

# Towards A Sustainable City: Strategic Approach To Smart City Development

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**Abstract:** The rapid development of technology and urbanization has encouraged many cities around the world to adopt the Smart City concept as a strategy to achieve sustainability. Smart City integrates information and communication technology (ICT) into urban management to improve efficiency, public services and the quality of life of its residents. This study examines various strategies to develop the Smart City concept with a focus on sustainability aspects. The approach used includes literature analysis, case studies, and interviews with experts in urban planning and technology. The main findings show that effective Smart City implementation requires a comprehensive framework that includes advanced technological infrastructure, active community participation, supportive government policies, and collaboration among stakeholders. In addition, proper and transparent data management is essential for accurate and responsive decision-making. The study also highlights the importance of environmental aspects in Smart City development, such as the use of renewable energy, efficient waste management, and environmentally friendly transportation. Conclusion, a sustainable Smart City development strategy depends not only on advanced technology but also on the synergy between technology, policy, and society. Therefore, the Smart City concept can be an effective solution to address the challenges of urbanization and achieve the goal of sustainable cities in the future.

**Keywords:** smart city; urbanization; development; integrates; comprehensive; sustainability

## 1. Introduction

The development of information and communication technology (ICT) has significantly impacted various aspects of human life, including the way cities are managed and developed. The concept of a "smart city" has emerged in response to the need to enhance public service efficiency, reduce energy consumption, manage resources more effectively, and improve the quality of urban life. Cities worldwide face complex challenges such as rapid urbanization, climate change, pollution, and increasing demand for quality public services. In Indonesia, the rate of urbanization is rising rapidly, with more than 56% of the population living in urban areas in 2020, projected to reach 70% by 2030 (BPS-Statistic Indonesia, 2018). This increase in the urban population significantly impacts the need for infrastructure, housing, transportation, and other public services, making the development of smart cities highly relevant.

Smart cities offer innovative solutions to address urban challenges through the application of advanced technologies such as the Internet of Things (IoT), big data, and artificial intelligence (AI). These technologies enable city governments to manage resources more efficiently, improve public services, and make more data-driven decisions. Various studies have examined smart city implementation strategies around the world. (Mehmood and Yigitcanlar, 2024) studied the impact of smart technologies on resource management and environmental sustainability in modern cities,



demonstrating how these technologies support sustainability goals. [Cohen et al. \(2019\)](#) investigated how European cities adopt digital technologies to enhance public services and citizen participation, emphasizing the crucial role of digital technologies in government-citizen interactions. [Angelidou et al., 2017](#), provided an analysis of smart city implementation strategies in developing cities and their impact on the local economy, offering insights on how developing cities can leverage smart technologies to drive economic growth [Hashem et al \(2016\)](#) The expansion of big data and the evolution of Internet of Things (IoT) technologies have played an important role in the feasibility of smart city initiatives. Big data offer the potential for cities to obtain valuable insights from a large amount of data collected through various sources, using highly networked services.

Currently, smart city technology, as part of the agenda of all cities with the aim of forming large and intelligent infrastructure ([Lee et al., 2008](#)). Along with this development, the spread of sustainability ideology has had a significant impact on urban planning and development ([Cai and Tang, 2021](#)). towards sustainable urban planning and development ([Zafirakou, 2018](#)). Currently, the concept of a smart city is seen as a vision, manifesto or promise that aims to form a sustainable city. In other words, a smart city is a city that is efficient, efficient, technologically advanced, green, and socially inclusive ([Vanolo, 2014](#)), placing a certain technological focus at the forefront to produce solutions to ecological, social, economic, and management problems, social, economic, and management challenges ([Yigitcanlar et al., 2019](#)). Smart cities' primary focus mostly being exclusive to technology has been heavily criticised by a number of scholars. For instance, the darker side of smart cities particularly the extreme dependency on technology, and on corporations dominating technology and related services is mentioned in the literature as threatening. As stated by ([Kunzmann, 2014](#)), sooner or later society will not manage any more to live without the ICT based services.

A comparative study by [Joss et al. \(2019\)](#) on smart city approaches across continents highlighted the successes and failures of implementations that could serve as lessons for other cities. Other research also contributes significantly to the development of the smart city concept. For example, ([Papa et al., 2015](#)) explored how social and technological innovations collaborate in shaping smart cities and their impact on communities. [Bibri and Krogstie, 2020](#) discussed the integration of sustainability and smart technologies in developing smart cities. [Manville et al., 2014](#) examined smart city models in various major European cities, providing insights into the role of government policies and private sector participation in implementing smart technologies. [Chourabi et al., 2012](#) emphasized the importance of innovation and information technology in smart city development to enhance the quality of life for residents. [Zandbergen and Uitermark, 2020](#) identified essential dimensions of smart cities, including technology, management, and public policy needed for their success. [Mora, Deakin and Reid, \(2020\)](#) examined the applications and implications of smart cities in various sectors such as transportation, energy, and public services. The role of citizens in smart city development was also raised in the research by [Calzada and Cobo, 2015](#), emphasizing the importance of citizen participation in the success of smart cities. [Dameri, 2015](#) discussed the importance of collective intelligence and stakeholder collaboration in developing sustainable smart cities. [Barrionuevo et al. \(2019\)](#) investigated the social and economic impacts of smart technology implementation in major cities in Latin America.

