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A Strategy of Smart Mobility Implementation: Characteristics, Factors, and Citizen Expectations

- Case of Indonesia -

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Abstract

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The rapid development of digital technology and the use of information in productive processes cause structural changes in the economy in the current situation of Industry 4.0. (Neves et al., 2020) As a result of digital transformation, smart cities emerge as a type of interaction among technological, organizational, and political innovations.

Innovation in mobility and transportation as an effect of smart city development, like ride-hailing, car-sharing, car-pooling, Mobility as a Service, electric vehicles, autonomous vehicles, and so on, seems to be a panacea for mobility issues (J. Lee et al., 2020a). Unfortunately, most innovation is not supported by policy and regulation. The public transport authorities frequently may take less time to regulate to enable the smart mobility concept, and like many other public authorities, transport authorities' bureaucracy may slow down the penetration of mobility innovation (Kamargianni & Matyas, 2017a)

The overpopulated city will face difficulties in providing adequate transportation in implementing smart mobility agenda, mainly because the lack of public transportation cannot be solved only by expanding the road and building new transportation infrastructure.

This study aims to understand the smart mobility characteristic to facilitate a strategic goal in creating public value based on citizen expectations. The study focuses on the case of Indonesia. Two essays were conducted through an in-depth literature review to achieve this objective.

The first essay investigated smart mobility characteristics and factors, where expert judgment and opinion were used to categorize the most important criteria. The result is to help government design a strategy to implement smart urban mobility in Indonesia's new capital. At the same time, the second essay focused on the citizen satisfaction expectations for smart mobility. Both results will combine to fill the gap between government and citizens' expectations for future urban mobility in the new capital of Indonesia.

Keywords: (Smart City, Smart Mobility, Citizen, Public Value, AHP, Satisfaction Expectation, SEM)

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Chapter 1. Introduction

1.1 Research Background

The fourth industrial revolution, or Industry 4.0 (Sarker, 2022) utilizes digital breakthroughs to intelligently and efficiently optimize industrial operations by combining many industrial technologies. It is a move toward digitizing all physical operations and putting them into digital ecosystems or using information technology to build the internet of things. The idea behind Industry 4.0 is to make production processes smarter and more efficient by using digital innovations. This means that machines are used instead of people to produce goods and provide services. Integrating digital technology into every aspect of business results in fundamental changes in how firms function and generate consumer value(BOUMALI & TAMINE, 2022)

Undergoing dramatic shifts, the innovation of technology, organization, and politics in smart cities brings big changes and becomes a solution in urban development. This change influences the economic aspect, governance, mobility, environment, living, and human lives (Neves et al., 2020). It also addresses global concerns by ensuring citizen well-being in the coming years by enabling the city to become smarter and more resilient (Ramirez et al., 2021b)

However, the idea or the concept of a "smart city" has been around for quite some time. The word was first used in the mid-1800s to designate new, efficient, and self-governing communities in the American West. It has modern roots in the 'smart growth' movement of the 1990s, which refers to sustainable urbanization.

Paradoxically, the legacy of the Industrial Revolution has resulted in the flourishing of cities and the degradation of metropolitan areas. These qualities elevate and reclaim the significance of cities as the primary engines of socioeconomic advancement(Camboim et al., 2019), but the problems in cities or urban environments occurred since the industrial age and started with overpopulation and ineffective urban design and planning. This situation is exacerbated by the poor public transport and mobility system. At the same time, government operates in an old style or runs with a flawed management system. Nowadays, the issues related to climate change liven up with the lack of sewerage and water infrastructure availability, poor waste management, and health issues. Lastly, fewer job opportunity makes all cities' problem more complicated (Khalid Khan et al., 2022)

Since the middle of the 2000s, the smart city concept has emerged as the most prominent approach to addressing the challenges posed by both cities and society as a whole. How a smart city expands and transforms depends on the city's interpretation, ideas, and vision with the support of infrastructure, ICT/technology, and innovation. This transformation aims to create a resilient and sustainable future city. Because city transformation takes continuous long-term, smart city development needs to support with a comprehensive strategy, policy, commitment, resources, money, budget, and investment, then a collaboration among stakeholders (Angelidou et al., 2018)

Furthermore, embracing advanced technologies in smart cities create hyper-connected ecosystems where different technologies can interact with one another, omnipresent and data-driven solutions, and integrating all of these elements into a single intelligent system (Neves et al., 2020). Therefore, technologies from the fourth industrial revolution, such as the internet of things (IoT), data analytics, artificial intelligence (AI), and machine learning, are present to support smart city services such as smart people, smart governance, smart environments, smart transportation, smart health, smart grids, smart cyber security management, and so on. Automating, streamlining, and providing residents of cities with comfort are the goals of these cutting-edge services (Sarker, 2022).

City transformation affects all aspects of human life. All sectors, including the government, must transform their business model to fulfill the new expectation and demands of their stakeholder. This tendency encourages governments system to transform their services with openness and transparency. Providing accessible data can be the excellent signing of a new beginning of the government era and, in the long term, impact social and economic, where the government function shift in making value for their citizen. The new role of government can do it through an e-government system. This system must provide accountable, accurate, and reliable information to serve citizens(Neves et al., 2020).

1.2 Indonesia New Capital Feasibility [1]

The capital of a country is a significant component of describing national identity, representing the magnitude of a country's power and political center. Jakarta, as the capital of Indonesia, has become a center of everything in Indonesia

[1] Indonesia New Capital Feasibility Study – Lampiran II Undang-Undang Republik Indonesia Nomor 3 Tahun 2022 Tentang Ibu Kota Negara

because Jakarta has more immense opportunities to get jobs, better education, entertainment, and other various facilities that attract Indonesian people to live in this city. As a result, the population of the Jakarta Metropolitan Area continues to increase every year, both due to natural growth and migration factors. The population of DKI Jakarta Province in 2017 reached 10,277,628 people. Based on United Nations data for 2017, Jakarta is the 9th most populous city in the world.

The high pull of government, economic, and political factors causes high urbanization, which needs to be balanced with the city's ability to facilitate the needs of all its residents. As the population increases, the need for space and infrastructure also increases. The need for housing, infrastructure, and facilities such as transportation and clean water is a need that is increasingly difficult to fulfill in Jakarta, and pollution and environmental damage are increasingly unstoppable.

Based on a study by the Jabodetabek Transportation Management Agency in 2015, the total number of mobility in Jakarta 2015 reached 47.5 million people who travel per day. The availability of safe, comfortable, and adequate public transportation has not matched the high mobility of people and goods in the capital. The DKI Jakarta road infrastructure ratio is only 5.42%, while the ideal should be 15%. The road capacity cannot accommodate the traffic from the suburban area to the city center. It's causing massive congestion, resulting in an average speed of only 10-20 km per hour within the Jakarta area or 16 km per hour during peak hours. And only 19 km per hour within Jakarta.

Jakarta's congestion conditions (gridlocks) are the worst, with a 33,240 stopstart index (Pantazi, 2015). The impact of congestion in Jabodetabek is causing significant economic, environmental, and social losses. Financial losses due to traffic jams in Jakarta in 2013 amounted to IDR 56 trillion (PUSTRAL UGM 2013). In 2017 losses due to traffic jams in Jakarta reached IDR 65 trillion (World Bank, 2017). The high level of congestion in Jakarta causes air pollution due to motorized vehicles. It caused Jakarta to 1st ranked as the city with the worst air quality in the world based on the Air Quality Index Value (AirVisual, 2019). This unhealthy air quality has the potential to have an impact on citizen health. Problems of depression, stress, and health problems have also increased due to commuting congestion, which can result in decreased productivity levels.

Jakarta also has a potential earthquake threat from tectonic activity and earthquakes caused by volcanic activity. As a "Ring of Fire" area, Indonesia has many volcanoes. Near the city of Jakarta, there is a threat of volcanic activity from Krakatau and Mount Gede, which can cause volcanic earthquakes. Both of these volcanoes are currently still active, and the most recent eruption was Mount Anak Krakatau in 2018. The city of Jakarta also has the potential for a tectonic earthquake and Megathrust Tsunami south of West Java and the Sunda Strait.

Based on the problems Jakarta and the Jabodetabek suburban faced, such as high urbanization rates and high traffic jams, which have implications for unhealthy air quality, limited raw water supply, annual flooding, and land subsidence as the threat of potential earthquakes, move the capital of Indonesia from Jakarta can be one of a good solution.

The development of the new State Capital is related to Nationalism. as seen from efforts to move capital cities in 40 countries which illustrates the strong connection between countries and a sense of Nationalism. For developed countries, especially in the West, capital cities are seen more as a need for administrative arrangements and state governance. However, for countries such as Africa, Asia, and Latin America, which are in the process of developing nations and countries, the existence of a capital city is a sensitive matter. It is considered an amplifier for national, unifying, and equitable symbols of a region's physical and economic development.

Indonesia's new capital (Nusantara) will become an economic engine for Kalimantan and a trigger for strengthening domestic value chains throughout Eastern Indonesia. The development of Nusantara places Indonesia in a more strategic position in world trade routes, investment flows, and technological innovation. In addition, Nusantara will also be a pilot for developing green and sustainable cities driven by the application of the latest technology. The vision of "World City for All" describes the people who will live in Nusantara in the future and the environmental conditions that will be restored and maintained.

The vision is divided into three main objectives, namely as:

a. a symbol of national identity: a city that embodies the identity, social character, unity, and greatness of a nation;
b. sustainable cities in the world: cities that manage resources efficiently and provide services effectively with efficient use of water and energy resources, waste management, integrated modes of transportation, livable and healthy environments, synergies between the natural environment and the built

environment; and

c. Indonesia's future economic driver: progressive, innovative, and competitive in technology, architecture, urban planning, and social. Superhub's financial strategy ensures the most productive synergies between workforce, infrastructure, resources, and networks and maximizes opportunities for all.

1.3 Problem Description

The smart city initiative aims to improve the quality of life in urban living by fulfilling the needs of cities and citizens. Smart cities rely on various technologies to achieve these goals, and they must continuously develop through reimagined, reintegrated, and redefined technologies. Another critical point is to understand how systematically develop the knowledge, capacity, and capability of public agencies, the private sector, and multiple users in city regions in terms of the built environment and urban infrastructure. On the other hand, a city must allocate adequate resources and integrate with different city key dimensions to enable added-value services for citizens.

Technological innovation boots the smart city development and motivates governments to revolutionize how citizens are served. The cities themselves are adamant that innovative uses of ICT will create sustainable innovation that will improve citizens' quality of life, enable new ways of creating value in cities, and, as a result, create new business models (Ji et al., 2021)

For several decades, cities have been investing in Intelligent Transportation Systems (ITS) to provide sufficient transportation services. The goal is to improve services while decreasing congestion, accidents, and air pollution through the strategic use of Information and Communications Technology (ICT). As the smart cities initiative has grown and changed, traditional ITS has become "smart mobility." In the smart mobility concept, all transportation modes are significant. Vehicle and communication technology innovation provides multiple services, including navigation, entertainment, tolling, parking, autonomous driving, real-time service information, and digital payment through the user's phone. (Chen et al., 2017).

The advent of "smart mobility" presents cities with a golden opportunity to boost their transportation infrastructure's efficiency. In cities with a well-developed public transportation network, ICTs can be put to good use. The goal of smart mobility is not limited to ensuring the long-term viability of urban transportation systems through the application of ICTs. However, it needs to be practical to help people travel longer distances, optimize traffic flows, gather information, improving cities and public transportation. To attend to the needs of citizens, a comprehensive and cohesive ensemble of these various factors is needed (Battarra et al., 2018c).

The main key to implementing smart mobility in smart city development is to transform smart mobility into resilient accountability for service performance and transparency alongside citizen participation. Future mobility envisions the entire transportation sector as a cooperative, interconnected ecosystem that provides services that meet the needs of citizens. Transportation infrastructure, transportation services, information, and payment services comprise the mobility ecosystem (Docherty et al., 2018). The vision to create smart mobility must be well-planned, integrated, and flexible to adapt to new challenges because it will take a long time to implement.

Three core characteristics that define smart mobility are citizen-centric, data-driven, and bottom-up innovations. In developing countries, mobility issues started with the high number of private vehicles, low quality of public transportation, congestion, overpopulation, inadequate infrastructure, insufficient financial resources for capital investment, operation, and maintenance, and a weaker institutional and technical ability. A sustainable and resilient city can only be achieved by involving all stakeholders in a collaborative and transparent system and prioritizing basic infrastructure, such as a cohesive road network and basic traffic management techniques (Chen et al., 2017).

However, even though citizens are crucial stakeholders in all phases of smart city development, they are frequently considered peripheral to the top-down implementation of smart city programs (Ji et al., 2021). It is time for governments to seek empirical evidence about citizens' preferences regarding smart services. This evidence can raise awareness, increase the efficiency of smart city service delivery, help governments' strategic positioning of a smart city, and provide indicators of where citizens' preferences work better. These developments will set the starting point of smart city plans that are economical, centered on the needs of the citizens, and tailored to the unique environment in which they are implemented. Despite these advantages, empirical studies examining citizens' preferences for smart city services are still limited. (Ji et al., 2021).

Based on the road map and law number 3 about the new Indonesian capital, the Indonesian government plan to move the capital into a new city outside Java island, in East Kalimantan Province. The main goal is to provide a convenient city for all citizens and improve economic development. As a city built from scratch, Indonesia will have more challenges in implementing a smart city due to limited resources such as budget, technology, infrastructure, and human resources. Regarding the smart city dimension, for a city built from scratch, smart mobility and smart governance dimension will need more attention to implement in the early stage of smart city development. Preparing a good plan and well design of basic infrastructure in ICT and transportation and involving citizens in the process will create a sustainable smart city in the future. Cities can improve the overall performance of their transportation systems by using smart mobility (Battarra et al., 2018c).

Smart mobility is one of the fundamental dimensions in building smart cities, especially for cities from scratch. To achieve a resilient and sustainable city, especially in mobility, it needs to be well-designed and well-planned because the city never dies and keeps growing continuously. Due to a lack of budget, human capital, and technology resources, emerging country governments must prioritize and classify smart mobility projects into stages. Based on the previous study, many smart city projects cannot satisfy citizens' needs. This study examines smart mobility characteristics, factors, and citizen satisfaction expectations for future mobility to propose policy recommendations.

1.4 Research Objectives

This study aims to understand the smart mobility characteristic to facilitate a strategic goal in creating public value based on citizen expectation, based on the objectives below:

1) Explores and analyze smart city development to formulate the concept of smart mobility as future transportation;
2) Identifying and ranking smart mobility characteristics and factors to facilitate a scalable and efficient project based on city nature;
3) Identifying the gap between government and citizen interconnectedness in implementing smart mobility projects based on citizen expectations.

1.5 Research Questions

The research questions addressed are as follows:

1) What are the characteristics of smart mobility services that are feasible to develop in a developing country?
2) What factors can accelerate the realization of sustainable urban mobility?
3) How does the government facilitate citizen participation in smart mobility projects in developing countries to provide adequate urban mobility by citizen expectation?
4) What is the gap in implementing smart mobility based on citizen expectations?

1.6 Research Outline

This study is organized as follows. Chapter 2 introduces a literature review of smart cities, smart mobility, public value, and citizen engagement. The main goal of Indonesia's new capital is to build a new city under the smart city concept. As a city built from scratch, smart mobility will be the most important dimension in the first stage. Chapter 2 introduces the previous literature review to address the goal of this research. This chapter will cover a smart city, smart mobility, and public value.

Chapter 3 examines characteristics and factors for smart mobility project selection based on expert opinion. This chapter focused on the government when providing new projects/services. Government usually offer new technology, infrastructure, policy, and innovative service to the citizen based on a top-down mechanism.

Chapter 4 investigates citizen satisfaction expectations for future mobility. This chapter covers the citizen side as a bottom-up approach. Because involving citizens' participation in government can be complicated, specifying the project/service into a small program will help the government with more information and their needs/expectations.

The result from chapter 3 and chapter 4 will help the decision-maker to plan and create a project based on citizen expectations.

Chapter 5 is this study's last chapter covering discussion, policy implication, limitations, future research, and conclusion. The result from chapter 3 and chapter 4 will combine to propose a strategy to the government.

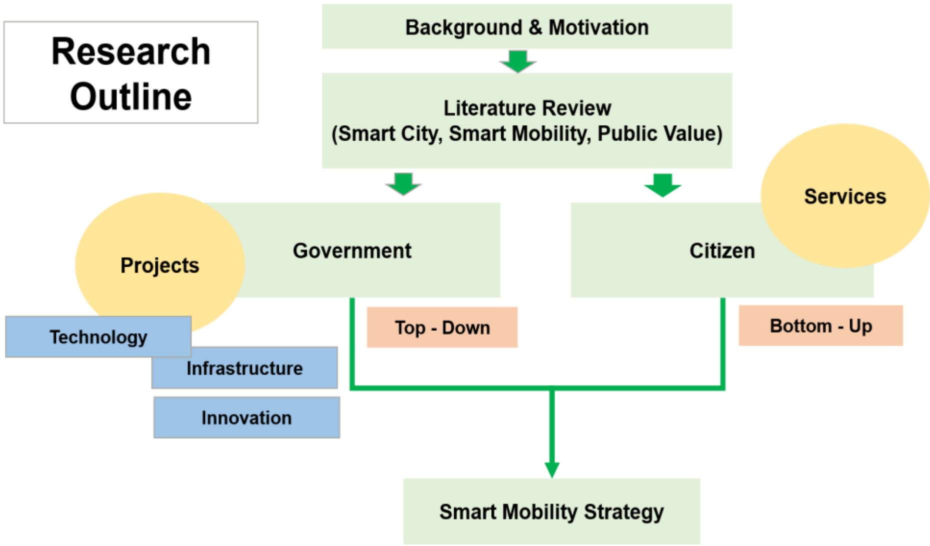

Figure 1. Research Outline

1.7 Contribution

Smart city development is easier in developed countries compared with developing countries since they have advanced technology, powerful resources, and excellent city planning policies. On the other hand, existing smart cities aid them by serving as a blueprint for future improvements. Its contrasts with emerging countries, where most of the priority deal with a fundamental need of citizen. In such instances, developing nations find it difficult to participate in smart city development projects. Developing countries aspire to embrace industrialized economies' sustainable smart city development policies for greater efficacy. Because of that, developed and developing countries will never have identical working environments to create smart cities (Yadav et al., 2019).

