) (Vol. 1, No. 1, pp. 826-839).

Syaefuddina, MA, Saifuddin, A., & Purwanti, W. (2022). The AMO Concept in the Application of Ghrm Realizes Health Digitalization in a Smart City Environment. *HORIZON*, 29(2), 40–49.

Taewoo, N & Theresa AP 2011. Conceptualizing smart city with dimensions of technology, people, and institutions. In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times (dg.o '11). Association for Computing Machinery, New York, NY, USA, 282–291.

Washburn, D., Sindhu, U., Balaouras, S., Dines, R.A., Hayes, N.M., & Nelson, L.E. (2010). Helping CIOs Understand "Smart City" Initiatives: Defining the Smart City, Its Drivers, and the Role of the CIO. Cambridge, MA: Forrester Research, Inc.