In Indonesia, cities like Jakarta, Surabaya, and Bandung have begun adopting the smart city concept by developing initiatives such as smart transportation systems. However, smart city implementation in Indonesia still faces challenges such as budget constraints, inadequate infrastructure, and a lack of coordination between central and local governments. The implementation of smart cities in Indonesia faces significant challenges, despite the efforts that have been made to build smarter cities. One of the main challenges is the limited budget available to local governments. For example, in Jakarta, although there have been initiatives to implement smart transport systems and technology-based traffic management, the available budget is often allocated more to fulfil basic needs such as education and health, while these technology projects require larger and more sustainable funds ([Kompas, 2023](#)). In addition, inadequate infrastructure is a major obstacle, especially in areas outside major cities. The city of Makassar, for example, faces problems in implementing technology-based waste management applications due to limited stable internet access and frequent power outages, which hinder the effectiveness of the smart city system ([Detik, 2023](#)). Another challenge is the issue of coordination between the central and local governments. In Bali, policies related to smart city technology often overlap between the local and central government, leading to disharmony in implementation ([The Bali Times, 2023](#)). Inequality in access to technology also exacerbates this problem, especially between urban and rural areas. For example, in Bandung, although there are various applications to facilitate public services, most people in peripheral areas still struggle to access these technologies due to limited devices and internet connectivity ([Tribun News, 2023](#)). On the other hand, the issue of data security and privacy is also a big issue. In Jakarta, despite the use of apps for public transport, concerns over personal data leakage are growing, especially due to weak data protection regulations ([Jakarta Post, 2022](#)). All these

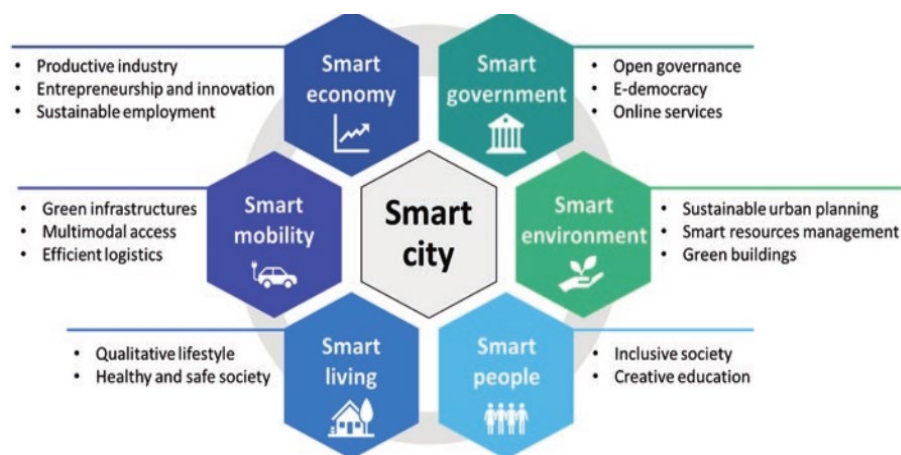
challenges show that while smart cities offer a lot of potential to improve quality of life, they remain major obstacles that need to be addressed thoroughly through a more inclusive approach and more integrated solutions. This research stands out by adopting a holistic and integrated approach to smart city development. It not only focuses on the application of advanced technologies but also considers governance, community participation, and economic and environmental sustainability. It is hoped that a more comprehensive strategy tailored to local conditions can be found to achieve the goals of sustainable cities

## Literature Review

### Smart City

Smart City is a concept that integrates information and communication technology (ICT) with city infrastructure to improve efficiency, public services, and the quality of life of its citizens. According to [Cocchia, 2014](#), Smart City refers to a city that uses technology to innovate, collaborate and improve the lives of its citizens. These technologies include intelligent transportation systems, efficient energy management, and more responsive public service delivery. The Organization for Economic Co-operation and Development (OECD) defines smart cities as “initiatives or approaches that effectively leverage digitalization to boost citizen well-being and deliver more efficient, sustainable and inclusive urban services and environments as part of a collaborative, multistakeholder process” ([OECD, 2019](#)). The smart city concept is often equated with other concepts, such as the knowledge city, sustainable city, intelligent city, ubiquitous city, digital city, and information city concepts. Essentially, all of these concepts focus on the application of information and communications technology (ICT) to urban management. These applications aim to improve the accountability, transparency, efficiency, and effectiveness of interactions between residents and local authorities. However, the concept of smart cities has shifted beyond a narrow focus on ICT diffusion. Instead, it addresses the needs and demands of individuals and communities holistically. Although ICTs are not the primary pillar of smart cities, they facilitate the establishment and development of smart communities ([Pira, 2021](#)).