The use of ICTs in smart mobility is not only intended to improve the sustainability of urban mobility. Nonetheless, it must be useful for overcoming distance and optimizing traffic flows while simultaneously collecting citizen feedback on the livability of urban areas and the quality of public transportation services. Combining and integrating smart mobility factors into a holistic system is the only way to create sustainable smart mobility based on citizens' needs(Battarra et al., 2018c; Benevolo, Dameri, & Auria, 2016).

Based on the objectives, this study contributes to academics and policy. In academics, most of the research on smart mobility comes from developed countries with well-equipped infrastructure, resources, and technology. In addition, much smart city research has been carried out to transform the city to achieve sustainability. There is still very little research that discusses smart mobility in cities that were built from scratch.

Citizen and stakeholder engagement is a precondition for sustainable urban mobility planning. Still, very few plans contemplate active participation by the public and are very limited to measures for gradual awareness-raising (Mozos-Blanco et al., 2018). It happens because involving citizens actively in government projects is complex. To facilitate citizen participation, most of the research only focuses on what can be done bottom-up. However, in this study, to see the gap between government policies and the citizens' expectations, every project or service planned by the government is carried out by combining top-down and bottom-up approaches. This is because the government and citizens have different points of view (Lombardi et al., 2012).

This study also contributes to policy recommendations. The government and other stakeholders must realize innovative mobility projects need a long time and process. A clear vision and planning in the early stage of the project help the government design strategy. As learned from many mobility cases, Smart Urban Mobility Plans (SUMPs) need to be built in detail.

The government must provide a conducive investment environment to solve funding issues and create a policy and strategy to guarantee that public-private partnerships work well. Lastly, the government needs to enhance the quality of the e-government system.

Chapter 2. Smart City Initiatives Trends and Future Urban Mobility: A Literature Review

2.1 Smart City Development

The concept of the smart city, in which various services are provided through the convergence of information and communication technologies (ICT) and physical infrastructure, has emerged as a social aspiration to solve urban problems and improve the quality of life in urban areas. The construction of a smart city is equivalent to a massive infrastructure megaproject and requires the participation of many people and organizations. These include service providers, urban planners, policymakers, and others who work with cutting-edge technologies like AI, big data, autonomous vehicles, etc. Consequently, it can be very challenging to develop, implement, and maintain smart city projects because of the complexity of incorporating technical domains into overall planning and management, the sophisticated smart city's governance structure, and laws that encourage different kinds of specialization. All factors are essential to successfully implementing even the most basic smart city projects.

The availability of Information Communication Technology (ICTs) and infrastructure are the underpinnings of smart city development (Wang & Zhou, 2022), and implementing smart city technologies contributes to the sustainability of cities (Shamsuzzoha et al., 2021). However, a city with robust information and communications technology systems cannot guarantee that the city is smart, because the city not only solves urban problems but should serve people either (Marchetti et al., 2019). A city will be considered smart when it uses information and communications technology in conjunction with human capital and smart governance (Sarker, 2022). The smartness of cities also demands the comprehensive integration of systems while considering sustainable factors(Ramirez et al., 2021b).

Many experts in the smart city sector have begun to focus on the concept of "smart sustainable cities (SSCs)” as a desirable endpoint for current and future urban development. Their mission is to improve city life for residents by addressing economic, environmental, and social issues related to sustainability (Ibrahim et al., 2018). The contributions of ICT in urban settings can be identified in the framework of smart sustainable city, emphasizing the benefits of efficiency in operations and urban services, the potential to enhance citizens' quality of life, and the promotion of environmental sustainability. It is emphasized how important it is for smart cities to tackle issues like inequality, instability, unemployment, and an aging population in order to help accomplish the sustainable development goals (Angarita Lozano, Diaz Marquez, et al., 2021).

2.2 Smart City Concept

Since its introduction in 1990, the concept of "smart cities" has quickly become one of the most discussed topics in recent years The intelligent city takes into consideration all aspects of the human ecosystem. It emphasizes assisting individuals, fostering economic expansion, and producing brand-new chances. On the other hand, there is the viewpoint that a smart city combines the techno-centric vision with the characteristics that relate and strike a balance between human and social capital, environmental sustainability, urban services, and technological factors (Mora & Deakin, 2019). This would result in the creation of a city that is accessible, sustainable, cohesive, and inclusive (Battarra et al., 2018a). This is due to the fact that a smart city requires more than simply technological advancements to function well. In addition, it requires knowledge and an engaged community that is a part of the urban change to affect the day-to-day lives of people.

The objective of smart city development may vary from city to city and from country to country. The definition of a smart city depends on the individual issues encountered by each city, the level of development, the willingness to innovate, the available resources, and the participation of its stakeholders (Neves et al., 2020). Smart city development facilitates a smart, interconnected, and sustainable urban system. The transformation of a smart city affects the multidimensions of a city, such as governing processes, operations, mobility, environment, and delivery of services (Kumar et al., 2019). With smart city solutions, it's possible to completely change the look of cities and improve the quality of life for their community members.

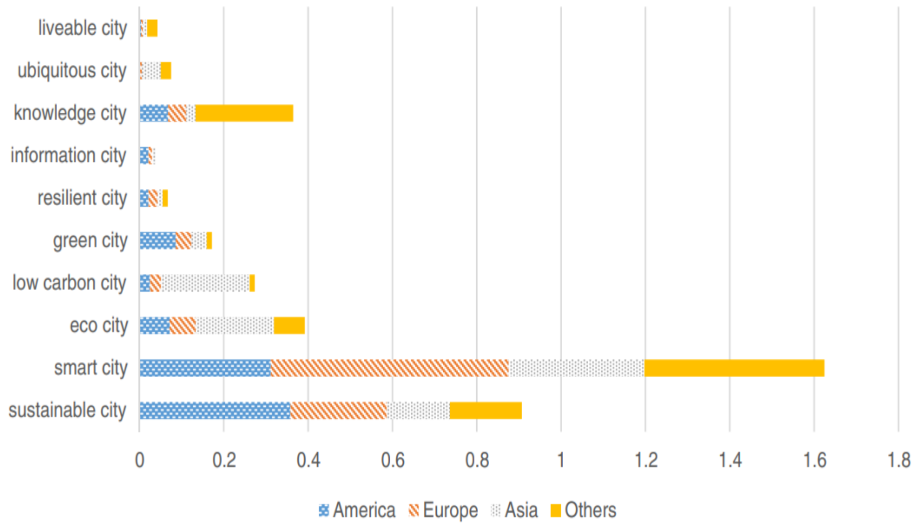

Figure 2. Smart City Concept

Source: Yang Fu, Xiaoling Zhang/ cities 60 (2017) 113-123, Trajectory of urban sustainability concepts: A 35-year bibliometric analysis

2.2.1 Smart City Definition

City planners, government officials, and other stakeholders in smart city development include using cutting-edge technology like artificial intelligence, big data, driverless cars, and more. Since there are many factors to consider, building, executing, and maintaining a smart city can be challenging. As such, it is crucial to grasp the difficulties associated with incorporating technical domains into overall planning and administration. Moreover, the governance structure and regulations that encourage different areas of expertise in a smart city play a key role in implementing complicated smart city initiatives (Kwak & Lee, 2021).

Table 1. Smart City Concept & Definition

Smart City Concept	**Smart City Definitions**
Intelligent City (Harisson, 2010)	A city connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city
Intelligent City (Barrionuevo et al., 2012)	Being a smart city means using all available technology and resources in an intelligent and coordinated manner to develop urban centers that are at once integrated, habitable, and sustainable
Intelligent City (Gartner, 2011)	A smart city is based on intelligent exchanges of information that flow between its many different subsystems. This flow of information is analyzed and translated into citizen and commercial services. The city will act on this information flow to make its wider ecosystem more resource-efficient and sustainable. The information exchange is based on a smart governance operating framework designed to make cities sustainable
Intelligent City (Washburn et al., 2010)	The use of smart computing technologies to make the critical infrastructure components and service of a city – which include city administration, education, healthcare, public safety, real estate,

Smart City Concept	**Smart City Definitions**
	transportation, and utilities – more intelligent, interconnected, and efficient.
Knowledge City (Komninos, 2011)	(smart) cities as territories with high capacity for learning and innovation, which is built-in the creativity of their population, their institutions of knowledge creation, and their digital infrastructure for communication and knowledge management
Knowledge City (Kourtit and Nijkamp, 2012)	Smart cities are the result of knowledge-intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic, and competitive performance of cities, such smart cities are based on a promising mix of human capital (e.g skilled labor force), infrastructural capital (e.g. high-tech communication (facilities), social capital (e.g. intense and open network linkages) and entrepreneurial capital (e.g. creative and risk-taking business activities)
Knowledge City (Kourtit et al., 2012)	Smart cities have high productivity as they have a relatively high share of highly educated people, knowledge-intensive jobs, output-oriented planning systems, creative activities and sustainability-oriented initiatives

Smart City Concept	**Smart City Definitions**
Knowledge City (Lombardi et al., 2012)	The application of information and communications technology (ICT) with their effects on human capital/education, social and relational capital, and environmental issues is often indicated by the notion of smart city
Knowledge City (Zygiaris, 2013)	A smart city is understood as a certain intellectual ability that addresses several innovative socio-technical and socio-economic aspects of growth. These aspects lead to smart city conceptions as "green" reffering to urban infrastructure for environment protection and reduction of CO2 emission, "interconnecte," related to the revolution of broadband economy, "intelligent" declaring the capacity to produce added value information from the processing of city's real-time data from sensors and activators, whereas the terms "innovationg","knowledge" cities interchangeably refer to the city's ability to raise innovation based on knowledgeable and creative human capital.
Digital City(Yovanof & Hazapis, 2009)	A connected community that combines broadband communications infrastructure, a flexible, service-oriented computing infrastructure based on open

Smart City Concept	Smart City Definitions
	industry standards; and innovative services to meet the needs of governments and their employee, citizens, and business
Digital City (Ishida, 2017)	It regards the use of ICT to support the creation on a wired, ubiquitous, interconnected network of citizens and organizations, sharing data and information and joining online service, supported by public policies such as e-government and e-democracy
Ubiquitous City (Lee et al., 2008)	A convergence of IT services within urban space, accessible regardless of time and location. These services will enhance a city's competitiveness and the quality of life of its citizens.
Green City (Benevolo et al., 2013)	It regards an ecological vision of the urban space, based on the concept of sustainable development. Green policies in city regard both reducing the city footprint on the environment, reducing pollution waste and energy consumption, and preserving or creating public green areas like parks and garden.
Source: (Benevolo, Dameri, & D'auria, 2016; J. H. Lee et al., 2014), *Vito albino, Umberto Berardi & Rosa Maria Dangelico (2015)*	

2.2.2 Smart City Initiatives Trends

A smart city encompasses both physical and non-physical factors in the city region. In comparison, physical characteristics focus on basic infrastructure such as roads, bridges, ports, airports, schools, and hospitals. Non-physical elements are data, information, communication, and human and social capital (Benevolo, Dameri, & Auria, 2016). Among that factors, ICT is the essential infrastructure (Altmann et al., 2017).

However, technological aspects alone are insufficient to ensure the effective implementation of a smart city. Human and social capital, e.g., knowledge, is required. Without community support awareness and engagement in urban transformation, the smart city remains a technological niche, unable to significantly affect people's daily lives (Mora et al., 2019). Cities must understand their citizens and produce acceptable technologies that will be favorably received to pick and develop appropriate citizen-focused technology. These smart city research paradigms are called "citizen-centric"(White et al., 2021)

The data assets consist of real-time or near-real-time data streams for city infrastructures, sensor networks, modern space platform technologies, and web services. It includes data provided by the citizen through crowdsourced data from social media, mobile applications, and platforms for citizen participation (Caird & Hallett, 2019). As a result, citizen acceptance of technology is a critical factor for governments and vital for the successful development of future smart cities. As a result, technology acceptance models can strengthen citizen-business-government partnerships while also increasing the efficiency and efficacy of urban service operations (Sepasgozar et al., 2019).

2.3 Future Urban Mobility Concept

Transportation has been identified as smart cities' most crucial dimension(Lim et al., 2021). The implementation of sustainable transport must be supported with an excellent underpinning transport ecosystem. (Yigitcanlar et al., 2019). Sustainable mobility incorporates smart mobility's goals to control pollution, relieve traffic congestion, increase people's safety, cut noise, and enhance movement to expedite and lower costs (Benevolo, Dameri, & Auria, 2016). In addition to design, system, infrastructure, and usage, four philosophical perspectives comprise sustainable mobility. The appropriate mobility proposal within the context of smart cities enables the implementation of projects that meet the citizens' needs and tend toward sustainability (Battarra et al., 2018b). Thus, sustainability has left specific issues such as resource depletion and pollution to consider economic, social, and environmental relations and their impact on problem-solving. Citizen-centricity, accessibility, and recognition of the road as a valuable area are the primary characteristics of the sustainable mobility framework. (Angarita Lozano, Diaz Marquez, et al., 2021)

Going beyond the numerous terms used to define "Smart Mobility," the most effective application of technology is making urban mobility more environmentally friendly. Smart mobility has become increasingly important because of the most significant percentage of activities and populations, particularly in large cities. As a result, they require a more extensive and efficient transportation network to ensure the availability of accessibility. At the same time, a metropolitan area must define policies and strategies to reduce transportation and mobility's impact on the environment and climate change. In the end, mobility should be concerned not only with vehicles and infrastructure but also, most importantly, with the happiness of the citizens' life (Appio et al., 2019a)

A sustainable mobility paradigm is a smart mobility, which entails an integrated system rather than a collection of projects for urban transportation to create sustainability (Battarra et al., 2018b). Smart mobility's primary goal is to connect city resources, people, vehicles, and infrastructure through real-time information flows (Fourie et al., 2020). The future of mobility is shaped by four key elements: automation, connectivity, decarbonization, and sharing (Canitez, 2019). This process is aided by the fact that younger generations, who are more technologically savvy and environmentally conscious, prefer collaborative consumption over private automobiles (Butler et al., 2021b; Moscholidou & Pangbourne, 2020a). Smart mobility is defined as a network system characterized primarily by physical and digital connections to meet citizen needs. Smart mobility is supported by appropriate technologies to improve its performance and attractiveness and tends to reduce energy consumption and carbon emissions (Battarra et al., 2018a). Meanwhile, Moscholidou & Pangbourne (2020a) define smart mobility as new and innovative emerging transportation services such as peer-to-peer ridesharing (Uber, Lyft), carsharing (Zipcar), dockless bikes and scooters (Lime, Mobike), and integrated travel information and ticketing applications (Mobility as a Service)(Moscholidou & Pangbourne, 2020b).

Smart mobility is to provide a sustainable transportation system and integrated ICT infrastructures to support better urban traffic systems, which necessitates real-time public transportation information, a multi-modal system, and traffic light optimization. Smart mobility is the best alternative for pursuing more sustainable transportation systems (Battarra et al., 2018a), as it is associated with lower social and environmental costs and increased social equity (Butler et al., 2021a; Docherty et al., 2018). A sustainable transportation planning approach is an emerging phenomenon and a solution to the problems above. The sustainable transport planning approach, in contrast to the conventional approach's priorities of encouraging the use of private vehicles and the construction of additional road infrastructure, focuses on the promotion of alternative modes of transportation, such as walking, bicycles, and public transportation, and has as a primary goal the provision of mobility and information services, as well as improved connectivity of existing networks. (Tafidis et al., 2017). Wider and well-designed sidewalks, green areas, increased accessibility, reduced road capacity, encouraged modal shift, parking management systems, policies, and an integrated mobility system can all be part of a powerful mobility strategy (Ferretto et al., 2021a)in ultimately providing adequate public transportation (E. Sdoukopoulos et al., 2016a).

However, smart mobility planning and development are difficult to put in place. The biggest challenge is that digitization policies and strategies must consider the interests and needs of the various stakeholders (government, citizens, commuters, transport providers, etc.)(Cledou et al., 2018a). Still, no matter how difficult it is to achieve, sustainable urban mobility should be the vision of every metropolitan area. Through appropriate planning and policymaking, authorities should prioritize the promotion of alternatives to private car modes of transportation such as public transportation, walking, and cycling, as well as multimodality in transportation and the adaptation of new travel patterns (Battarra et al., 2018a; Perra et al., 2017).

After all, the clarity of regulation in smart mobility services has a significant impact and must be part of the strategy for urban sustainability mobility. With precise regulation, cities will be more resilient in dealing with and withstand tension from new market supply and demand, set specific targets and strategies to face uncertainty, and prepare mitigation plans in anticipation of the potential impacts of smart mobility services. Regulations should target particular types of smart mobility, highlight providers' responsibilities and consequences, and strive to align the smart mobility offer with cities' long-term strategies (Moscholidou & Pangbourne, 2020a).

2.3.1 Pedestrian and Walkability

As an essential of the smart city dimension, smart mobility (Brdulak & Brdulak, 2017) can be viewed as a causality of a territory's intelligent configuration due to its contribution to full city accessibility and efficient land usage. The development of more sustainable behaviors impacts citizen quality of life and the services available to all citizens (Vecchio & Tricarico, 2019). Modern cities face numerous challenges regarding mobility, waste management, resource access, and so on (Kopackova et al., 2022). Despite using various traffic management strategies, city transportation systems frequently struggle to cope with high traffic volumes and become congested. Traffic congestion in major cities contributes to pollution and poor urban air quality (Jittrapirom et al., 2017; Mounce & Nelson, 2019).

Walkability is the degree to which the built environment supports and encourages walking by making it comfortable, easy, and safe, connecting individuals to numerous places with a reasonable time and effort, and having exciting things to look at along the network (Bongiorno et al., 2019; Fancello et al., 2020; Secinaro et al., 2022).