A core element of a Smart City is the implementation of ICT, which serves as the backbone for data collection and processing. By utilizing large amounts of data, cities can monitor real conditions from various aspects, such as traffic, energy consumption, and waste management. According to [Rocha et al., 2021](#), integrating ICT in city infrastructure enables higher efficiency in service provision and resource management, helping decision makers to plan better policies. Although the concept of smart cities is widespread, research in this area is still in its infancy. According to ([Yigitcanlar et al., 2019](#)), the notion is still ambiguous, with limited conceptualizations and practical frameworks that could assist policymakers in realizing their smart city initiatives. One straightforward definition of smart cities is the use of different technologies, including the IoT, in urban areas to collect and share information and improve the operational performance of urban cities’ services, such as mobility and energy. Conceptually, the notion of smart cities consists of six city-oriented elements: habitat, population, transportation, economy, environment, and government ([Albino et al, 2015](#)). An illustration is provided in [Figure 1](#).



**Figure 1.** The six pillars of smart cities.

The other aspect that is equally important is physical infrastructure, which includes roads, public transportation, and utilities such as water and electricity. ([Neirotti et al., 2014](#)) emphasized that good infrastructure is indispensable to support the implementation of technology in a Smart City. Without

adequate physical infrastructure, even the most advanced ICT systems cannot function optimally. Therefore, holistic planning that considers both of these elements is essential. (Gil-garcia, Zhang and Puron-cid, 2016), Among these beneficial effects are: increased effectiveness, improved public services, stronger accountability, increased communication based on performance information, improved collaboration between different individuals and organizations, and increased knowledge sharing. Policy and program effectiveness could be conceptualized and measure in many ways and sometimes overlap with some of the other benefits. In fact, one way to think about effectiveness is in terms of outputs and outcomes of government policies and programs. These results may include benefits related to other dimensions, but most of the time they represent the actual impact that government actions have on society and how they enhance the quality of life of the citizens by solving complex problems. Some of the keywords related to this dimension are effective policies, effectiveness, efficacy, and performance.

Sustainability is a key element in Smart City. In this context, sustainability includes not only environmental, but also social and economic aspects. Rudewicz, 2023 explain that Smart City should focus on reducing carbon footprint and efficient resource management. These sustainability initiatives can include the use of renewable energy, waste reduction, and programs to increase environmental awareness among the community. Innovation and collaboration between the public, private and civil society sectors are also crucial in realizing a Smart City. According to (Appio, Lima and Paroutis, 2018), successful cities are those that apply a collaborative model in every stage of project planning and implementation. The involvement of various parties can lead to innovations in the provision of better services and products, resulting in solutions that are more adaptive to the needs of the city.

### **Challenges of Smart City Implementation**

Smart City implementation offers many benefits and opportunities to improve the quality of life and operational efficiency in urban areas. By utilizing advanced technologies, cities can provide better public services, manage resources more efficiently, and create a more welcoming environment for their citizens. However, despite this positive potential, a variety of complex challenges arise that can hinder the development and successful operation of smart cities. These challenges include technical, social, and policy aspects, all of which can affect a city's ability to achieve Smart City goals. According to (Seyed Hashtroudi and Aghadadashi, 2018) Hashem et al (2016) The growing demand for smart city and big data stimulates innovation, and the development of new smart applications is becoming important. However, to improve the services of the smart city, the collected data must be managed well. Bouskela, et al., (2016) Building a smart city appears to require basic adherence to a systematic process. This process involving selecting a competent leader and supporting team, completing an extensive diagnostic of the city's specific technology, human resources and institutional capacities, financial assets, limitations, and challenges, and especially building a coherent collaborative and engaging system among all stakeholders

Regulations and policies can limit the development and implementation of new technologies, causing confusion among the stakeholders involved. Research by Vasilev, 2024 shows that without a clear and adaptive framework, Smart City initiatives risk delays and unexpected costs. In addition, ambiguity in regulations can create uncertainty among potential investors, who may hesitate to invest in projects that face legal risks. Therefore, an approach based on collaboration between the public, private and community sectors is needed to develop policies that are in line with the needs and expectations of citizens (Bertot and Estevez, 2016). One of the main challenges in Smart City implementation is the issue of data privacy and security. With the collection of data from various sources, including IoT devices and mobile applications, the risk of misuse of citizens' personal information is increasing. The data collected includes sensitive information, such as behavioral patterns, usage habits, and personal location, which makes people concerned about potential privacy rights violations. Research shows that people's fear of privacy violations can reduce their trust and participation in smart city initiatives. According Moura and Serrão, 2020 meeting this challenge requires strict policymaking to protect citizens' data and ensure that the information collected is used in a transparent and ethical manner.

Wellman (2002) argues that to create an inclusive Smart City, it is important to encourage programs that provide access and training to citizens, especially to those living in areas with limited access to technology. This will help reduce the risk of widespread social injustice and ensure that all citizens can share in the benefits offered by smart city innovations. Without these interventions, certain groups of people, such as the elderly, low-income groups, or those living in remote areas, risk being left behind in the benefits offered by Smart Cities, which could exacerbate existing social and economic disparities. Therefore, governments and stakeholders need to work together to provide better technology infrastructure, as well as the digital skills training needed so that people can utilize these technologies effectively and contribute to the development of better and smarter cities. This approach will not only create more equitable opportunities for all citizens, but also ensure that every voice is heard in the decision-making process, resulting in more holistic solutions that meet the needs of the community.



However, many Smart City programs fail due to lack of participation and effective communication with local communities. According to Bertot et al. (2016), to create a successful Smart City, it is important to build a close relationship between the government, private sector, and citizens. The active involvement of the community in the project planning and implementation process not only increases the level of acceptance but also creates solutions that better suit the real needs of the community being served. Moreover, lack of community involvement can lead to deep dissatisfaction, especially when Smart City initiatives do not meet local expectations.

The cities that are unable to keep up with technological developments may experience obsolescence in infrastructure and public services. Furthermore, policymakers are often faced with the challenge of facilitating appropriate training and education for government employees and the public so that they can manage and utilize the technology. In addition, policymakers are often faced with the challenge of facilitating appropriate training and education for government employees and the public so that they can efficiently manage and utilize new technologies. In this regard, research by Vasilev, (2024) suggests that continuous education and skills training are key to building technological resilience in modern cities. Cities also need to develop infrastructure that can support the transition and integration of new technologies. Research by (Khristina et al., 2024) emphasizes the importance of system interoperability and well-designed infrastructure to ensure that different technologies can work together. The inability to integrate new technologies with existing systems can create gaps in services and reduce operational efficiency. In addition, ensuring that any investment in technology takes sustainability into account is important, as all innovations should contribute to the city's long-term sustainability goals.

### **Smart City and Sustainability**

The Smart City is a revolutionary concept that integrates information and communication technology (ICT) with urban infrastructure to improve efficiency, quality of life, and sustainability. Smart city development aims to create a more resilient environment, where technology is used to address the increasingly complex challenges of urbanization, including climate change, pollution, and population growth. By implementing technology-oriented solutions, Smart Cities can create a more sustainable and environmentally friendly ecosystem. One important aspect of sustainability in a Smart City is energy resource management. Smart cities use technologies such as smart grids to monitor and manage energy usage more efficiently. By utilizing renewable energy sources, such as solar and wind power, cities can reduce their dependence on fossil fuels, which contributes to the reduction of greenhouse gas emissions. According to Mutambik et al (2023), implementing smart energy solutions can reduce energy consumption by up to 20% within a few years, creating a significant positive impact on environmental sustainability.

Chang et al. (2018). In smart sustainable cities, “sustainable” should be twined with “smart” to achieve the desired outcomes. Accordingly, the concept of smart and sustainable cities has become a global hot topic. Mehmood and Yigitcanlar, (2024) underlined the growing interest among Western countries in establishing environmentally sustainable smart cities. The term “smart sustainable city” is defined as “a city that meets the needs of its present inhabitants, without compromising the ability of other people or future generations to meet their needs, and thus, does not exceed local or planetary environmental limitations, and where this is supported by ICT” (Hojer & Wangel, 2015). Bibri and Krogstie, (2020) claimed that in planning smart sustainable cities, ICT plays a key role, which includes supporting cities when planning, operating, and managing urban systems, and thus, contributing to sustainability. Yigitcanlar et al., (2019) suggested that cities could not be smart without being sustainable, even when evidences in the practical application of the “smartness” point to the contrary. Nevertheless, sustainability does not solely deal with environmental issues. It also incorporates social and economic dimensions, albeit the social dimension being the least addressed (Marsal-Llacuna, 2016).

The second aspect of sustainability that is closely related to Smart Cities is green mobility. Smart and integrative transportation systems allow cities to optimize travel routes, improve the efficiency of public transportation, and promote the use of vehicle sharing. Research shows that smart mobility solutions not only reduce congestion but also lower air pollution. Russo and Rindone, (2023) showed that the application of technology in transportation can reduce CO<sub>2</sub> emissions by 30% in the next few years. Community involvement in Smart City planning and development is also an important aspect of achieving sustainability. Community participation in decision-making ensures that the projects launched meet local needs and expectations. Khristina et al., (2024) state that active community involvement can strengthen the sense of ownership and increase the acceptance of Smart City initiatives. In this way, the initiatives developed are more relevant and effective in meeting the challenges faced by the community.