Planning for walkability is about creating a safe and comfortable environment for people to walk in so they can quickly get to places they find essential and exciting. The walkability idea includes pedestrians and facilities for vulnerable people, such as wheelchairs, strollers, or other mobility aids while walking on pedestrian networks. Based on a people-centered approach, other features can be added as one goes through the pedestrian experience. These include how streets connect, how easy it is to walk to different places, and how the sidewalk is designed (Loo, 2021). The previous study found the complexity of creating walking conditions and the necessity of roadway quality. Lack of walking priority and car-dominated are issues in the development of walkability(Bozovic et al., 2021)

The majority of the laws and infrastructure in developing countries are designed to accommodate automobiles, and policymakers don't appear to give much thought to how people in those countries get around on foot. Both the walking infrastructure and the number of rules that need to be followed are extremely lacking. On the other hand, younger generations are less likely to own cars, which, combined with the opportunities to redesign streets presented by the autonomous vehicle scenario, may result in an even greater increase in the demand for walkable areas (Trichês Lucchesi et al., 2021)

2.3.2 Parking Management System

Parking policy is one of the most critical elements in a transportation system that build a connection between transportation and land-use policy (Marsden et al., 2020). Traditional parking policies have been centered on creating a parking supply far above demand. The unintended consequence of the conventional parking mechanism is encouraging the use of private automobiles while simultaneously undermining public transit, walking, and cycling (Pitsiava–Latinopoulou et al., 2012; A. Sdoukopoulos et al., 2019). Most parking policies are made because more people own and use cars. There is less space for parking, there aren't enough roads, and there aren't many other ways to get around. Through several different types of interventions, new parking policies try to manage parking demand in a way that works well. These interventions include controlling the number and location of parking spaces, parking costs, parking time limits, residential parking permits, employee parking, etc, with different levels of policy enforcement(Shiftan & Burd-Eden, 2001) to make it easier to get around without using a car (Banister, 2008; Loo, 2021; Sochor et al., 2018). Parking policies should be carefully integrated into a transport development plan to achieve long-term quality goals and provide an allencompassing vision of the city that can be characterized as sustainable mobility (Pitsiava–Latinopoulou et al., 2012).

Intelligent Parking Information Systems (IPIS) is an excellent way to manage transportation in smart cities, and we're looking for a parking space that provokes traffic, air pollution, and time loss can be reduced (Yang & Lam, 2019). It envisions that by 2040, parking management practice will be in harmony with the market-based approach and new transportation planning paradigm in which parking is designed to be flexible, adaptable, and convertible to other uses (C. Reddick et al., 2020). Successful experience has been documented in the city of Vienna, where a parking space management program led to a 25 percent reorientation of visitors to public transport, a 25 percent decrease in the use of parking spaces in the morning, and a 10 percent decrease in the use of parking spaces in the afternoon, and a reduction in the average time required to locate a parking space from 9 to 3 miles per hour (Pitsiava–Latinopoulou et al., 2012)

2.3.3 Innovative Mobility Services

2.3.3.1 Mobility as a Service (MaaS)

In recent years, the advancement of information and communication technologies (ICTs) has created various possibilities and altered human behavior. The prevalence of mobile device connectivity significantly changes how people look and share information, make purchases, organize and carry out activities, and communicate, among others. It also influences the field of transportation, particularly our mobility patterns (Caiati et al., 2020; Lopez-Carreiro et al., 2021).

The New mobility services are made possible by advanced mobility technologies, the most prominent example of which is the nearly ubiquitous proliferation of smartphones, which a significant number of people regard as the most critical advancement in the transportation sector over the past decade. A future that proponents argue will offer more efficient vehicle use, optimize transport networks, better utilize infrastructure, and deliver a more seamless customer experience is closely tied to the Internet of things, big data analytics, and autonomous vehicles.

In addition, digitalization has enabled the development and innovation of new mobility services, such as multimodal travel information services, where travelers can select from various services and options (Esztergár-Kiss & Kerényi, 2020). The idea to combine mobility services with other traditional modes of transportation, such as bus, metro, tram, taxi, and so on, under the umbrella of a single digital platform for planning, booking and payment into a single service provider create a new mobility concept that called as Mobility as a Service (MaaS)(Caiati et al., 2020; Esztergár-Kiss & Kerényi, 2020; Krauss et al., 2023) and it will be the foundation for future mobility services, in which connected, autonomous and electric vehicles perform in a holistic ecosystem (Shibayama & Emberger, 2020)

MaaS aims to create a single, linked, and supportive transportation market that is easy for users to use (Kamargianni & Matyas, 2017a) and, in the end, to reduce car ownership while providing a comfortable and sustainable transportation system. The MaaS model benefits both the public and the government. It allows people to use transportation management tools, resources, and data more efficiently to meet their needs. The MaaS concept started in Sweden with the first real-life demonstration of the UbiGo service, which was developed and tested as part of the Go:Smart project in Gothenburg in 2012. Other examples include SMILE in Vienna, Switchh in Hannover, Tuup in the Turku region of Finland, SHIFT in Las Vegas, and SkedGo in Australia (Polydoropoulou et al., 2020). The ecosystem of MaaS is comprised of many different actors and stakeholders (Kamargianni & Matyas, 2017b)

A previous study found that gender, age, education level, occupation, and household structure were related to the willingness to adopt MaaS. The acceptance of MaaS was additionally impacted by the mobility patterns of individuals (Lopez-Carreiro et al., 2021). Early adopters of MaaS are characterized by high levels of Mobility and high levels of socioeconomic status, education levels, and personal incomes. To a greater extent than older adults, younger people are eager to adopt MaaS. Early adopters are healthy, have an active lifestyle, and frequently travel via trains and airplanes (Zijlstra et al., 2020).

On the other hand, individuals who are unlikely ever to adopt MaaS are more likely to be elderly, never fly, make a limited number of weekly trips, and be in poor health. (Polydoropoulou et al., 2020), Previous research typically connects MaaS strategies with urbanized and high-density areas with a significant presence of public transportation services. However, (Lopez-Carreiro et al., 2021)people who live in low population density areas are also interested in adopting MaaS because of the comfort, efficacy, and accessibility of the system.

MaaS is expected to reduce the current private car dependence and positively affect the quality of life. Multimodal systems are designed and promoted to create a sustainable transportation mode equivalent to the need of various travelers' type. However, its true significance is still up in the air, and it depends greatly on how the MaaS framework is managed and shaped by policymakers and urban planners. Effective cooperation between private and public transportation providers requires the development of strategies and action plans. Policymakers should emphasize the advantages provided by these novel services to maximize the benefits to the mobility network and society (Lopez-Carreiro et al., 2021)

Furthermore, in the MaaS ecosystem, government institutions are crucial and play a vital role in developing and disseminating MaaS. The legal and institutional frameworks that govern a given market shape its structures and performance in various ways, including legislation and permits, subsidies, financing, availability, and standardization (Meurs et al., 2020). It is also important to remember that the public sector's traditional function in facilitating mobility has evolved due to technological advancements. (Esztergár-Kiss & Kerényi, 2020). Sustainable innovations like MaaS are not typically implemented as only mobility solutions. Their policy frameworks and recommendations must address market growth, fair competition, financial support, commuters' protections, safety and confidentiality, customer satisfaction requirements, and inclusivity (Kamargianni & Matyas, 2017a)

2.3.3.2 Automated Mobility on Demand (AmoD)

The development and implementation of self-driving vehicles are inextricably linked to concerns about the future development of cities. These trends indicate that developing physical and cyber infrastructural platforms that coordinate and connect passengers with service providers will significantly impact future urban mobility. According to the findings, adopting the new mobility services where all vehicles are secured and automated could provide lucrative opportunities for the automobile and technology industries (Canitez, 2019; dos Santos et al., 2022). Shared autonomous vehicles are expected to save travel time and money, improve driver convenience, provide a solution to parking shortages, reduce traffic volumes and road space, and become environmentally friendly to reduce air pollution (Yoo & Cho, 2022). In all scenarios, the policy implications of the transformation can be significant, implying that the evolution of the transportation system must be closely monitored in order to deal with potential future effects (dos Santos et al., 2022).

CAVs (Connected and Autonomous Vehicles) are a technology that has the potential(N. Liu et al., 2020) to have a significant impact on mobility and urban landscapes. CAVs have emerged globally to promote sustainable goals for economic, social, and environmental benefits, and they have the potential to usher in the smart city age. CAVs have the potential to reduce energy costs, improve fuel economy, improve workplace efficiency and productivity, and promote inclusive economic growth. CAVs are socially marketed for their benefits in accident prevention and traffic safety, traffic congestion reduction, public health and well-being improvement, changing travel behavior, cultivating equality, and accessibility. CAVs can help reduce emissions and air pollution, minimize energy consumption, optimize fuel use, prevent environmental degradation, and reduce noise nuisance(N. Liu et al., 2020). However, the complexity of CAVs makes them more vulnerable to data exploitation and cyberattacks than their predecessors, increasing the risks of privacy breaches and cyber security violations for their users (Nikitas et al., 2022). It can harm public acceptance of CAVs, giving them a bad reputation at this initial stage of development, creating obstacles for adoption and enhanced use, and making future growth model development more difficult.

2.4 Public Value and Citizen Engagement

One of the key roles of government is to provide an effective administration to the citizen. The function of government has become more dynamic in the digital transformation era, while administrative processes have transformed into digital and mobile. The digitalization of government is called e-government, where the government supports technology such as the internet to provide better services to citizens. E-government has a broad impact on government by enabling better policy outcomes, higher quality services, greater engagement with citizens, and improving other vital outputs (Rodriguez Müller et al., 2021)

The public value framework views a rise in citizen contentment as a key benefit of moving toward paperless government. Citizens may be more satisfied with their government if they are able to interact with it more efficiently and effectively through a well-designed e-government system. The adoption of e-government is bolstered by citizens' satisfaction with it, which in turn increases their trust in the government.

The theory of public value has been very influential in studying the public sector and has significantly contributed to expanding the government paradigm.

The provision of services, which enables the delivery of public value through actual service encounters for citizens, is the first of three essential components that make up the public value. The services must guarantee that all citizens receive fair treatment and equality without any difference. The second component is the attainment of desirable results, referred to as outcomes, and the governance planning process for the various sectors. The last part consists of trust, confidence, and legitimacy in the public sector. Through trust, citizens will be effectively encouraged to consider ways in which they can participate in or collaborate with the activities of the government. Motivating forces are derived from a human vision, and the challenges of efficiency, accountability, and equity are examples. Therefore, public sector managers need to adopt a new way of thinking about government activity, policy-making, and service delivery to make their actions successful and meet the needs of citizens. This new way of thinking should highlight the significant differences in public management.

Professor Mark Moore of the Kennedy School of Government developed the theory of public value, which examines how public organizations operationalize the principles of public value. It emphasizes the importance of public participation and reinforces the notion that public services are distinct from private competitive markets. The purpose of public value is to provide public managers with a straightforward method for articulating their organization's objectives. In addition, public value is intended to encourage public managers to consider what is most valuable about the services they administer and how effective management can make those services the best they can be (Yotawut, 2018). Kavanagh (2014) argued that public value necessitates that government officials take into account the impact of their policies and decisions on values central to a democratic society, including fairness, individual freedom, information transparency, and citizen's voice (Twizeyimana & Andersson, 2019b; Yotawut, 2018)

Smart cities rely heavily on the input of their residents. Therefore, the smart city literature did not invent the idea of participation, but it did shed new light on the need for novel approaches (enabled or not by new technologies) that could be expanded to the city level. Democracy, according to Arnstein (1969), is a spectrum with three main steps: non-participation, tokenism (gathering of ideas but no impact on decision-making), and co-decision (with decision-making shared between officials and citizens). Second, residents can play an active role in knowledge production and urban innovation by taking on the role of co-creators (Simonofski et al., 2019).

Public value has been used in numerous business procedures. In addition to helping you solve problems, it can be used to establish objectives, measure progress, and pick out the features you need. In order to maximize happy customers, this management strategy takes a novel, methodical, and practical approach. In addition, goals set by result-based management will be attained. Worldwide, New Public Management is used as a regulatory framework for public processes to guarantee that government agencies can continually refine their public service delivery and delight their constituents. New Public Management recommends and enables public organizations of the present and future to use public value as a tool for result-based management.

Chapter 3. Investigating Characteristics and Factors of Smart Mobility Project

3.1 Introduction

Enhancing a city built from scratch will have a different entry point, strategy, and focus. City from scratch must be well-plan and well-equipped, especially for infrastructure because it will be the backbone of smart city development. As the new beginning of smart city development in city from scratch, smart mobility can be one core dimension of a smart city. It differs from enhancing existing cities, while a smart economy, smart environment, smart governance, smart people, or smart living can be the highest priority.

There are high hopes for the potential benefits of connected and automated mobility, such as the improvement of transportation in terms of making it safer, more accessible, and more environmentally friendly. In the context of road transportation, this would mean addressing its negative externalities, which include things like traffic accidents, pollution, and congestion, all of which place a significant burden on society, the economy, and the environment. Access to new mobility options would also be made available to users who are currently underserved, such as the elderly, people with mobility impairments, and those who do not possess a driver's license (dos Santos et al., 2022). It is an information approach that is user-generated and user-centric, and it has emerged as a result of disruptions in both technology and business models (Docherty et al., 2018;

Moscholidou & Pangbourne, 2020b). As a consequence of this, it seeks to influence changes in the transportation system in order to improve city functions in terms of the outcomes relating to the environment, society, and the economy, as well as to make better use of the infrastructure (Butler et al., 2021b).

The government's predominant ambition in using ICT is to improve the relationships between the citizens inclusively, transparent, open, and collaborative and stimulate citizen participation actively in government projects and policies (Twizeyimana & Andersson, 2019a). Citizen feedback will increase government services, quality, and trust that the government can sustain its performance and satisfy citizens (Yotawut, 2018). Due to the lack of budget, knowledge, and resources, citizen satisfaction and feedback will help the government in the emerging country to prioritize its project and policy. Prioritizing will help the government to select the project and design a further strategy and policy to achieve the goal of the smart mobility project. In the case of the new capital of Indonesia, this chapter focuses on the government's part in selecting the priority of smart mobility characteristics and factors.

The model was developed by identifying smart mobility attributes using an in-depth, comprehensive literature review. Based on that, the framework for smart mobility characteristics and factors was proposed to assess in this study. Furthermore, experts will evaluate the criteria and sub-criteria of smart mobility characteristics and factors. Therefore, this chapter is designed to identify smart mobility characteristics and factors to facilitate a scalable and efficient project based on the city’s nature in the new capital of Indonesia. The goal of this chapter is to answer the following questions:

1) What are the characteristics of smart mobility services that are feasible to develop in a developing country?
2) What factors can accelerate the realization of sustainable urban mobility?

This chapter is organized to address the issues above: The second section is devoted to the literature review. Section 3 describes the research methodology. Section 4 defines data collection. The fifth and sixth sections explain smart mobility characteristics and factors. Section 7 presents the analysis results, and lastly, section 8 concludes the chapter by drawing discussion and conclusions.

3.2 Literature Review

The goal of smart mobility is not limited to ensuring the long-term viability of urban transportation systems through the application of ICTs. However, it needs to be practical to help people travel longer distances and optimize traffic flows while gathering information from locals about improving cities and public transportation. To effectively foster urban activity growth while also attending to the needs of citizens, a comprehensive and cohesive ensemble of these various factors is needed (Battarra et al., 2018a). Since formulating such regulations is difficult, there is a need to learn from the experiences of numerous cities worldwide that have adopted smart mobility services efficiently and effectively. In respect, propose a taxonomy for planning and designing smart mobility services(Cledou et al., 2018b).

Cledou et al (2018b) A widely known terminology is provided by the taxonomy so that information regarding these services can be discussed and shared. It is composed of eight dimensions, including the type of services offered, the maturity level of the offering, the users of the service, the applied technologies, the delivery channels, the benefits, and the beneficiaries. The taxonomy is comprised of eight different dimensions, including the following: the type of services, the level of maturity, the type of users, the applied technologies, the delivery channels, the benefits, and the beneficiaries. Within the scope of this research, there are a total of 12 different categories of services. These categories include: driving, guidance, locating objects, monitoring traffic, monitoring transport, journey planners, parking, payment, reporting mobility, sharing transport, and traffic light optimization.

The technology dimension talks about ICT tools, internet access, mobile broadband, Wi-Fi access points, Near field communication (NFC), Closed-circuit television (CCTV), Global positioning (GPS), Radio frequency identification (RFID), smart sensor, Inductive-loop traffic detector, Computational techniques simulation algorithms, video recognition. The delivery channel is about dynamic message signs, mobile devices and applications, smart cards, short message services (SMS), and websites. Benefit dimensions are classified into the smart economy, smart governance, smart mobility, smart environment, smart living, smart people, and what kind of public value exists. This taxonomy will help the government and practitioners to understand and administrate smart mobility initiatives, improve and share knowledge, conduct strategic planning, and formulate policy regarding smart mobility.

Benevolo, Dameri, & D’auria, (2016)proposed smart mobility taxonomy and the intention to use ICT by mapping the benefits of implementing smart mobility.

This taxonomy consists of four categories: public mobility, private and commercial mobility, infrastructure and policies support mobility, and system for collecting, storing, and processing data, information, and knowledge aimed to design, implement and evaluate policies. ICT plays a huge role in Smart Mobility programs of their complexity and integration, and they continue to innovate. At the mature phase of the smart mobility stage, ICT becomes the leading player and has a significant impact (Benevolo, Dameri, & Auria, 2016). Smart mobility consists of three stages, readiness, intermediate, and mature. In the intermediate phase, smart mobility is related to the action, where the government needs to implement smart mobility plans, like a repetition of pilot projects and integrated mobility plans. In the mature phase, Intelligent Transport System has already been implemented. Still, the readiness phase, supported by knowledge and citizen participation, is the most important factor in successfully implementing smart mobility. In this stage, the awareness of smart mobility advantages will make the next phase of smart mobility easy to implement.

Núñez et al., (2022)We must consider economic, environmental, and social factors to fulfill people's requirements for urban mobility. In the context of social sustainability, the ability to satisfy the needs of society to move freely, access, communicate, market, and make connections is what is meant by the term "sustainable mobility.” This ability must be achieved without compromising other fundamental human or ecological values.

Furthermore, there are issues with the quality of public transportation services in the recognized environmental dimension, which are troublesome and require further attention, both on an individual and collective level. Perceptions of one's time spent in a moving vehicle's environment are the focus of this metric. It could be better since obstacles, like unfriendly drivers and infrequent buses, make it hard to travel around. Even so, a general agreement stems from the problem affecting pedestrian access and public transportation: insecurity. It's more challenging to feel safe because of how the world looks; there are more obstacles to overcome concerning criminality, which are exacerbated by gender.