Transparency and accountability are other important principles in creating a sustainable Smart City. Utilizing information technology, governments can provide citizens with better access to how data and information about the city is managed. More transparency in decision-making can strengthen people's trust, allowing them to engage more actively in initiatives related to the environment. Research by (Di

Vaio, Varriale and Alvino, 2018) underlines the importance of transparency mechanisms for building public trust. Resilience to climate change risks and impacts is an important aspect of Smart City plans. Smart cities are developed with climate change and potential environmental risks, such as flooding and air pollution, in mind. According to research by (Khristina et al., 2024), technology-based solutions, such as air quality monitoring systems and water management, are essential to mitigate the impacts of climate change and maintain the sustainability of cities. This approach shows that the integration of scientific knowledge in urban planning can lead to more effective data-driven solutions.

Sustainable innovation in Smart City should also include the development of digital infrastructure that can support various interconnected technologies and systems. Infrastructure designed for interoperability can help cities to adopt and implement new technologies more easily. This is important to ensure that investments are not only efficient but also support long-term sustainability goals. As stated by (Glaeser, 2022), building durable and flexible infrastructure is key to achieving sustainability in Smart City development.

### Technological Role in City Management

The implementation of the smart city concept in Indonesia faces a number of complex problems that need to be addressed immediately so that the vision to improve the quality of life of urban communities can be optimally realized. Although smart cities promise a positive transformation in city management through the integration of advanced technology, the reality shows various obstacles that hinder this progress. One of the main problems is the inadequate infrastructure in most parts of Indonesia. Although some big cities such as Jakarta, Surabaya, and Bandung have taken steps towards smart cities by adopting information technology, accessibility to fast, widespread internet networks and efficient transport systems is still very limited. Various infrastructure sectors are reliable Information Technology systems, on which information flows and analysis networks can be built. Information Technology systems are not only for collecting and analysing data for city information, but can also be utilised to collect information on how the city functions.

Information and communication technology refers to a connected system of interactive tools and technologies that are used to send and receive information. Whether it be an individual or an entire company, if a single entity is using multiple types of technology to communicate, they must be linked to ensure efficiency. These systems of interactive tools can include state-of-the-art innovations, such as artificial intelligence, and less advanced technology, like the corded telephone. The ability and newness of the device aren't important. If multiple technology tools are being used by an individual or business, they should be connected. Information and communication technology have changed the way people go about their days living, working, and communicating. These innovations have taken over certain duties that people never would have imagined a machine to do, such as answering phones and giving human like responses or speaking into a device and having it write a message, as shown in Figure 2.



**Figure 2.** ICT Components.

The financial issue is a serious challenge in the development of smart cities in Indonesia. The cost of implementing advanced technologies such as the Internet of Things (IoT), smart energy management systems, or smart sensor infrastructure is often unaffordable for local governments, especially in small and medium-sized cities. Innovative funding strategies and strong collaboration between the government,

private sector and communities are needed to overcome these financial limitations. Poor coordination between central and local governments is also a significant problem in the implementation of smart cities in Indonesia. National policies that support smart city adoption need to be consistently implemented and well adapted by local governments according to their local contexts and needs. More effective coordination between levels of government is key to executing smart city projects properly and efficiently.

The use of advanced technologies such as big data for public decision-making, IoT for transportation management, or AI to improve the efficiency of public services requires strong data protection to prevent misuse and privacy violations. The lack of clear regulations is often a major barrier to the adoption of smart city technologies in the community. Active community participation is also an important issue in the implementation of smart cities in Indonesia. Citizen involvement in the planning, implementation and evaluation process of smart city projects is crucial to ensure that the solutions implemented are truly relevant and acceptable to the wider community. With these issues in mind, the Indonesian government, along with academic institutions, the private sector, and the public need to work together to overcome these barriers. The development of a comprehensive, data-driven, and inclusive strategy is key to realizing a smart city vision that is appropriate to Indonesia's local context, sustainable, and provides maximum benefits for the entire community. Successful smart city implementation is expected to contribute significantly to improving quality of life, efficiency of public services, and sustainable development in the future

## **2. Research Methodology**

### *2.1. Research Approach*

This research uses a qualitative approach, which aims to deeply understand the various factors that influence smart city development, especially in the context of sustainable urban development strategies. This approach was chosen because smart cities are not only related to the application of advanced technology, but also include various complex social, economic, environmental and policy aspects. Therefore, a qualitative approach is the most suitable method to explore the dynamics and interactions between actors that play a role in smart city implementation, including the government, community and private sector. In the context of this research, a qualitative approach allows for a broader exploration of how smart city development strategies can be aligned with sustainability principles to achieve a balance between technological innovation, government policies, and the social and economic needs of urban communities.

This approach provides flexibility in data collection and analysis, which is essential in understanding the challenges and opportunities faced in implementing smart cities in various cities. This method allows the research to capture the perspectives and experiences of key stakeholders, including government officials, academics, businesses, and citizens who are users of smart city services. The information obtained will be thematically analyzed to identify patterns, key challenges and success factors in the sustainable implementation of smart cities.

### *2.2. Data Collection Methods*

This research uses two main methods in data collection, namely literature study and interviews. This approach was chosen to obtain a more comprehensive picture of sustainable smart city development strategies, by considering various aspects related to technology implementation, government policies, community involvement, and the challenges and opportunities faced in realising smart cities.