Núñez et al., (2022) findings connect to the evidence discussed in the work of Louro et al. (2021), who link urban mobility with livable metropolitan areas. Urban mobility could make the city more livable, where the city is safe, clean, beautiful, well maintained, and has a high economic impact. In particular, the potential benefits that active transportation, such as walking and cycling, may have for a person's physical and mental health are revealed to the public. Similarly, they have connected features of sustainable mobility, such as accessibility and urban design, with creating environmentally friendly cities.

Battarra et al., (2018c) described that ICTs are a way to improve the efficiency of the transportation system in cities with a well-functioning mobility system. However, in metropolitan areas with a lack of transportation infrastructure, new technologies become just a label instead of being integrated into urban policies. Information and communication technologies (ICTs) have been integrated into the transportation infrastructure of the world's most prosperous cities, which have adopted a holistic, coordinative approach to urban planning. Beyond the catchy slogan, however, in order to implement initiatives and projects that can respond to community needs and effectively support sustainable activities, a clear vision of the Smart City and the role that mobility plays within it is essential.

Accessibility, sustainability, and ICT are the three essential characteristics of smart mobility development, as smart mobility involves not only the massive use of technology but also the need to address the challenges of inclusiveness, accessibility, and sustainability. The use of ICTs in smart mobility is not only intended to improve the sustainability of urban mobility. Nonetheless, it must be useful for overcoming distance and optimizing traffic flows while simultaneously collecting citizen feedback on the livability of urban areas and the quality of public transportation services. Only a holistic and integrated combination of these multiple factors will support the development of urban activities and take into account the needs of citizens (Battarra et al., 2018a; Benevolo, Dameri, & Auria, 2016)

Moscholidou & Pangbourne (2020b) By looking at how smart mobility policies create the long-term ability to provide sustainable transportation, it was found that defensive and fragmented regulation could not be used to make smart mobility innovations work well. That only looks at the production, consumption, or management of smart mobility. In order for smart mobility to help the transition to a transportation system that is socially, environmentally, and economically resilient, the government needs to think long-term and work toward goals that benefit the public more (Docherty et al., 2018). So, cities need to be careful when choosing the laws, rules, and technologies that will help them strengthen and organize their focus on sustainability through better connections and, in the end, help them reach their goals.

Mozos-Blanco et al., (2018), Showed that sustainable urban mobility plans should consider mobility and people’s quality of life, implications in the short- and long-term, affected groups, and social culture. Improvements must be made to how the city is arranged and how public transportation is run. Plans for sustainable urban mobility should take into account the relationship between mobility and people's quality of life, as well as the needs of the many stakeholders and the local community as a whole. The city's layout and public transit system need significant updates.

E. Sdoukopoulos et al., (2016b), Have identified that transport infrastructure in developing countries is not well planned, making it hard for people to mov. In contrast, thee future. Because of this, it can be hard to add a sufficient bus lane, a bridge, an extra bus stop, or more parking spaces. Urban mobility solutions can be learned from the experiences of European regions that have already implemented effective transportation systems. Especially for developing nations, the experience of many enlightened cities that evolved in implementing leading strategies for sustainable transport was priceless. This study assesses the solution in mobility for Mediterranean cities categorized by four themes: public transport, transport infrastructure, city logistics, and integrated planning/sustainable urban mobility plan. This method will help Turkey, Israel, and Morocco to design mobility strategies.

(Ferretto et al., 2021b) When choosing a way to get around, people are very limited by the choices and functions of a structure that makes some options more or less desirable than others. Changing this building's design to encourage more environmentally friendly ways to get around can make a big difference in the quality of life and urban environment. In Europe, reallocating a portion of highways to modes of sustainable mobility is becoming a political priority. Priority systems, more bike lanes, wider and better-designed sidewalks, and more green space are all things that can help make better use of road space. They can also boost the appeal of active travel and the urban environment, as well as the ease of getting to certain sites and the feeling of safety there. In some situations, reducing the number of cars that can use a road is a way to make room for new bike lanes or wider sidewalks and encourage people to change how they get around. This helps reduce long-term congestion problems.

(Bebber et al., 2021) The economy, society, and environment all have to work together for urban mobility to be sustainable. In addition to putting an emphasis on making the best use of resources, the economic pillar puts an emphasis on increasing productivity and regional growth. The social pillar ensures fairness, justice, security, health, community development, and the protection of cultural artifacts. To keep climate change from getting worse and to slow it down, we need to reduce pollution, protect nonrenewable resources, and save biodiversity. Sustainable urban mobility includes cities where people can walk and ride bikes, as well as public transportation, car-sharing networks, and electric and self-driving cars. In the past few years, transportation in cities has come a long way. The main goal is to cut down on the number of private cars in cities without making it harder to get around.

Citizen engagement in formulating political policies and objectives administered by professional practice is key in ensuring such services' continued viability and growth. In this way, the situation in a city may be accurately assessed, and improvements can be planned and proposed based on the opinions of the people who live there. Governments can establish priorities for action by conducting surveys among a statistically valid cross-section of society.

According to C. Reddick et al. (2020), there are two primary channels through which citizens can interact with their government. To give one example, "face-to-face" interactions between citizens and government employees at physical sites or "service centers" are an example of traditional service channels. Other instances include "hotlines" or voice communication at "service centers" that are geared toward answering a specific set of questions about a specific service (whether over fixed or mobile telephones). Interactions through these mediums are almost always real-time and require the allocation of both material and human resources. Contact with or messages sent to government websites (e-government), use of appropriate clients on devices such as computers or mobile phones connecting to the internet, or limited information and transactions with the government via purpose-constrained applications on mobile phones all fall under the umbrella of digital service channels (m-government). Such communications require digital infrastructure because they occur at different times for different people. These avenues have been dubbed "self-service" because they permit citizens to contact the government for service delivery and to ask questions about the service. These methods can also be used by citizens to learn more about available services.

Table 2. Summaries of Study for Smart Mobility Service Characteristics and Factors

STUDY	CRITERIA										
	ENV	**SOC**	**ECO**	**SUST**	**INFRA**	**ICT/TECH**	**ACC**	**CE**	**SAF**	**ORG/REG**	**DEL CHN**
(Cledou et al., 2018b)					#	#	#				#
(Benevolo, Dameri, & D'auria, 2016)	#		#			#	#	#	#	#	
(Núñez et al., 2022)	#		#			#	#		#	#	
(Battarra et al., 2018c)				#		#	#				
(Moscholidou & Pangbourne, 2020b)	#	#	#				#		#	#	
(Mozos-Blanco et al., 2018)	#			#			#	#	#	#	
(E. Sdoukopoulos et al., 2016b)	#				#	#	#				
(Ferretto et al., 2021b)									#	#	
(Bebber et al., 2021)	#	#	#	#	#	#	#		#	#	
(C. Reddick et al., 2020)		#	#					#		#	#

ENV = Environment; SOC = Social; ECO = Economic; SUST = Sustainable; INFRA = Infrastructure; ICT/TECH = ICT/Technology; ACC = Accessibility; CE = Citizen Engagement; SAF = Safety; ORG/REG = Organization/Regulation; DEL CHN = Delivery Channel

3.3 Research Methodology

3.3.1 Methodology Approach

Today, city development and deployment must be considered in the context that the city needs to comply with sustainability norms and standards. Despite the existence of numerous techniques for addressing sustainability, city authorities fail to provide transportation solutions that meet the demands of inhabitants and address urban development issues for two primary reasons: (1) a lack of a comprehensive characterization of sustainability that may address the conflicting needs of residents; and (2) a paucity of adaptable decision-support systems that permit the evaluation of transport policy based on expert opinion (Ngossaha et al., 2017).

Making a decision entails identifying the best course of action from among available alternatives. The process of balancing multiple criteria when making a choice is known as multi-criteria decision-making (MCDM), and it is among the most complex and important aspects of decision-making. When different factors in making a decision are at odds with one another, MCDM is used to zero in on the optimal solution (Yu & Hong, 2022). With the help of multi-criteria decision-making (MCDM) methods, experts from different fields can make informed calls, even if they lack information necessary to fully evaluate one of the criteria. Neither the theory behind the results nor the lack of convenient interaction between experts and the proposed system have prevented few of these frameworks from being successfully integrated into existing tools. The analytic hierarchy process (AHP), proposed formally by Saaty in 1980, is just one of many methods currently available for enhancing MCDM. The AHP uses a comparison of elements across levels of the hierarchy to arrive at an overall importance score. It then considers the choices available at the lowest tier of the hierarchy in order to arrive at the optimal course of action (Escolar et al., 2019).

AHP is a powerful method for creating and analyzing variables or conclusions based on multiple criteria. Using the pairwise comparison method, it is utilized to rank alternatives by establishing criterion weights. Using a basic nine-point scale, comparison values may be derived from surveys or the opinions of experts in the relevant field (Escolar et al., 2019)

3.3.2 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a technique to prioritize smart mobility characteristics and factors. Thomas Saaty (1980) introduced the Analytical Hierarchy Process as a valuable way of sorting out the complex decision-making process by evaluating the priority scale of each indication and generating the best choice. The AHP could be an effective method for dealing with complex and unstructured situations involving multiple objectives, correlations, and interactions. This technique aids the decision-maker in determining the critical dimension of a problem and organizing it in a hierarchical structure similar to that of a family tree (Zaim et al., 2012). AHP relative values may be derived from an expert survey or actual measurements using a nine-point basic scale (Ghimire & Kim, 2018; Saaty, 1987; Saaty, 1990, 1994; Wind & Saaty, 1980).

AHP takes into account people's opinions when making decisions or putting smart mobility's main criteria, sub-criteria, and factors and characteristics in order of importance. So, it is a decision-making model that looks at the hierarchical structure of the research problem. In AHP, users can get relative values from a survey of experts or from real measurements using a nine-point scale (Saaty, 1988; Taherdoost, 2017; Zahedi, 1986). The step of measurement in AHP as followed.

1. This research aims to rank the abovementioned characteristics of smart mobility services. Accordingly, the hierarchical tree of smart mobility service characteristics was formulated considering four main criteria, nineteen sub-criteria, and three main criteria and twelve sub-criteria for smart mobility service factors. The hierarchical tree for smart mobility service characteristics and factors was built.
2. The pairwise comparison questionnaire, which is presented in the appendix, was developed with due consideration to the objective of the study and the categories of the characteristics and factors of smart mobility services. On a nine-point scale, this questionnaire was distributed to experts in the field to generate their opinions (Taherdoost, 2017).
3. Estimated the weights for each category of smart mobility service

characteristics and factors.

4. Lastly, assess the consistency index of the estimation. The CI is known as the consistency index, and a value of zero indicates that all respondents' judgments are completely consistent with one another. Nevertheless, it's acceptable to have a few inconsistencies in between.

CR = CI/RI

CI = λmax – n/(n-1)

The consistency ratio is denoted by CR, and the random index is denoted by RI. The table below displays the typical values of RI. A CR less than or equal to 0.1 indicates a range that is considered acceptable (Zahedi, 1986)

Table 3. Random Index (RI) Values

RI Values										
N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

3.4 Data Collection

In this study, the AHP method was used to make the questionnaire, collect data from different experts, and analyze the data (Wind & Saaty, 1980).

For the case of Indonesia's new capital, the AHP model was chosen because it was the best way to find out what characteristics and factors were needed to make smart mobility work. The AHP model was chosen for the case of Indonesia's new capital because it could best help identify the characteristics and factors needed to implement smart mobility. A questionnaire was created using a hierarchical model. Specialists or experts in the field of smart cities participated in the study by providing their opinions. Relevant experts from the municipal leaders, urban planning experts, and ICT experts working on smart cities, transportation experts, a new capital law expert, and academics were selected, and the survey was conducted, with the results analyzed by comparing the barriers on a qualitative nine-point scale.

AHP can be utilized for as many decisions as there are participants. To ensure the validity of the results, the number of participants must be reasonable. Researchers have employed a range of participant numbers, from five to seven (Armacost et al., 1994). The number of participants also depends on the audience's potential size. Respondents for this study were drawn from academia, the private sector, and government agencies working in the field of smart cities. The majority of urban planning experts are government officials, in addition to academics. Municipal secretaries and provincial secretaries, who work closely with smart city projects or their municipality within a smart city program area, will have sufficient knowledge about smart city and smart mobility because they involve in the project from the planning stage into the implementation stage.

For this study's analysis, 16 expert opinions were utilized. The study objectives, a definition of the scope of a smart city, and smart mobility were provided to the experts. Before filling out the questionnaire to record their opinions, they will be able to comprehend the precise meaning of the model's variables thanks to the explanations provided, as different definitions and understandings of smart cities can lead to inconsistent results.

Figure 3 below shows the expert respondents' demographics. A total of 16 expert respondents were surveyed, including 56,25% female and 43.75% male. The majority of expert respondent education is graduate master's students 68.75% and Doctoral students 31.25%. One respondent had more than 40 years of work experience, three had more than 30 years, two had more than 15 years, and ten had more than 11 years of work experience.

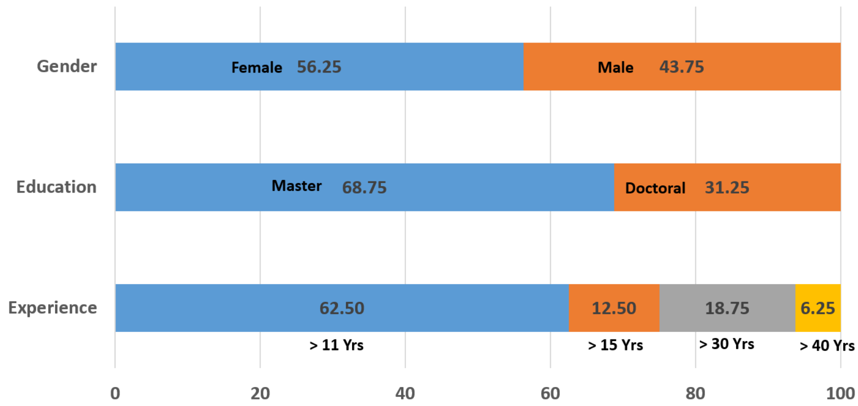

Figure 3. Expert Respondent Demographic

The table below briefly explains the expert profile—most experts are affiliated with different government institutions and academicians.

Table 4. Expert Affiliation

Experts	Profile/Designation	Affiliation	Experience
Expert 1	e-government and information technology	Government official, Bandung Province	>11 years
Expert 2	Professor, city and urban planning	Academician, Jogjakarta	>40 years
Expert 3	Lecturer, city and urban planning	Academician, Bandung	>11 years
Expert 4	Smart city head coordinator	Government official, Ministry of ICT	>11 years
Expert 5	Smart city team	Government official, Ministry of ICT	>11 years
Expert 6	Smart city team	Government official, Ministry of ICT	>11 years
Expert 7	Smart city team	Government official, Ministry of ICT	>11 years
Expert 8	Secretary of Municipality	Government official, Sumedang	>30 years
Expert 9	Secretary of Province	Government official, Bandung	>30 years
Expert 10	Ministry expert official	Government official, Jakarta	>30 years
Expert 11	Member of National	Government official,	>15 years

Experts	Profile/Designation	Affiliation	Experience
	Social Security Council	Jakarta	
Expert 12	Jakarta Smart City	Smart city officer	>15 years
Expert 13	Trans Jakarta	Officer, Jakarta	>11 years
Expert 14	Bandung City Innovation and Technology Research Development	Government official, Bandung	>11 years
Expert 15	New Capital Team	Government official, Jakarta	>11 years
Expert 16	Lecturer, Smart City	Academician, Jakarta	>11 years

3.5 Smart Mobility Characteristics

3.5.1 Accessibility

Accessibility is one the most important indicators to assess smart mobility and has become one of the indicators that researchers used to measure mobility with ICT and sustainability. In their study, (Battarra et al., 2018b)used accessibility as one of the characteristics to assess because it contributes to creating a new mobility infrastructure, improves public transport and reinforcement the car park system, and can determine the public transport demand, public transport supply, public transport line, bus stop density, rail network, rail network stop and toll parking (Battarra & Mazzeo, 2022). Even though the concept of accessibility in mobility already existed since 1959 (R. Liu et al., 2018) still, there is no consensus definition and measure of accessibility, but the evaluation of accessibility can help how to improve the innovation and evolution of mobility because accessibility is one of the pillars to achieve the goals of sustainable and smart mobility (Angarita Lozano, Díaz Márquez, et al., 2021)

3.5.2 ICT/Technology

Any city that wants to keep up with the increasing rate of urbanization and the growing number of problems associated with urban management must conform to the imperative of providing value-added services to its citizens and communities. These days, public use of ICTs and local government have to connect with the citizens through technologies (Deakin & Al Waer, 2011). Digital cities develop by maximizing the function of the technologies, where a smart city's physical infrastructure and networking software are already guaranteed in this vision, as stated by Komminos (2002). To improve innovation and the creation of knowledge, understanding, and governance, people now have access to a global forum made possible by advances in information and communication technology (Albino et al., 2015). In order to ensure that residents of a city have access to high-quality living conditions, the smart city model advocates for the effective and efficient management of the city's natural resources and community empowerment (Yigitcanlar et al., 2022). When used to keep tabs on and manage the city's physical infrastructure, streamline governmental action, connect knowledge with innovative and creative actors, deliver essential services to residents, and encourage participation from the public, information, and communication technologies serve as a catalytic force.

Obama's (2009) open government agenda places a premium on publicly accessible data to increase openness, public trust, and political accountability. They are the cornerstone of a reform movement that seeks to improve public services for the general populace. It is possible to involve the public in this process through the use of open data. However, there may be significant challenges in moving from the current model of information control to a more open system paradigm. However, there are potential advantages to making public government data (Conradie & Choenni, 2014; Dwivedi et al., 2021). The challenges and potential avenues toward citizen engagement can be better understood through a citizen-centric approach to investigating how governments involve citizens in using e-services (OECD, 2009). Distributing user-centric applications depends on several factors, including high-quality e-services and easy access (Gagliardi et al., 2017). Trust between the government and the people can only be established through the people's involvement in policymaking (Janowski, 2015).