#### *2.2.1. Literature Study*

The literature study was conducted by reviewing various relevant references on the concept and implementation of smart cities in various countries, including the strategies used, the impacts caused, and the challenges faced in the process of urban transformation towards sustainable smart cities. This literature review will serve as a basis for understanding the theories and best practices in smart city development, and provide insights into how cities around the world have successfully integrated technology in urban governance to improve the efficiency of public services and quality of life.

- Analyze previous research on smart cities, including various models, implementation strategies, and factors that influence success or failure in implementation. The literature reviewed includes academic research, policy reports, case studies, and articles that discuss recent developments in the field of smart city technology.
- Sources from a wide range of academic and policy references, including scholarly journals, government reports, public policies, and documents from international organizations that focus on smart city development and urban sustainability.

### 2.2.2. Interviews

Interviews were conducted to gain insights directly from stakeholders involved in smart city development and implementation. This interview technique is used to explore information that cannot be obtained only through literature studies or secondary data analysis, so as to provide a deeper understanding of the challenges, opportunities, and innovations that can be applied in building a more effective and sustainable smart city, engage key stakeholders:

- Government officials who play a role in the planning and implementation of smart city policies, such as the heads of transport agencies, communication and informatics agencies, and representatives from relevant ministries.
- Academics and researchers in the fields of urban planning, information technology, and public policy who have deep insights into the trends and challenges in smart city development.
- Private sector representatives, including technology companies and startups involved in developing digital solutions for smart cities, such as smart transport system developers, city data management companies, and internet service providers.
- Citizens as direct users of smart city services, to understand how they experience using technology-based services, as well as the extent to which smart city implementation has fulfilled their needs in their daily lives.

### 2.3. Number and Type of Informants for Interviews

In this research, interviews were conducted to gain in-depth insights into sustainable smart city development strategies. Therefore, the selection of informants was done through purposive sampling, taking into account their involvement in the smart city planning, implementation and evaluation processes. The number of informants interviewed will be adjusted to the research needs, with a target of 24 key informants who have a strategic role in smart city development. The distribution of informants by category is as follows:

#### 2.3.1. Government Officials (7 Informants)

This category includes representatives from government agencies that play a role in policy formulation and smart city implementation at the national and local levels. The selected informants include:

- The Ministry of Communications and Informatics, which is responsible for the development of digital infrastructure and technology-based services.
- Ministry of Transport which handles technology integration in urban transport and mobility.
- Ministry of Environment which focuses on the application of technology in environmental sustainability.
- Ministry of National Planning and Development, which designs long-term strategies for smart city development.

#### 2.3.2. Academics and Researchers (6 Informants)

This category consists of experts and academics with expertise in urban planning, information technology, public policy, and sustainability. Informants in this category include: Lecturers or researchers from universities that have research related to smart cities and sustainable urban development.

- Lecturers or researchers from universities who have research related to smart cities and sustainable urban development.
- Researcher from an urban planning institute or centre that analyses global and local trends in smart city development

#### 2.3.3. Industry and Private Sector Players (5 informants)

This category involves technology companies and the private sector that contribute to the development of smart city solutions. Informants in this category include:

- Developers of IoT, big data, and artificial intelligence (AI) technologies used in smart city systems.
- Startups developing technology-based public service applications.
- Digital infrastructure providers, such as telecoms network operators and city data management companies.
- Private investors or partners involved in funding smart city projects.



#### 2.3.4. Community Representatives and Smart City Users (6 Informants)

To understand how smart cities affect people's daily lives, interviews will also involve citizens who are direct users of technology-based services. This category includes:

- Citizens who use digital public service applications, such as e-government, online tax payment, or smart transport systems.
- Communities or community organizations that are active in advocating for urban governance and environmental sustainability.
- Micro, small and medium enterprises that utilize technology in their business, for example in the smart economy ecosystem.
- Public figures or local community leaders who understand how smart city implementation impacts the welfare of citizens.

#### 2.4. Data Analysis Technique

Data obtained from various sources, such as literature studies, case studies and in-depth interviews, were analysed using thematic analysis method to identify patterns, trends and key factors that play a role in sustainable smart city development. This method was used because it is able to organise and interpret data systematically based on themes relevant to the research objectives. This approach illustrates how the integration of technology, policy and community participation in building smarter and more efficient cities.

##### Stages of Data Analysis

##### 1. Data Coding

- The first stage in data analysis is coding, which is grouping the information obtained based on the main themes, such as government policies, technology infrastructure, implementation challenges, community participation, socio-economic impacts, and environmental sustainability aspects.
- Data from in-depth interviews will be coded based on the perspectives of stakeholders, including government officials, academics, private sector, as well as communities, to understand the various viewpoints that contribute to smart city implementation.