Data, district boundaries, and citizen needs are all linked together to create dynamic service availability maps. It's a proof of concept that shows how easy it is to make meaningful and comparable visual representations of districts using only open data that has been thoroughly checked for accuracy. Policymakers can use it to help them make decisions, and citizens and communities can utilize it to learn about what's going on in their area, have their voices heard, influence city policy, and see the effects of their actions on the world around them. The ICT application helps open up the governance system by making new real-time data and adding it to the open data that already exists. Open data may not be enough to provide real-time value-added services on its own, and data may need to be reworked so that it can be used by many people, but closed data systems may stop the delivery of value-added services and the participation of citizens and communities in city governance.

3.5.3 Infrastructure Availability

The growing Internet of Things ecosystem is increasingly dominating the Internet of Data in smart cities. Over the last two decades, hardware performance has been dramatically accelerated at lower costs, coupled with drastic component miniaturization, resulting in the pervasiveness of smart objects. By providing smarter infrastructure, the convergence of Big Data, the Internet of Things, and Artificial Intelligence promises to create better places (parks, buildings, and homes) (transportation, energy, waste management) (Appio et al., 2019a).

For a number of reasons, public transportation will continue to be regarded as a public good, deserving of government support. Ensuring inclusive access for those who do not drive or cannot afford their private vehicle, providing more affordable and appealing transportation to consumers, managing congestion through the use of new technology, and the new parking system, all of which necessitate the improvement of public transportation infrastructure (Enoch et al., 2020). Smart mobility scale for specific mobility must provide transportation infrastructure and services and alternative transportation infrastructure (Bebber et al., 2021). The lack of integrated planning and envisioning a sustainable transportation system and the need for accessibility of alternative modes of transportation such as bicycles and walking should be the common urban mobility priority in infrastructure availability. Pedestrian and parking areas must also be identified as ecosystems in smart mobility (E. Sdoukopoulos et al., 2016a)

3.5.4 Delivery Channel

Platforms are digital systems that reduce transaction costs by organizing fragmented data, matching supply and demand, and letting people work together in different ways. These days, most digital services are built around platforms. New digital platforms can help with good governance, public safety, environmental protection, smart transportation, smart government, smart education, and smart farming. Digital authority has been studied extensively regarding how it affects the world. Still, the legal literature has only scratched the surface of what this means for the local values that governments represent and put into practice.

Traditional forms of communication no longer entice participants, and governments are beginning to incorporate digital channels into their information strategies to increase citizens' participation in developing new policies. Cities must be reinvented, and local governments must reconsider how they interact digitally with citizens. However, not all areas are widely available and accessible to all citizens. People in remote areas who live without technology support cannot be neglected. Therefore, the government must guarantee their right as citizens by providing both digital and non-digital services to ensure that all citizens can participate. Although social media, e-mail, streaming sessions, and online debates have been beneficial, these channels do not reach everyone because not all citizens have equal access to digital tools (Sant'Ana et al., 2021)

The government's predominant ambition in using ICT is to improve the relationships between the citizens and the state through e-government channels inclusively, transparent, open, and collaborative, and stimulate citizen participation actively (Twizeyimana & Andersson, 2019a)

3.6 Smart Mobility Factors

3.6.1 Political & Regulatory

The growth of urban centers and the rise of digital technology are changing how urban systems work. The way people act in these cities is changing quickly, which makes it harder for their governments to manage urban space. Setting up a citizen dialogue is a creative way to get people involved in research to learn more about how they see societal problems.

So, the previous regulation needs to be changed quickly to keep up with how cities are changing, and government needs to be more agile in facing the rapid change of citizens. Poor engagement in public consultations affects the quality of new policies and makes it harder for the community to accept them later. The government must include new urban mobility services in city mobility plans to reorganize the metropolitan area successfully, and it requires active participation from the public (Duarte et al., 2021)

3.6.2 Socio-Economic

Related to economic perspectives where macro and micro policy, investment, and unemployment rate affected into economic strategy, financial support like budget and acquisition of smart city projects can be very crucial (Feleki et al., 2020a). Most importantly, a clear regulatory position must show that cities are ready to deal with possible market pressure. The vast majority of smart mobility services must also be able to make money for their shareholders. It is important to consider what kinds of rules allow smart mobility providers to run sustainably, under what market conditions, and if those conditions are good for the long run. On a larger scale, like in the case of micro-mobility, smart mobility operations may only be profitable in monopoly or oligopoly situations. This can cause price distortions and other problems, like higher prices, bad service, and social exclusion, which have been seen when traditional public transportation services have been deregulated (Moscholidou & Pangbourne, 2020b).

Equity is linked to social and environmental acceptance, meaning that no one is left out of social, economic, or political activities or mistreated because of who they are. Thriving livelihoods are places where people can work and reside today and in the future while still considering the surroundings and other things. All residents must have the same access to opportunities, goods, and services in these places. They must be entirely secure, friendly, and well-planned (Núñez et al., 2022).

3.6.3 Digital Divide

Economic and social inequality creates a digital divide among citizens. People with low access, skill, and knowledge of technology are vulnerable to getting information. Especially in emerging countries, digital literacy can be an obstacle for the government to transform into a digital government. To fill the digital literacy gap among citizens, the government must invest heavily in ICT infrastructure, educate people and officials about the new technology, improve the quality and government management system, and allocate a budget for R&D investment (Dewan & Riggins, 2005; F. Zhao & Khan, 2013).

3.7 Analysis Results

3.7.1 Characteristics Analysis Result

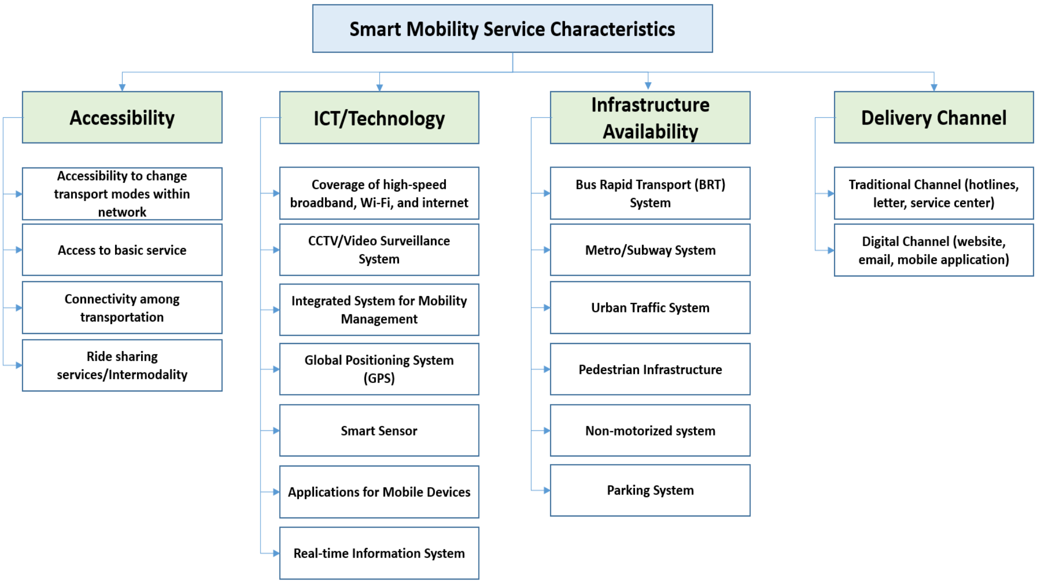

Figure 4. Smart Mobility Service Characteristics

3.7.1.1 Characteristics Main Criteria Analysis

Figure 4 represents the AHP Hierarchy Tree, and figure 5 illustrates the results of the AHP estimation for the main characteristics of smart mobility services. The result derived from experts' opinions ranks infrastructure availability 58.9 percent as the most essential characteristic of smart mobility services to implement in Indonesia's new capital, followed by accessibility at 25.6 percent, ICT/Technology at 11.7 percent, and digital divide at 3.8 percent.

According to the findings of this study, infrastructure availability is the top priority when building a smart city, especially when starting from scratch. This demonstrates that consistency infrastructure and accessibility are critical points as the foundation of smart mobility services, with ICT/Technology being the next layer to support implementation, and delivery channel as the last priority or characteristic for smart mobility services because the delivery channel will be very effective after the performance of the smart mobility rather than in the initial or the beginning of the stage.

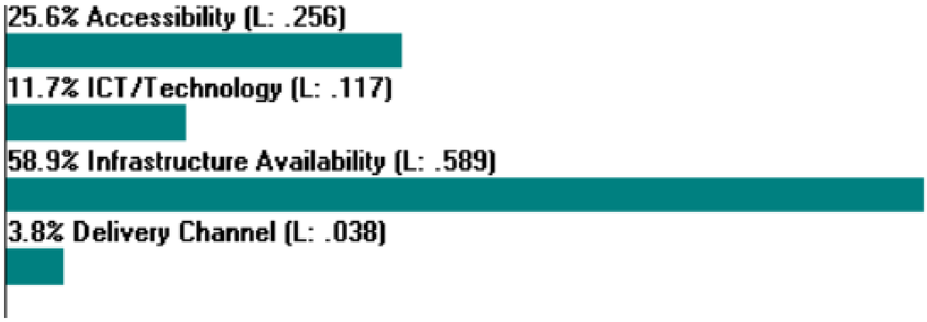

Figure 5. Smart Mobility Characteristic Criteria Ranking

3.7.1.2 Characteristics Sub-Criteria Analysis

The results of characteristic sub-criteria ranking within each category, in terms of their percentage weights, were estimated, shown in figure 6 below.

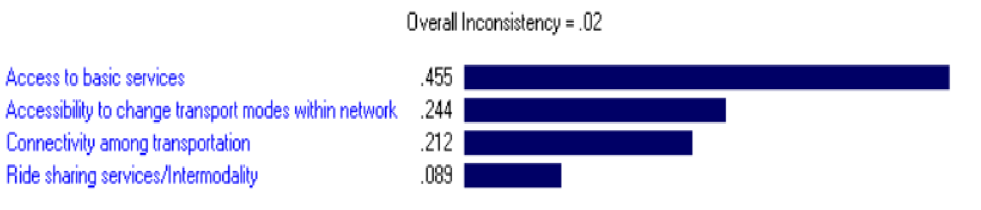

Figure 6. Accessibility Sub Criteria

Under smart mobility characteristics' main criteria, Accessibility is the first criterion to assess. This study's item is access to basic services, accessibility to change transport modes within a network, connectivity among transportation, and ride-sharing services/inter-modality. Based on the experts' judgment, access to basic services is the first rank for accessibility sub-characteristic with 45.5% importance. Accessibility to change within network 24.4%, connectivity among transportation 21.1%, and ride-sharing service/inter-modality with 8.9% priority.

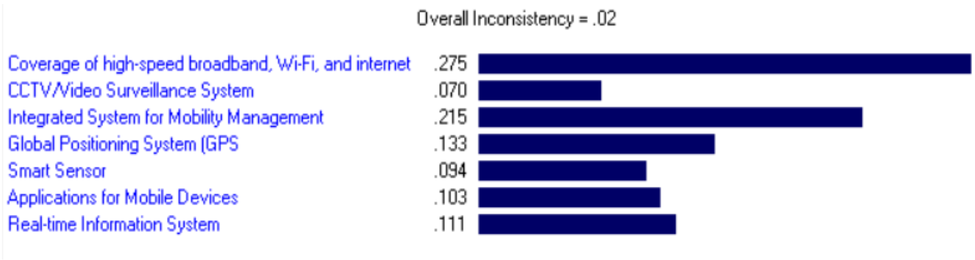

Figure 7. ICT/Technology Sub Criteria

Figure 7 shows that coverage of high-speed broadband, Wi-Fi, and the internet is the first rank in the ICT/Technology sub-criteria with 27.5% of importance. The second importance is Integrated Systems for Mobility management 21.5%, Global positioning system (GPS) 13.3%, real-time information systems 11.1%, applications for mobile devices 10.3%, smart sensors 9.4%, and the last is CCTV/video surveillance 7%.

Figure 8. Infrastructure Availability Sub Criteria

This study has six sub-criteria under the main infrastructure availability criteria represented by figure 8. The first importance of the infrastructure availability is the Metro/subway system, with 30.8%. The second importance is Bus Rapid Transit (BRT) system, with 26.7%. Urban traffic system respectively has 17.9% importance, pedestrian infrastructure with 11.6%, non-motorized systems with 7.6%, and parking systems with 5.4% importance.

Figure 9. Digital Divide Sub Criteria

The digital divide is the last main criterion in this study and represents in figure 9. It compares with two sub-criteria, digital channel and traditional channel. In the era of technology, the digital channel is more important, with 78.5%, than the traditional channel, with 21.5 %. It means traditional channels are still essential to support the smart mobility service.

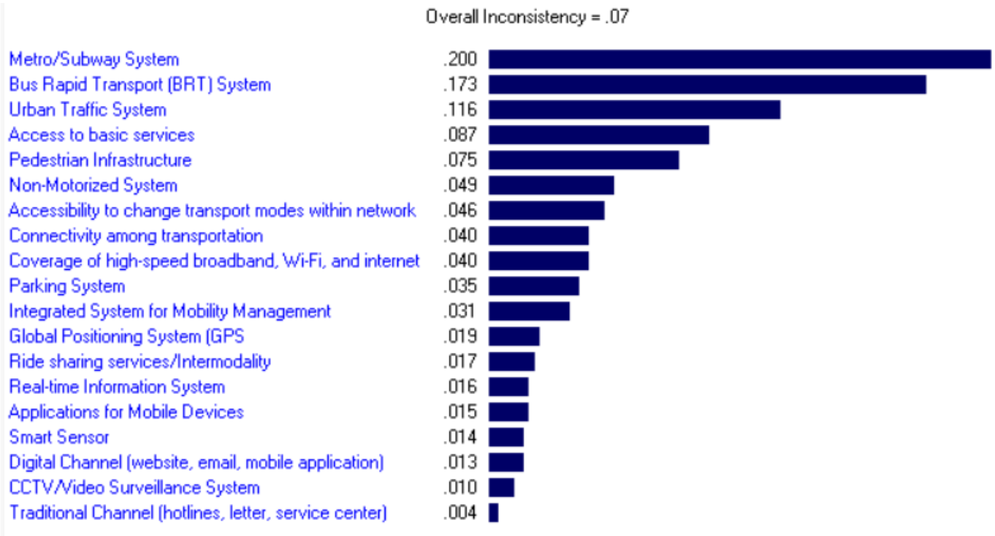

Figure 10. Characteristics Ranking

Figure 10 shows the overall characteristics ranking. The five most important criteria are the metro/subway system at 20%, Bus Rapid Transport (BRT) System at 17.3%, Urban Traffic System at 11.6%, Access to basic services at 0.87%, and Pedestrian Infrastructure at 0.75%

3.7.2 Factor Analysis Result

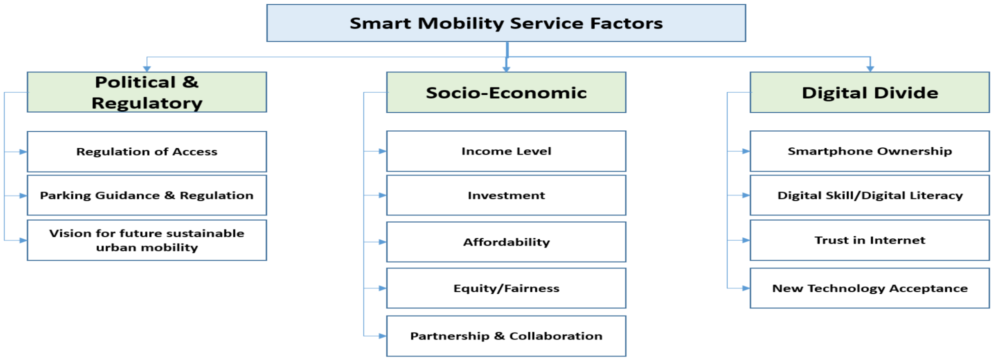

Figure 11. Smart Mobility Service factors Hierarchy Tree

3.7.2.1 Factor Main Criteria Analysis

Figure 12 represents the results of the AHP estimation for the main criteria of smart mobility service factors. The result derived from experts' opinions ranks political & regulatory as the first important criteria at 48%, socio-economic at 39.2%, and digital divide at 12.8%

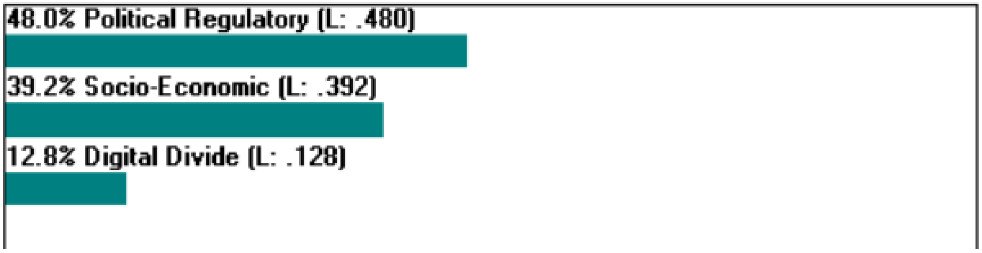

Figure 12. Smart Mobility Factors Main Criteria Ranking

3.7.2.2 Factor Sub-Criteria Analysis

Next, each sub-criteria based on the main criteria was assessed, and the results show in the figure 13 below. First is the result for political & regulatory main criteria, with three sub-criteria offering the regulation access was the highest priority at 58.9%, vision for future sustainable urban mobility at 28%, and parking guidance & regulation at a13.4%.

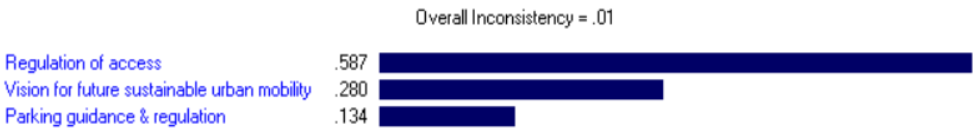

Figure 13. Political and Regulatory Sub Criteria

In the socio-economic factor, the most significant priority is income level at 32.7%, affordability at 27.1%, partnership & collaboration at 16.6%, investment at 14%, and equity/fairness at 9.6%, as shown in figure 14

Figure 14. Socio-Economic Sub Criteria

The last main criterion assessed is the digital divide, and the result is shown in figure 15 below. Digital skill/digital literacy is the highest important rank factor at 48.5%. The second highest priority is smartphone ownership at 21.8%, new technology acceptance at 15.2%, and lastly trust in the internet at 14.6%.

Figure 15. Digital Divide Sub Criteria

Figure 16 below shows the overall result ranking for smart mobility service factors. This study's five highest priority or importance rank is regulatory of access at 21%, income level factor act at 17.2%, affordability at 14.2%, and vision for future sustainable urban mobility at 10%.

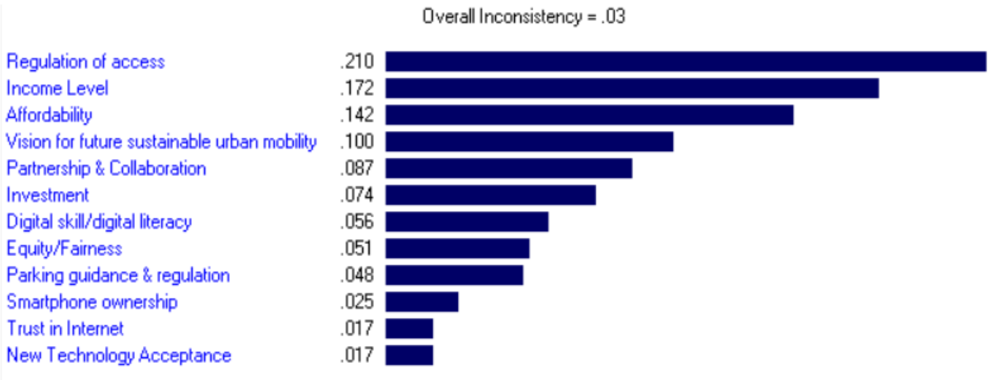

Figure 16. Smart Mobility Factors ranking

3.8 Analysis Result Summary and Discussion

3.8.1 Analysis Result Summary

In considering the fact that this research was conducted based on the Indonesian context, the initial findings may have many further consequences for policymakers in Indonesia. Based on the experts' judgment for smart mobility service characteristics, the most important main characteristics, respectively, infrastructure availability, accessibility, ICT/Technology, and Delivery channel, and sub-characteristics for all sub-criteria are metro/subway system, bus rapid transit (BRT) system, urban traffic system, and access to basic service. The overall results for smart mobility service characteristics showed that infrastructure availability is the most important criterion: 58.9%, accessibility 25.6%, ICT and technology 11.7%, and delivery channel 3.8%. The overall result for cub-criteria showed the five highest rankings, metro/subway system 20%, rapid bus transport (BRT) system 17.3%, urban traffic system 11.6%, access to basic services 8.7%, and pedestrian infrastructure 7.5%.

Meanwhile, the overall result for smart mobility service factors showed political regulations as the highest main criteria at 48%, socio-economic at 39.2%, and digital divide at 12.8%. The five highest ranking for all sub-criteria ranking is regulation access 21%, income level 17.2%, affordability 14.2%, vision for future sustainable urban mobility 10%, and partnership and collaboration 8.7%

3.8.2 Discussion

a. Smart Mobility Characteristics

- Infrastructure availability and accessibility are the most important characteristics in implementing smart mobility. Infrastructure availability (58.9%), with the most important subcriteria for the Metro/Subway System (30.8%), Bus Rapid Transit (BRT)(26.7%), Urban traffic system (17.9%), Pedestrian infrastructure (11.6%), non-motorized system (7.6%), and parking system (5.4%).
- The metro/subway system and BRT are mass transportation. The availability of these two forms of transport is essential to make citizen
- The metro/subway system and BRT are mass transportation.

The availability of these two forms of transport is essential to make citizen movement more manageable and convenient because Metro/subway and BRT are mass transportation to reduce the supply and demand imbalance, the ability to transport a vast number of passengers daily (E. Sdoukopoulos et al., 2016a).

- As metro/subway and BRT is a public transport system that aims to combine the capacity and speed of rail with flexibility and lower cost, services need to give high priority to expense/fare, comfortable and convenient transfer, provide complaint system, safety rider, one-click payment, and enjoyable of at public transportation (Zheng et al., 2021)
- The public transportation infrastructure requires a large investment of money and time (J. Lee et al., 2020b). Because of that, the smart mobility project must be designed comprehensively and holistically to avoid issues about lack of planning between infrastructure projects, lack of collaboration on policy and technical support, and lack of funding/budget support for constructing appropriate transportation projects (E. Sdoukopoulos et al., 2016c)

b. Smart Mobility Factors

- From this study, the most important factors for implementing smart mobility are political & regulatory (48%), and the highest sub-criteria is regulation of access (58.9%). Since the development period of new mobility services is shorter than the typical horizon of strategic transport policymaking, generally about one or two decades. Therefore, policymaking must be sufficiently adaptable to accommodate any new innovative mobility services (Shibayama & Emberger, 2020)

- A wide range of economic, social, and political factors is found to have significant effects on urban mobility (E. Sdoukopoulos et al., 2016a; Zheng et al., 2021)
- Platform-based mobility services have been revolutionized as a result of the successful implementation of smart mobility services in many different countries, and smart mobility services were a game-changing innovation that prompted socioeconomic and political arguments. Most smart mobility services are based on sharing economy models, making regulatory conflict an especially significant concern for these services (Leat et al., 2021) (J. Lee et al.,2022)

c. The first and second most critical phases of smart city development are readiness and the city blueprint. Before agreeing on a city transformation vision and its associated strategies, aims, and objectives, the proposed roadmap's first two phases aim to examine the city's economic, environmental, social, and political state and evaluate its current assets. (Maysoun Ibrahim, 2018)

Chapter 4. Investigating Citizen Satisfaction Expectation on Future Mobility: Case of Indonesia

4.1 Introduction

Transportation externalities have risen to the top of the political agenda in modern cities as transportation volumes have increased and environmental awareness has grown. Quality of service is critical in the public sector, especially for basic services like transportation. Beyond providing seamless and effective mobility, transportation has had far reaching consequences, and it has become one of the main pillars of modern society. The ability to quickly transport people and goods to almost any location has contributed to unprecedented economic growth in recent decades. An integrated public transportation system can play a significant role in achieving urban mobility sustainability. The experiences from developed countries may represent best practices for other countries in implementing innovative, green urban mobility solutions tailored to their specific needs.

Smart mobility comes with hopes for impending and revolutionary change and the belief transportation in the future will connect and be automated in one platform and holistic ecosystem. People have more options for choosing transportation modes during their travel time because the sustainability of mobility means a safer journey, easy access, affordable fares, and convenience. Sustainable mobility systems contribute to increasing citizen quality of life. Expectations for smart mobility performance in envisioning urban futures, smart mobility, or ICT-enabled transportation services is increasingly recognized as an essential component of urban sustainability transitions. Smart mobility expectations are frequently uncontested, even though they contribute to a specific future vision of urban mobility (van Oers et al., 2020).

There are a variety of city rankings that measure citizen satisfaction. In spite of the majority of urban regions comprising moderate cities, research has thus far focused on more extensive and more prominent metropolitan administrations. The data cannot be used to measure administrative effectiveness and citizen satisfaction. In addition, Information and Communication Technology (ICT) has yet to fulfill its promise of initiating significant change. In reality, it has been a clear and concise modification of standalone services, not a novel process to demonstrate good accountability of governmental policies and the quality of services residents demand. To thoroughly connect policies with societal requirements, Smart City frameworks only incorporate the exact comments of some people. According to Hong et al. (2021), the problem stems from some members of society being unable to be heard or adequately understood. However, the government can still overestimate or underestimate resident complaints due to discrepancies in data collected at different points in the report, even if a survey was conducted.

For instance, low-income residents and minority neighborhoods frequently complain about worse road conditions and increased models of nuisance behavior. (Ramirez et al., 2021a).

When working toward the goal of developing a participatory evaluation proposal for environmentally responsible and intelligent transportation, it is essential to focus on the fundamental principles underlying citizen participation. This is due to the fact that it is expected that citizens of receptive cities will make the greatest commitment possible so that they can contribute their knowledge and life experiences to achieve findings that are more effective, efficient, relevant, and sustainable within the time allotted for the project. The initial stage of participation is referred to as the informative level, and during this stage, the authority merely transmits information to the participants without engaging in conversation with them. This level is the beginning of the participation process. The second level is consultative, and it is at this level that information regarding the opinions, proposals, and interests of citizens in relation to issues of public concern is gathered. At the third and final level, members of the public are offered the chance to have direct input into the decision-making process pertaining to an intriguing topic. And finally, the fourth level corresponds to co-management, which is where an articulation between the citizenry and the authority is expected, with the purpose of involving in the design, implementation, control, and evaluation of a public interest activity and influencing in an associated decision-making process. Co-management is where an articulation between the citizenry and the authority is expected, with the purpose of involving in the design, implementation, control, and evaluation of a public interest activity. At the fourth level, co-management activities take place (Angarita Lozano, Diaz Marquez, et al., 2021).

This study focused on the case of Indonesia to identify the gap between government and citizen interconnectedness in implementing smart mobility projects based on citizen expectations. The mobility case is to see what are the future mobility expectations in the new capital of Indonesia. Because of that, most of the variables in this study were used from the previous study and selected through an in-depth literature review. Therefore, this chapter intends to answer the following research questions:

1) How does the government facilitate citizen participation in smart mobility projects in developing countries to provide adequate urban mobility by citizens' expectations?
2) What is the gap in implementing smart mobility based on citizen expectations?

This chapter is structured as follows: Section 2 presents model establishment and hypothesis development. Sections 3, 4, 5, and 6 describe a previous study to explain citizen satisfaction expectations, safety and security, comfort and convenience, and government and citizen engagement. Section 7 presents the research methodology. Section 8 defines the survey and data. Section nine highlights the analysis and results. Finally, the chapter ends by drawing conclusions and exposing them, and lastly, section 8 concludes the findings.

4.2 Model Establishment and Hypothesis Development

The figure shows the research proposed model detailing the relationship between the study variables based on a comprehensive literature review. The variables for the study were adopted and redeveloped from previous studies. The dependent variable is transport safety and security, comfort and convenience, and governance and citizen engagement, and all variables were measured using a five-point Likert scale. Based on the study, the questionnaires were created. The table 5 below shows the reference to the questionnaires.

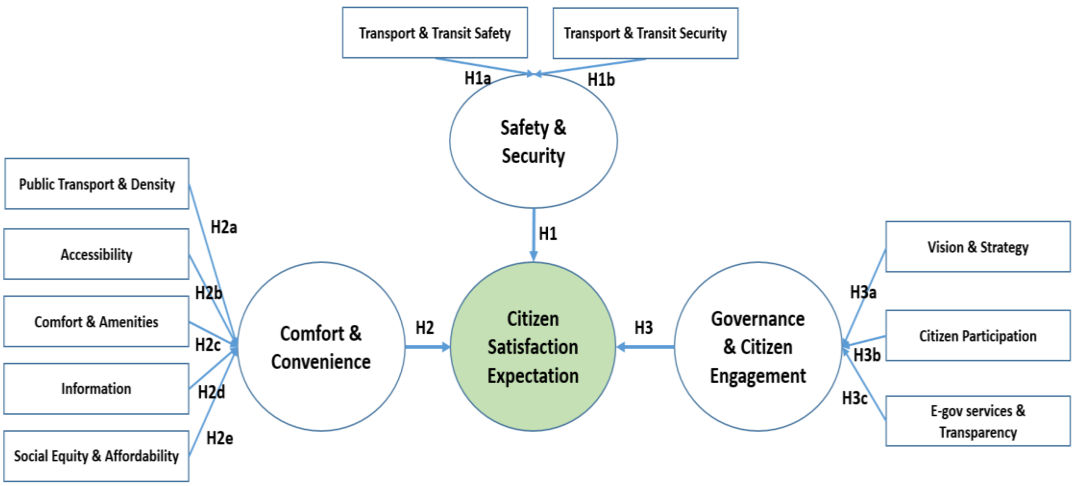

Figure 17. Citizen Satisfaction Expectation Model

Table 5. Citizen Satisfaction Summary

Study	Variable																	Analysis Method & Tools
	Safe	**Sec**	**Rel**	**Cmf**	**Srv**	**Afr**	**PT**	**Den**	**Acc**	**Amt**	**Inf**	**Seq**	**Vsn**	**Str**	**CP**	**Egov**	**Trp**	
(Luke & Heyns, 2020)	**o**		**o**	**o**		**o**												SERVQUAL
Delloite, 2018					**o**							**o**	**o**	**o**		**o**	**o**	-
(Imre & Çelebi, 2017)				**o**	**o**		**o**											-
(Sinha et al., 2017)	**o**	**o**		**o**	**o**		**o**	**o**	**o**	**o**	**o**	**o**						TOPSIS
(R. de Oña et al., 2014)	**o**			**o**					**o**	**o**	**o**							SERVPERF
(Del Castillo & Benitez, 2012)	**o**	**o**		**o**	**o**	**o**			**o**		**o**							Multivariate discrete distribution
(Kamaruddin et al., 2012)	**o**		**o**			**o**			**o**		**o**			**o**				SEM
(J. de Oña et al.,	**o**			**o**		**o**	**o**				**o**			**o**			**o**	-

Study	Variable																	Analysis Method & Tools
	Safe	Sec	Rel	Cmf	Srv	Afr	PT	Den	Acc	Amt	Inf	Seq	Vsn	Str	CP	Egov	Trp	
2016)																		
(Chuenyindee et al., 2022)			o	o								o				o	o	SERVQUAL, SEM
(Mandhani et al., 2020)	o	o	o	o	o						o						o	Integrated Bayesian Model, PLS-SEM
(Beck & Rose, 2016)				o	o	o	o			o	o						o	Best worst scaling
(Yilmaz et al., 2021)					o		o						o	o	o	o	o	American Customer Satisfaction Index, Structural Equation Modelling
(Munira & Santoso, 2017)	o	o		o		o	o	o	o		o	o					o	HSCI (Heterogeneous

Study	Variable																	Analysis Method & Tools
	Safe	Sec	Rel	Cmf	Srv	Afr	PT	Den	Acc	Amt	Inf	Seq	Vsn	Str	CP	Egov	Trp	
																		customer satisfaction index) – Regression
(Magalhães & Rivera-Gonzalez, 2021)	**o**	**o**	**o**				**o**		**o**									Discrete Choice Model
(Ghosh et al., 2017)	**o**	**o**		**o**			**o**			**o**	**o**						**o**	Service quality performance matrix (SQPM), user satisfaction index Regression
(Tyrinopoulos & Antoniou, 2008)	**o**				**o**		**o**				**o**							Ordered Logit Model
(Yuan et al., 2019)	**o**	**o**		**o**	**o**		**o**			**o**				**o**			**o**	PLS-SEM
(Chauhan et al.,	**o**	**o**		**o**			**o**		**o**	**o**	**o**			**o**				SEM

Study	Variable																	Analysis Method & Tools
	Safe	**Sec**	**Rel**	**Cmf**	**Srv**	**Afr**	**PT**	**Den**	**Acc**	**Amt**	**Inf**	**Seq**	**Vsn**	**Str**	**CP**	**Egov**	**Trp**	
2021)																		
(Lee-Geiller & Lee, 2019)					**o**						**o**				**o**	**o**	**o**	Qualitative meta analysis
(Kim et al., 2018)	**o**	**o**		**o**			**o**			**o**	**o**							Rasch Analysis

Safe = Safety; Sec = Security; Rel = Reliability; Cmf = Comfort; Srv = Service; Afr = Affordability; PT = Public Transportation; Den = Density; Acc = Accessibility; Amt = Amenities; Inf = Information; Seq = Social Equity; Vsn = Vision; Str = Strategy; CP = Citizen Participation; Egov = E-government; Trn = Transparency

4.3 Citizen Satisfaction Expectation

Service quality is a multidimensional construct, which has been extensively discussed in the scientific literature. [Citation needed] The degree to which passengers' satisfaction with various aspects of the service shifts over time is a major factor in determining the amount of variation in the quality level that is perceived by users. During this time period, the European Union was also in the process of adopting a user-oriented perspective on the quality of service. (e.g., European Commission, 1995, 1996, 2001, 2007) (J. de Oña et al., 2016). It promoted a quality approach to public transportation that was centered on the needs and expectations of customers.

The technique of evaluating service quality, which computes a service quality index based on the differences between expectations and perceptions or satisfaction with the characteristics describing the service, is by far the most common and widely used method for determining customer satisfaction. Changes in the transportation system or in the opinions of passengers, who may become more critical of the service as time passes, can cause shifts over time in the importance that passengers assign to each service aspect, as well as shifts in their levels of satisfaction with the service. These shifts can occur in transportation or mobility. In addition, the significance that passengers attach to the utilization of the transit system and the various facets of the service can shift over the course of time. More specifically, this significance can shift as a result of factors such as people's attitudes toward the mode of transit, people's sensitivity to economic and environmental aspects, and people's ever-rising expectations regarding the service, which are becoming increasingly demanding. For instance, as people's living standards have improved and the transportation industry has grown, passengers' expectations for certain aspects of the service, such as the comfort of their journey, have increased. This is due to the fact that passengers' living standards have improved (Fu et al., 2022).