##### 2. Identification of Patterns and Relationships

- Once the data has been coded, the next step is to identify the linkages between the findings to understand the emerging patterns in smart city implementation.
- This analysis will explore how factors such as infrastructure readiness, supporting policies, technology adoption, community engagement, as well as economic and environmental aspects interact to shape smart city strategies.
- In addition, a comparison will be made between different cities that have implemented smart cities to understand the similarities and differences in the approaches used, as well as evaluate the effectiveness of the policies that have been implemented.

##### 3. Data Interpretation and Synthesis

- The results of the data analysis will then be organized into a systematic narrative, which provides insights into the key success factors and challenges to be overcome in smart city implementation.
- The data interpretation will explain how technology can be optimized to improve the efficiency of city governance, how policies can support innovation, and how sustainability principles can be applied in smart city development strategies.
- The conclusions drawn from this analysis will be used as the basis for developing strategic recommendations for policy makers and other stakeholders to accelerate the adoption and optimization of smart cities in Indonesia.

### 3. Result And Discussion

#### Smart City Program Objectives

Establishing a City by applying the Smart city concept requires a comprehensive approach that is integrated into a single unit (system), with one main goal, namely serving all community needs quickly, precisely, friendly and satisfactorily, based on the maximum utilization of information technology.

#### 3.1. Smart Governance

- The Smart Governance dimension represents the difference or gap between the current condition and the expected condition when the Smart Governance concept is realized in the future. The gaps that are used as the basis for this analysis are as follows.

- Still in the early stages of implementing the Smart Governance concept.
- The policies that have been made are still being adjusted to the direction of development.
- The availability of human resources and performance achievements are still not optimal.
- Synergy between government and private institutions in encouraging public services is still not optimally carried out in accordance with the objectives of policy development.

### 3.2. *Smart Branding*

The Smart Branding dimension represents the difference or gap between the current condition and the expected condition when the Smart Branding concept is realized in the future. The gaps that are used as the basis for this analysis are as follows.

- Lack of platform development and trade ecosystem promotion that creates a supportive and comfortable atmosphere for businesses, for example by introducing local online markets.
- The need to increase the development and promotion of a simple yet efficient investment ecosystem, such as through the implementation of Investment Lounge, Dashboard, and Regional Investment Portal, to facilitate investors in exploring investment opportunities.
- The lack of effort in developing and marketing products and services from the local creative industry sector, including food and beverages, handicrafts, fashion, digital, and various other sectors, with the aim of increasing the attractiveness and added value of the creative potential of the region.

### 3.3. *Smart Economy*

The Smart Economy dimension represents the difference or gap between the current condition and the expected condition when the Smart Economy concept is realized in the future. The gaps that are used as the basis for this analysis are as follows.

- Poor accessibility, lack of adequate facilities, and lack of an efficient monitoring system can be obstacles in achieving the ideal conditions of the economic center.
- Lack of availability of skilled human resources, limited access to knowledge and technology, complexity in obtaining licenses, challenges in business management, and constraints in obtaining capital, especially for small and medium-sized enterprises (SMEs).
- Lack of access and infrastructure to support the development of tourism potential owned and managed by various stakeholders in the tourism area.
- The need for management and identification of resources in the agriculture, forestry, culture and youth participation sectors.

### 3.4. *Smart Living*

The Smart Living dimension represents the difference or gap between the current condition and the expected condition when the Smart Living concept is realized in the future. The gaps that are used as the basis for this analysis are as follows.

- a. Not maximizing collaboration between various parties, as an effort to improve security and disaster preparedness and create a safer and more resilient environment for all;
- b. The need for equal distribution of individuals who receive quality education services from the government as a form of commitment to the overall welfare of the community;
- c. The need to improve the ease of access and availability of services from medical personnel and health facilities.

### 3.5. *Smart Society*

The Smart Society dimension represents the difference or gap between the current condition and the expected condition when the Smart Society concept is realized in the future. The gaps that are used as the basis for this analysis are as follows.

- a. The need for easy and broad access to ICT infrastructure such as fast broad band networks, reliable connectivity, and connected smart devices.
- b. The participation of community involvement that has not been maximized in providing participation and feedback.
- c. The integration of the roles of individuals, communities, and institutions has not been maximized in the functions of digital networks, information exchange, collaboration, and coordination.
- d. The function of technologies such as the Internet of Things (IoT), artificial intelligence (AI), data analytics, and cloud computing that are used for various aspects of daily life has not been optimized.

### **Smart City Readiness Action Plan**

Smart city action plans are smart city programs and activities prepared to strengthen the carrying capacity of smart city-based city/regency development. Action plans are needed to support the vision and strategy of regional development. Action plans are an inseparable component in smart cities, so that they can answer problems clearly and objectively related to the changes that will be made. The smart city action plan is divided into 4 plans, the following are the four divisions of the smart city action plan as follows:

1. Smart city policy and institutional development.
2. Infrastructure development plan supporting smart city.
3. Application and software development plan supporting smart city.
4. Plan to strengthen human resources through smart city literacy.

### ***3.6. Smart City Policy and Institutional Development Plan***

The development of the City through the development of smart city policies and institutions is an effort made to realize effective, efficient, communicative local governance and governance, and continue to perform bureaucratic performance through integrated innovation and technology adoption.