4.4 Safety and Security

Transportation service quality has long been recognized as an important factor in influencing traveler behavior. It is a key driver in sustainable transportation policies because it encourages travelers to choose modes of transportation (J. de Oña et al., 2016). The availability of CCTV cameras, security guards, and adequate lighting at night and during the day are all important factors in the transportation system. Security personnel should be stationed at the access route, waiting for areas, and transfer facilities, lighting should be improved during the day and night. More CCTV cameras should be installed in waiting and transfer locations and search and rescue dogs. On-board safety at night (rank 13 out of 20), safety at bus stops at night (14), and ticketing facility and comfortable seats are the highest (Chauhan et al., 2021). Safety is one of the most important aspects of customer satisfaction (Kamaruddin et al., 2012)

The following improvements are required in and around transit stations: Passengers will be able to plan their journeys more effectively if real-time transit schedules are made available in mobile applications. A sufficient amount of enforcement, such as the employment of security personnel in isolated areas around the transit station, should be provided for the purpose of ensuring the safety and security of passengers. (Mandhani et al., 2020), and also, to enrich, proper lighting and cleanliness in the general area of transit stations are required. Passengers regard mobile network connectivity within metro stations as a major concern. The important characteristics include courtesy, safety, accessibility, cleanliness, temperature, proximity, and speed (R. de Oña et al., 2014). Therefore, the following hypothesis is proposed:

H1: Safety and Security has a significant effect on citizen satisfaction expectation

4.4.1 Transport & Transit Safety

Transport and transit safety refers to how safe people feel when waiting at terminals, bus stop, and stop (the end of the journey) to take public transportation(Tyrinopoulos & Antoniou, 2008). Service quality in multimodal hubs defines as the overall level of user satisfaction with various characteristics, including the transfer environment, accessibility, signposting, safety, security, public utilities, comfort and convenience, and so on. Good coordination and integration with the various modes of transportation help decongest roads, reduce journey times, improve the environment, and offer greater convenience and easy transfer to commuters. The transport hub is the core component of sustainable urban transport policies, as it facilitates riders to switch between modes (Chauhan et al., 2021). The proposed hypothesis is:

H1a: Transport and Transit safety positively contribute to increasing the expectation of safety and security

4.4.2 Transport & Transit Security

The smart mobility concept is based on three main experience dimensions: safety, comfort, and convenience. For example, the safety for illumination variable describes the pavement's lighting, which directly affects trip risks, pedestrian safety, and a sense of security at night(Chauhan et al., 2021; Loo, 2021) said that there must be security in waiting areas and inside transportation modes, transfer areas, and pedestrian crossings, with CCTV cameras, security guards, and enough lighting at night and during the day. In addition, security is linked to the expectation that there will be few accidents and crimes (Luke & Heyns, 2020). Therefore, the following hypothesis is proposed:

H1b: Transport and transit security positively contribute to increasing the expectation of safety and security

4.5 Comfort & Convenience

Comfort and convenience during traveling are basic needs of the customer, and it is different among them. Vulnerable people such as children, women, disabled persons, and the elderly need special access and amenities. It means not solely depending on fancy facilities but covering all their basic needs. For the elderly, other dimensions, such as service and security, convenience, and driver service, need to be improved because they are crucial for the elderly. Still, their perceived performance from the elderly's perspective is low (Yuan et al., 2019). Additional services must be considered, such as increasing the number of buses specifically for women. Others are implementing other simple policies like designated waiting areas, transparent bus shelters, an emergency complaint service, and alternative services and routes like request-stop programs for women travelers at night. (Munira & Santoso, 2017).

According to Sinha et al. (2017), improving public transportation requires a focus on accessibility, affordability, and economy. In contrast, according to (Kamaruddin et al., 2012)research, users preferred to use the LRT because of its efficiency and effectiveness in terms of time speed, fare, accessibility, dependability, communication, comfort, and safety. If basic amenities such as platform infrastructure, cleanliness, and interactions with staff and officials fall short of expectations, this can lead to dissatisfaction (Ghosh et al., 2017). Therefore, the following hypothesis is proposed:

H2: Comfort & Convenience has significant effect on citizen satisfaction expectation

4.5.1 Public Transport and Density

It has been decided that public transportation and population density are also important factors in the quality of transportation services. These factors must include how crowded the bus is, how comfortable the seats are, how much the bus shakes, and how the ride feels(Yuan et al., 2019). Therefore, the following hypothesis is proposed:

H2a: Public and transport density positively contribute to increase the expectation on comfort & convenience

4.5.2 Accessibility

Citizens' travel satisfaction is influenced not only by their experience in the transport system itself but also by their access to the transport system and associated activities (R. Liu et al., 2018); hence, a transport hub is a critical component of sustainable urban transport strategies. It is a more complicated transit facility than a normal station, allowing passengers to switch between modes (Chauhan et al., 2021). Therefore, the following hypothesis is proposed:

H2b: Accessibility positively contributes to increasing the expectation of comfort & convenience

4.5.3 Social Equity

The provision of facilities for persons with disabilities, those with mobility impairments, the elderly, women, and children is an example of what is meant by social fairness. While affordability refers to the financial burden commuters are required to bear to pay for transportation services (Luke & Heyns, 2020), all of the people who fall into these categories have the potential to suffer and be vulnerable to facing inequality in transport access. This inequality may even cause more extensive social inequality because people with low incomes, low levels of education, rural migrants, or minority populations live in areas with undesirable transport options and access (P. Zhao & Li, 2019).

This indicator will assist the government in achieving vertical social fairness by encouraging the improvement of public transportation in locations where many residents cannot afford other modes of transportation. (P. Zhao & Li, 2019).

Therefore, the following hypothesis is proposed:

H2c: Social equity & affordability positively contribute to increase the expectation on comfort & convenience

4.5.4 Information

General information usually tells the passenger enough about the general features of the transit service, like the lines, terminals, and stops, as well as the times of departure, tickets, and available passes. There is more information about how often the lines run, how accurate the departure times are, and what services are available at the terminals and stops (Tyrinopoulos & Antoniou, 2008). But some studies focus on specific groups, like the elderly, to find out more (Yuan et al., 2019). Therefore, the following hypothesis is proposed:

H2d: Information positively contributes to increase the expectation on comfort & convenience

4.5.5 Comfort and Amenities

It has been determined that comfort is a key component in enhancing the quality of transportation, and this component should also consider the state of the equipment and facilities for mobility (Chauhan et al., 2021; Luke & Heyns, 2020). According to studies, cleanliness, privacy, safety, convenience, stress, social contact, and landscape impact travel satisfaction (Turel & Serenko, 2006). Not only may quality public transportation services promote customer loyalty by increasing satisfaction and attracting new users, but they can also impact the travel mode selection of urban inhabitants, particularly for short-distance and intra-city travel (P. Zhao & Li, 2019). The convenience and comfort elements include passenger loads, dependability, journey duration, safety and security, cost, appearance, and convenience (Eboli & Mazzulla, 2021). In addition, to make the elderly feel comfortable, the onboard riding experience, crowding levels, seat comfort, and vibration levels need to be considered. This age group is more susceptible to the effects of shifting environments (Yuan et al., 2019). Therefore, the following hypothesis is proposed:

H2e: *comfort & amenities positively contribute to increase the expectation on comfort & convenience*

4.6 Government and Citizen Engagement

Nearly all governments around the world now have websites where citizens can access government data and services, but many have been criticized for being of low quality. Inadequate guidelines and evaluation tools for public managers may be to blame for the poorly maintained government websites, which are the only goals of e-government initiatives. (J. Lee et al., 2022; T. Lee et al., 2020). Public information may increase transparency and facilitate citizen engagement, but it may also overwhelm citizens by requiring them to gather, assemble, and process information (T. Lee et al., 2020).

Inviting citizens to opportunities to cultivate their digital literacy (such as visual literacy, information literacy, socio-emotional literacy, re-production literacy, and hypermedia literacy), as well as to build digital presences and identities in a digital public ecosystem through social learning, is part of using criteria for citizen engagement. In addition, governments need to incorporate their website strategies into mainstream survival skills and education campaigns in order to cultivate digital literacy and citizenship. This is because the digital ecosystem is already enabling and, in many cases, empowering the skills that are being targeted by these campaigns (Lee-Geiller & Lee, 2019). Therefore, the following hypothesis is proposed:

H3: Government and citizen engagement has significant effect on citizen satisfaction expectation

4.6.1 Vision & Strategy

E-government is a socially inclusive, hyper-integrated ICT platform with an evolutionary systems design that effectively delivers government services with transparency, dependability, and accountability. The initial phase of e-government focuses on using current ICT to simplify the interchange of information and improve continually as a tool for providing various services to its residents. Then, due to technological advancements, e-government emerged to streamline non-managerial administrative tasks like money transfers, paperwork and inspecting. To properly appreciate citizens' needs and expectations for e-government services and to deliver their vision and strategy, this article integrates the standpoints of information systems and public administration by proposing a complex, multifaceted inter-framework for e-government. It will boost the government's credibility and openness (Malodia et al., 2021). Therefore, the following hypothesis is proposed:

H3a: Vision & strategy positively contribute to increase the expectation on government and citizen engagement

4.6.2 Citizen Participation

Citizens can exhibit their democratic citizenship and interest in public issues through participation and engagement. The citizen's passive function as a recipient can become active. Citizens can give new information, engage in decision-making, or help with projects. Participation gives citizens a sense of importance, which inspires them to be active in daily policy or action decisions (Criado & Gil-Garcia, 2019). It is not the same as the traditional methods of participation, which may include congressional meetings, press conferences, citizen boards, focus group discussions, filmmaking, and other similar activities. The use of information and communications technology (ICT) to engage citizens in deliberation, decision-making, service design, and the delivery of public services makes participation simpler, quicker, and more open to public scrutiny.(Kopackova et al., 2022). Therefore, the following hypothesis is proposed:

H3b: Citizen Participation positively contributes to increasing the expectation of government and citizen engagement

4.6.3 Government Service & Transparency

Government websites serve as persistent platforms for information sharing, e-service delivery, and collaboration for public objectives between the government and its citizens. Government platform enable public officials, people, corporations, and other civic institutions to engage in a manner that would otherwise be extremely difficult. This channel can be utilized to communicate the government's vision, strategy, and performance and promote government openness. Today's governments face many challenges, including rising citizen expectations, dissatisfaction with government, distrust, and a lack of interest in politics. To address these issues, new governance structures must be developed that encourage citizen participation through increased opportunities for two-way communication. The poor maintenance of government official media (websites) may be attributable to the absence of sufficient guidelines and evaluation tools for public managers, which would enable them to accomplish the e-government programs' superior aims (T. Lee et al., 2020; T. (David) Lee et al., 2021). Therefore, the following hypothesis is proposed:

H3c: e-government services and transparency positively contribute to increase the expectation on government and citizen engagement.

4.7 Research Methodology

The primary consideration for using Structural Equation Model (SEM) is determining a conceptual model that best describes the relationship among variables. The study adopted the Partial Least Square Structural Equation Model (PLS-SEM) to validate the research model. To evaluate and analyze the hypothesized model and the data collected, Smart-PLS version 3.2.9 were deployed.

4.7.1 Structural Equation Model (SEM)

These methods get around the restrictions that the researcher had to deal with in the past and are able to model and estimate the intricate relationship between variables simultaneously (Hair Jr, Hult, Ringle, Sarstedt, et al., 2021a). The concepts that are being taken into consideration are typically not observable and are measured in a roundabout manner by a number of indicators, which makes the result more accurate (Sterba et al., 2014).

Nowadays SEM method use most on many disciplines of study like accounting, construction management, entrepreneurship, family business, higher education, hospitality and tourism, human resource management, international business research, knowledge management, management, marketing, management information systems, operations management, psychology, software engineering, and supply management (Hair Jr, Hult, Ringle, & Sarstedt, 2021)

4.7.2 Covariance-based SEM (CB-SEM) and Partial Least Square SEM (PLS-SEM)

The structural equation model (SEM) is a multivariate data analysis method that is of the second generation and allows for the analysis of relationships while also taking into account the possibility of measurement error in indicators. CB-SEM and PLS-SEM are the two categories that fall under the umbrella of SEM methods. The two approaches are distinct from one another with regard to the manner in which they estimate model parameters and the presumptions they make regarding the character of measurement. When compared to CB-SEM, PLS-SEM places a greater emphasis on prediction while simultaneously relaxing requirements regarding data and relationship specification. Estimating partial model relationships through an iterative process of ordinary least squares regressions is how PLS-SEM works to achieve its goal of maximizing the amount of variance in endogenous latent variables that can be explained.

On the other hand, CB-SEM estimates model parameters in such a way as to minimize the difference between the estimated covariance matrix and the sample covariance matrix. Instead of using a common factor model logic to estimate concept proxies for the concepts that are being investigated, you can use this method instead. The method is not restricted by identification problems and does not rely on distributional assumptions; this allows it to be used effectively regardless of the complexity of the model, which is a circumstance that typically restricts the use of CB-SEM. PLS-SEM has the added benefit of being able to handle formative measurement models more effectively. It also has an advantage when analyzing secondary data and when dealing with small sample sizes.

SEM The CB-SEM and the PLS-SEM are the two methods that are utilized by researchers the majority of the time when estimating relationships in SEM (Hair, 2022). CB-SEM is a common factor-based SEM method that approaches the construct as a collection of common factors that explain the covariation between the associated indicators. This approach treats the construct as though it were a factor set. When empirically measuring theoretical concepts, CB-SEM is more direct and precise, but it is also unsuitable for prediction because of its lack of dimensionality.(Hair et al., 2011, 2019) discuss the important issues and things to think about when deciding whether or not to use PLS-SEM. These include the characteristics of the data and the models, as well as estimation and evaluation of the models.

Think about employing the CB-SEM technique. When the objective is to test and validate a theory, certain error terms, such as covariation, need to be specified in greater detail. In the event that the structural model contains cyclical relationships, the investigation must include a global goodness-of-fit criterion.

Utilize the PLS-SEM analysis technique in situations in which testing a theoretical framework from the perspective of prediction, in particular out-of-sample prediction, is the goal of the investigation. The structural model is quite complex, as it contains a great deal of different constructs, indicators, and model relationships. Because the study relies on secondary data, it is possible that it does not provide sufficient substantiation based on the principles of measurement theory. The sample size is limited when the population being studied is small (for example, in business-to-business research), but it is important to note that PLS-SEM also functions very well with very large sample sizes. Distribution problems, such as an absence of normality, are a source of concern. In order to conduct follow-up analyses, the study needs a score for the latent variable.

4.8 Survey and Data

The objectives of the study, as well as data collection, informed the development of the questionnaire. For the purpose of collecting information, a questionnaire was created in Google Forms and distributed online from May 16th to May 23rd. The information that was gathered through the use of the online questionnaire was disseminated to citizens, scholars, and public servants through personal and group chats. The questionnaire that was used contained two separate sections. Both the first set of questions, which collected sociodemographic data, and the second set of questions, which were based on the instruments' Bahasa Indonesia translations, are presented below. The variables are evaluated using a 5-point Linkert scale, where 1 indicates total disagreement and 5 indicates total agreement with the statement.

The first version of the questionnaire was distributed as a pilot among ITPP students and friends. The questionnaire was revised and after finalized, the final version was uploaded to google forms and distributed. The survey questionnaire is shown in Appendix B.

The summary of the demographic characteristics of respondents responding to the survey are shown in the figure 18 below. There were a total of 265 sample respondents, including 160 women (60.4%) of the total and 105 men (39.2%). The age distribution of survey respondents was 106 respondents (40%) in the age range of 35-44 years old. 59 respondents followed it in the age range 25-34 years old (22.3%), 32 respondents (12.10%) in the age range between 16-24 years old, and 24 respondents over 55 years old. (24.8%). Next, 89 respondents (33.6%) had incomes of between 4,000,000 – 8,000,000 rupiah, 77 respondents (29,1%) had incomes between 8,000,001 – 12,000,000 rupiah, 51 respondents (19,2%) had incomes more than 12,000,000 rupiah, 27 (10,2%) respondents had incomes between 2,500,000 – 4,000,000 rupiah. In comparison, 21 respondents (7,9%%) had less than 2,500,000 rupiah incomes. Most of the survey respondents traveled for work/office, with 150 (56.6%), 52 respondents (19.6%) for study/school, and 63 respondents (23.8%) for social/recreation purposes. Next, 155 respondents (58,5%) traveled more than five days/per week, 59 respondents (22,3%) spanned 3-5 days/per week, 33 respondents (12.4%) traveled 1 – 2 days/per month, while 18 respondents (6.8%) traveled 1-2 days/week.

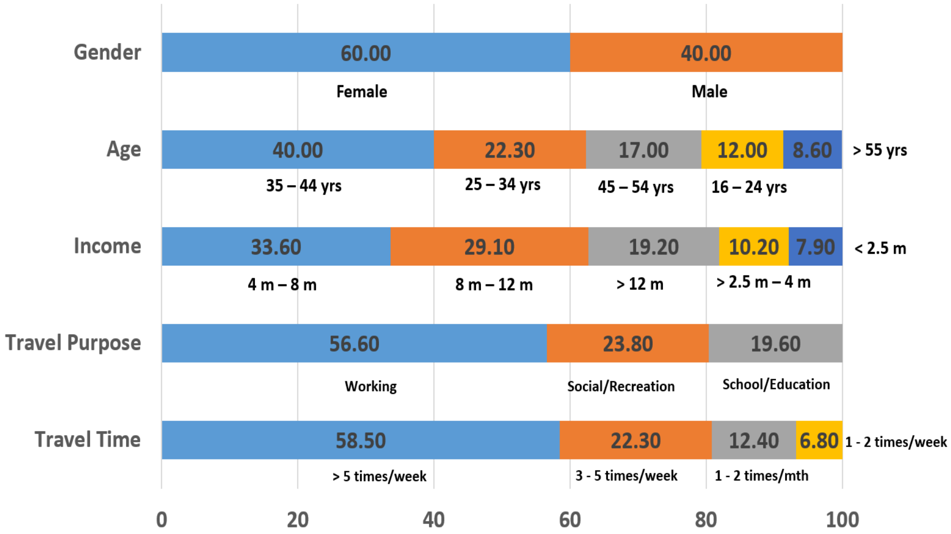

Figure 18. Respondent Socio-Demographics

4.9 Analysis Result

4.9.1 Measurement Model – Lower Order Construct

The evaluation of the quality criteria begins with assessing the factor loadings, followed by the determination of construct reliability and construct validity. Based on the framework of this research, the first stage, as a lower order, will be measured using reflective measurement. Reflective measurement model assessment steps and the rules of thumb are shown in figure 19 below (Hair Jr, Hult, Ringle, Sarstedt, et al., 2021b)

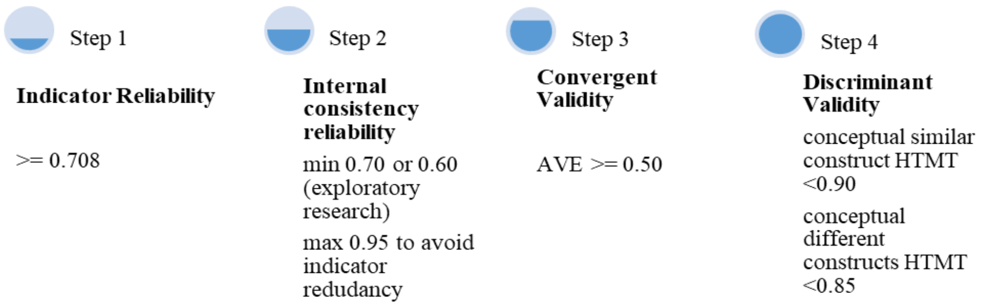

Figure 19. Structural Equation Model

4.9.2 Indicator Reliability

Indicator reliability indicates the commonality of an indicator. According to mark (1996), “Reliability is defined as the extent to which measuring instrument is stable and consistent. The essence of reliability is repeatability. If an instrument is administered repeatedly, will it yield the same results”? The value of indicator reliability recommends it is above 0.708. Suppose the value of indicator loading is under 0.708. In that case, we still can consider not removing the indicators from the construct if removing the indicator will not increase the effectiveness of the internal consistency reliability. That’s why indicators with loading between 0.40 – 0.708 are sometimes retained, but indicators below 0.40 should be eliminated from the measure model (Hair Jr, Hult, Ringle, Sarstedt, et al., 2021b).