1. Preparation of smart city.
2. Preparation of smart city regional regulations.
3. Smart city institutional development.
4. Preparation of smart city governance.
5. Cooperation with cities and districts
6. Development of smart city ecosystem

### ***3.7. Smart City Supporting Infrastructure Development Plan***

The smart city supporting infrastructure development plan is a plan that contains infrastructure needs so that the smart city development goals can be achieved. In general, the infrastructure to be developed in the smart city program is digital infrastructure, physical infrastructure and social infrastructure.

#### **1. Digital Infrastructure**

There are several main needs that must be met in the development of digital infrastructure, including the development of computer networks, data centers and the availability of control rooms. The city needs to have an internet network that has connected all OPDs through a fiber optic network. In this case, the programs that are still needed include:

- a. Development of fiber optic or broadband networks.
- b. Development of internet network infrastructure to areas far from the city centre.
- c. Rejuvenation and addition of IT infrastructure (servers, computers, and several other IT devices)
- d. Addition of surveillance cameras (CCTV) in strategic locations.
- e. Provision of sensors such as air pollution sensors, traffic violation detection sensors in strategic locations.
- f. Addition of internet bandwidth

#### **2. Physical Infrastructure**

Digital infrastructure is not only needed to realize the smart city concept, but also the physical elements that support it. Broadly speaking, the physical infrastructure needed is the smooth mobilization of each region. The physical infrastructure that needs to be developed in a smart city is as follows:

- a. Improvement and maintenance of residential streets.
- b. Development and maintenance of tourist attractions and access to tourist attractions.
- c. Improvement and maintenance of residential drainage
- d. Improvement of health services in accordance with Permenkes standards.
- e. Construction of a public service mall.

#### **3. Social Infrastructure**

Social infrastructure is an important thing to develop, because it concerns the gathering place and socialization of people in an area. Social infrastructure that needs to be developed by the government includes:

- a. Development of green spaces and playgrounds.
- b. Revitalization of water resources.
- c. Building and developing social facilities for PMKS (Persons with social welfare problems).
- d. Development of sports facilities and centers.

### *3.8. Smart City Application and Software Development Plan*

Application and software development is an effort to realize more efficient and effective regional governance. The following are some of the application development needs required by the government including:

1. Develop integration of bureaucratic governance applications (Procurement of goods and services, Information and communication center services, regional development planning services, correspondence services and other service applications) using the Single Sign On (SSO) application form.
2. Develop integration of public service applications (licensing, public complaints) using the Single Sign On (SSO) application form
3. Development of community data needs applications (etc: Smart Infrastructure, employment needs application, staple food price application, and other open data applications needed by the community).
4. Continuous development of geospatial information systems that are integrated with development planning and implementation.
5. Development of MSME applications or platforms that reach all MSMEs.
6. Development of applications or platforms for regional information and tourist facilities that cover the full range of tourist information.
7. Development of a Social Safety Net (JPS) SIM application.
8. Development of an integrated online library (smart library/e-library).
9. Development of an integrated health information system (e-health).
10. Applications supporting bureaucratic governance and other public services

### *3.9. HR Strengthening Plan through Smart City Literacy*

Digital literacy is an effort to socialize and improve the quality of human resources in their ability to use information and communication technology factors to create, find, utilize and communicate digital content effectively, efficiently and responsibly. Knowledge and utilization of the smart city concept needs to be conveyed to the community so that the community can also participate in utilizing the smart city concept. To realize this understanding, there are programs related to smart city literacy, namely:

1. Socializing and technical guidance on productive and useful use of ICT.
2. Socializing and technical guidance on the use of ICT for public services to government officials to improve skills and skills to support smart city programs.
3. Socialization program and technical guidance on internet and digital society.
4. Conduct socialization and technical guidance to external parties through branding and promotion of smart city development to the community, potential investors, contractors, business people, campuses and others.
5. Digital economy literacy activities for MSMEs, campuses, and the wider community.

## **4. Conclusion**

1. The Smart City development strategy is a holistic effort to create a smart, efficient and sustainable city, some important points that can be summarized are:
2. The use of technologies such as IoT, big data, and artificial intelligence (AI) is essential in supporting city management, but its success requires good governance, clear regulations, and transparent data management to support accurate decision making.
3. Smart City strategies must consider environmental, social and economic aspects. The use of renewable energy, efficient waste management, and environmentally friendly transportation are prioritized to reduce negative impacts on the environment while improving the welfare of the community.
4. The success of a Smart City relies heavily on the active participation of the community in the planning, implementation and evaluation process. This involvement ensures that the initiatives implemented are relevant to local needs and have broad support from the community.
5. The implementation of Smart City in Indonesia faces various challenges such as limited infrastructure, digital divide, data security, and financing. Solutions offered include increasing digital literacy, equitable infrastructure development, innovation in funding, and flexible and adaptive policies.

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