The result of outer loading in our study is mentioned in the Table below. All loading factor values for each item are above 0.708, except CA5 for comfort and amenities variables slightly under, value of 0.692, CP3 for Citizen Participation with 0.697, and H3 for Citizen Satisfaction Expectation of 0.680. All these items were not removed because the value is above 0.40 or not less than the recommended value of 0.50 (Sarstedt et al., 2016). The loadings factor is shown in the table. 6

Table 6. Loading Factor Values

Construct	Variables	Indicators	Loading Factor Values
Safety & Security	Transport & Transit Safety (TTSafe)	TTSf1	0.969
		TTSf2	0.965
	Transport & Transit Security (TTSecure)	TTS1	0.902
		TTS2	0.925
		TTS3	0.830
Comfort & Convenience	Public Transport Density (PTD)	PTD1	0.879
		PTD2	0.907
		PTD3	0.788
		PTD4	0.876
	Accessibility (ACC)	ACC1	0.887
		ACC2	0.870
		ACC3	0.785
		ACC4	0.879
	Social Equity & Affordability (SEA)	SEA1	0.879
		SEA2	0.915
		SEA3	0.856
	Information (INF)	INF1	0.916

Construct	Variables	Indicators	Loading Factor Values
		INF2	0.926
		INF3	0.866
		INF4	0.897
	Comfort & Amenities (CA)	CA1	0.859
		CA2	0.803
		CA3	0.830
		CA4	0.826
		CA5	***0.692***
Governance & Citizen Engagement	Vision & Strategy (VS)	VS1	0.939
		VS2	0.950
	Citizen Participation (CP)	CP1	0.933
		CP2	0.935
		CP3	***0.697***
	E-government & Transparency (EGOV)	EGOV1	0.927
		EGOV2	0.935
		EGOV3	0.795
Citizen Satisfaction Expectation		CSE1	0.727
		CSE2	0.706
		H1	0.703
		H2	0.744
		H3	***0.680***

4.9.3 Collinearity

The Variance Inflation Factors are the standard for assessing indicator collinearity (VIF). The level of collinearity increases as VIF values increase. Collinearity issues are indicated by VIF values of 5>= or if VIF values <= 3. Our study has no collinearity issue since all the values of VIF are less than 5, as shown in the table 7 below. The range value for safety and security construct is between 1.905 to 4.145. The VIF for transport & transit safety is relatively high, 4.145, but it is still reliable since the value is less than 5. The VIF under comfort & convenience construct is 1.558 for CA5, and the highest is INF3 with 4.361. The value of VIF is also reliable at Governance & Citizen Engagement construct with 1.400 for CP3 and the highest for EGov 2, 3.281

Table 7. Variance Inflation Factor (VIF)

Construct	Variables	Indicators	VIF
Safety & Security	Transport & Transit Safety (TTSafe)	TTSf1	4.145
		TTSf2	4.145
	Transport & Transit Security (TTSecure)	TTS1	2.479
		TTS2	3.043
		TTS3	1.905
Comfort & Convenience	Public Transport Density (PTD)	PTD1	2.562
		PTD2	3.095
		PTD3	1.953
		PTD4	2.530
	Accessibility (ACC)	ACC1	2.620
		ACC2	2.536
		ACC3	1.858
		ACC4	2.579
	Social Equity &	SEA1	2.446

Construct	Variables	Indicators	VIF
	Affordability (SEA)	SEA2	2.766
		SEA3	1.836
	Information (INF)	INF1	3.871
		INF2	4.361
		INF3	2.431
		INF4	3.055
	Comfort & Amenities (CA)	CA1	2.366
		CA2	1.856
		CA3	2.159
		CA4	2.076
		CA5	1.558
Governance & Citizen Engagement	Vision & Strategy (VS)	VS1	2.611
		VS2	2.611
	Citizen Participation (CP)	CP1	3.164
		CP2	3.196
		CP3	1.400
	E-government & Transparency (EGOV)	EGOV1	3.157
		EGOV2	3.281
		EGOV3	1.722

4.9.4 Reliability Analysis

Construct reliability is used to determine whether or not a model is reliable and whether or not a questionnaire is consistent. Cronbach's Alpha and Composite Reliability can be used to create a measurement scale. The construct is considered reliable if the Cronbach's Alpha and composite reliability values are greater than

0.70 and the Average Variance Extracted (AVE) value is greater than 0.50. Cronbach's alpha, composite reliability, and AVE are all higher in Transport & Transit Safety.

Table 8. Citizen Satisfaction Expectation Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE)

Indicators	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
TTSafe	0.931	0.967	0.935
TTSecure	0.864	0.917	0.786
PTD	0.887	0.922	0.746
ACC	0.878	0.916	0.733
SEA	0.859	0.914	0.781
INF	0.923	0.945	0.812
CA	0.863	0.901	0.646
VS	0.880	0.943	0.892
CP	0.827	0.895	0.743
EGOV	0.866	0.918	0.789

4.9.5 Convergent Validity

Convergent validity refers to the extent to which the construct converges to explain the variance of its indicators. Convergent validity can be measured using t-tests. A construct's convergent validity is evaluated using the metric known as the average variance extracted (AVE), which takes into account all of the indicators on the construct. As a consequence of this, the AVE is synonymous with the commonality of a construct. The minimum AVE that is considered acceptable is 0.50. (Hair Jr, Hult, Ringle, & Sarstedt, 2021). Items converge to measure the underlying construct and therefore establish convergent validity when the AVE value is greater than or equal to the recommended value of 0.50. (Fornell & Larcker, 1981).

Convergent Validity result based on Average Variance Extracted (AVE) in this study shows that all the construct was more significant than 0.50, the range is 0.646 for Comfort & Amenities (CA) as the lowest value and 0.935 for Transport & transit Safety (TTSafe) with value 0.935 it means there are no issues. The AVE value for each of the constructs shows in table 7.

4.9.6 Discriminant Validity

For the calculation of discriminant validity, the Fornell-Larcker (Fornell, 1981) criterion was used. To achieve this, the square root of the extracted variance (AVE) in the parentheses of the upper path in the first column must be greater than the correlations in the same column in the lines that follow. Every column must gratify the criterion. In the tables, the fact that this criterion is met for all subscales demonstrates the discriminant validity of the tested instrument. According to recent research cited by Henseler, Ringle, and Sarstedt (2015), however, the Fornell-Larcker criterion does not perform well and frequently fails to reliably identify discriminant validity issues; therefore, it should be avoided (Hair Jr, Hult, Ringle, Sarstedt, et al., 2021b). According to research conducted by Henseler et al. in 2015, assessing discriminant validity using the heterotrait-monotrait ratio (HTMT) of correlation can be used as an alternative strategy to address these issues. The HTMT is defined as the geometric mean of the average correlation between indicators measuring the same construct, divided by the mean value of correlations between indicators across constructs (Hair Jr, Hult, Ringle, Sarstedt, et al., 2021b).

Table 9. Fornell Larcker Criteria

	ACC	CA	CP	CSE	EGOV	INF	PTD	SEA	TTSafe	TTSecure	VS
ACC	**0.856**										
CA	0.674	**0.804**									
CP	0.415	0.608	**0.862**								
CSE	0.701	0.610	0.636	**0.713**							
EGOV	0.405	0.589	0.761	0.588	**0.888**						
INF	0.738	0.654	0.473	0.708	0.435	**0.901**					
PTD	0.776	0.569	0.385	0.634	0.387	0.679	**0.864**				
SEA	0.769	0.615	0.409	0.628	0.369	0.757	0.603	**0.884**			
TTSafe	0.615	0.402	0.294	0.625	0.258	0.587	0.597	0.496	**0.967**		
TTSecure	0.588	0.589	0.412	0.528	0.413	0.458	0.518	0.453	0.477	**0.887**	
VS	0.458	0.527	0.724	0.651	0.672	0.559	0.349	0.473	0.330	0.348	**0.945**

Table 10. Cross Loading

	ACC	CA	CP	CSE	EGOV	INF	PTD	SEA	TTSafe	TTSecure	VS
ACC1	**0.887**	0.631	0.385	0.628	0.376	0.651	0.709	0.673	0.572	0.558	0.413
ACC2	**0.870**	0.492	0.304	0.629	0.318	0.614	0.669	0.634	0.535	0.408	0.394
ACC3	**0.785**	0.685	0.375	0.513	0.356	0.565	0.547	0.620	0.437	0.583	0.397
ACC4	**0.879**	0.528	0.364	0.623	0.342	0.692	0.720	0.706	0.551	0.484	0.371
CA1	0.567	**0.859**	0.522	0.537	0.504	0.569	0.506	0.493	0.366	0.531	0.472
CA2	0.551	**0.803**	0.541	0.549	0.537	0.636	0.511	0.572	0.422	0.482	0.469
CA3	0.558	**0.830**	0.461	0.501	0.446	0.496	0.457	0.429	0.321	0.458	0.473
CA4	0.580	**0.826**	0.516	0.487	0.465	0.490	0.405	0.535	0.300	0.491	0.396
CA5	0.438	**0.692**	0.381	0.335	0.403	0.403	0.392	0.435	0.150	0.388	0.262
CP1	0.446	0.602	**0.933**	0.624	0.704	0.490	0.397	0.432	0.297	0.420	0.752
CP2	0.425	0.590	**0.935**	0.620	0.700	0.440	0.381	0.405	0.324	0.388	0.649
CP3	0.113	0.321	**0.697**	0.339	0.562	0.241	0.159	0.149	0.075	0.219	0.416
CSE1	0.439	0.427	0.471	**0.727**	0.481	0.445	0.353	0.411	0.318	0.285	0.481
CSE2	0.404	0.448	0.553	**0.706**	0.531	0.370	0.259	0.367	0.222	0.280	0.469
Egov1	0.385	0.561	0.737	0.567	**0.927**	0.468	0.325	0.398	0.269	0.383	0.700

	ACC	CA	CP	CSE	EGOV	INF	PTD	SEA	TTSafe	TTSecure	VS
Egov2	0.429	0.577	0.697	0.583	**0.935**	0.407	0.410	0.373	0.268	0.444	0.644
Egov3	0.232	0.409	0.583	0.388	**0.795**	0.250	0.284	0.171	0.121	0.241	0.399
H1	0.488	0.260	0.292	**0.703**	0.250	0.540	0.443	0.413	0.698	0.350	0.374
H2	0.689	0.535	0.384	**0.744**	0.317	0.644	0.732	0.546	0.656	0.606	0.389
H3	0.427	0.489	0.597	**0.680**	0.562	0.475	0.386	0.468	0.250	0.299	0.627
INF1	0.694	0.571	0.401	0.633	0.376	**0.916**	0.649	0.742	0.528	0.399	0.503
INF2	0.707	0.619	0.421	0.649	0.385	**0.926**	0.615	0.730	0.602	0.454	0.467
INF3	0.632	0.583	0.453	0.626	0.411	**0.866**	0.562	0.656	0.437	0.371	0.583
INF4	0.625	0.585	0.430	0.643	0.396	**0.897**	0.620	0.600	0.545	0.427	0.463
PTD1	0.723	0.587	0.419	0.623	0.374	0.643	**0.879**	0.548	0.559	0.487	0.347
PTD2	0.664	0.490	0.322	0.578	0.319	0.629	**0.907**	0.544	0.552	0.491	0.325
PTD3	0.553	0.326	0.276	0.421	0.290	0.459	**0.788**	0.449	0.434	0.334	0.204
PTD4	0.723	0.522	0.296	0.540	0.347	0.585	**0.876**	0.531	0.502	0.455	0.306
SEA1	0.641	0.466	0.304	0.504	0.288	0.652	0.495	**0.879**	0.446	0.337	0.378
SEA2	0.741	0.594	0.388	0.587	0.366	0.736	0.600	**0.915**	0.503	0.470	0.447
SEA3	0.650	0.560	0.385	0.567	0.320	0.614	0.497	**0.856**	0.365	0.386	0.423

	ACC	CA	CP	CSE	EGOV	INF	PTD	SEA	TTSafe	TTSecure	VS
TTS1	0.533	0.455	0.315	0.517	0.314	0.424	0.516	0.409	0.529	**0.902**	0.281
TTS2	0.492	0.562	0.378	0.477	0.388	0.410	0.422	0.422	0.406	**0.925**	0.349
TTS3	0.545	0.566	0.420	0.399	0.411	0.383	0.437	0.373	0.311	**0.830**	0.297
TTSf1	0.577	0.362	0.286	0.623	0.256	0.572	0.569	0.453	**0.969**	0.422	0.352
TTSf2	0.613	0.418	0.283	0.585	0.243	0.563	0.587	0.509	**0.965**	0.503	0.284
VS1	0.426	0.477	0.702	0.583	0.642	0.491	0.304	0.423	0.287	0.341	**0.939**
VS2	0.440	0.517	0.669	0.644	0.629	0.561	0.353	0.468	0.333	0.317	**0.950**

The values of the cross-loading factor are shown in the table above. From this study, all the deals in cross-loading work well where the relationship between variable build well, and there is no issue. For the example, we can see the cross-loading for accessibility, where the value of each item under accessibility (acc1, acc2, acc3, acc4) has a greater value compared with other things under different variables.

Table 11. Heterotrait-Monotrait Ratio (HTMT)

	ACC	CA	CP	CSE	EGOV	INF	PTD	SEA	TTSafe	TTSecure	VS
ACC											
CA	0.779										
CP	0.450	0.687									
CSE	0.837	0.735	0.784								
EGOV	0.452	0.668	0.898	0.726							
INF	0.818	0.723	0.519	0.828	0.472						
PTD	0.869	0.632	0.417	0.731	0.433	0.741					
SEA	0.883	0.708	0.449	0.762	0.407	0.848	0.684				
TTSafe	0.677	0.434	0.307	0.713	0.275	0.632	0.652	0.555			
TTSecure	0.685	0.685	0.477	0.625	0.470	0.512	0.582	0.521	0.524		
VS	0.523	0.591	0.826	0.800	0.750	0.619	0.386	0.540	0.362	0.401	

The value for HTMT that Henseler suggested must be lower than 0.90 for the structural model with conceptually similar constructs, like cognitive satisfaction, loyalty, and affective satisfaction. A value lower than 0.85 are recommended.

We were recommended for different conceptual constructs. If the value of HTMT is under 0.90 or 0.85, a bootstrap confidence interval can be used to test discriminant validity (Henseler et al., 2015). The result of HTMT in this study is shown in table Heterotrait-Monatrait Ratio. Based on the result of this study, there is no issue with HTMT value. All variables showed a value less than 0.90 even though we found some values nearly to 0.90, such as the relationship with information (INF) and Accessibility (ACC) with 0.818, Egov (EGOV) with citizen participation value of 0.898, Social Equity and Affordability (SEA) with Accessibility 0.883, and SEA with Information 0.848.

4.9.7 Validating Higher Construct

After the model was validated or established based on the measurement result at the first stage, the next step is validating the higher model construct or measuring all the hypotheses in our study. Safety and Security were the higher order construct based on two lower-order constructs, transport & transit safety and transport & transit security. The second higher construct is Comfort & convenience, with five lower-order constructs public transport & density, accessibility, social equity & affordability, information, and comfort & amenities. The last higher construct is governance and citizen engagement, with three lower constructs vision & strategy, citizen participation, and e-government & transparency. To establish the higher model construct validity, outer weights, outer loading, and VIF.

4.9.8 Bootstrapping

Whether or not the path coefficients (beta) are statistically significant can be determined with the help of the bootstrapping method, a non-parametric procedure (Streukens & Leroi-Werelds, 2016). Bootstrapping is a statistical method for making population-level estimates from a large number of sample sizes. To create a sample, we pick individual observations at random from a much larger data sample and then add them back in after we've done our analysis. This makes it possible to repeat an observation multiple times within a constrained space. Replacement sampling is the term for this kind of sampling method. The software is instructed to run the calculation 5000 times in order to efficiently determine if the tested model is statistically significant. Twelve of the values in the table are statistically significant (p 0.01).

Table 12. Higher Order Measurement

Higher Order Construct	Lower Order Construct	Outer Weight	T Statistics	P Values	Outer Loadings	VIF
Safety & Security	TTSafe	0.707	7.798	0.000	0.920	1.295
	TTSecure	0.446	4.435	0.000	0.784	1.295
Comfort & Convenience	PTD	0.160	1.815	0.070	0.828	2.718
	ACC	0.316	3.132	0.002	0.915	4.276
	SEA	0.041	0.455	0.649	0.819	3.083
	INF	0.423	4.104	0.000	0.922	3.108
	CA	0.193	2.196	0.028	0.799	2.049
Governance & Citizen Engagement	VS	0.518	3.991	0.000	0.930	2.270
	CP	0.376	3.179	0.001	0.910	2.958
	EGOV	0.209	1.574	0.116	0.843	2.566
Citizen Satisfaction Expectation	CSE1	0.258	12.007	0.000	0.729	1.868
	CSE2	0.245	8.718	0.000	0.710	1.867
	H1	0.272	7.404	0.000	0.694	1.456
	H2	0.339	9.186	0.000	0.744	1.509
	H3	0.288	10.797	0.000	0.685	1.327

4.9.9 Structural Model

The structural model was used to test our hypothesis. Furthermore, bootstrapping is used to assess the direct effects of all hypothesized relationships as represented by statistical testing of the hypotheses. The hypothesis is supported if t > 1.96. As previously stated, the study has three main hypotheses and ten supporting hypotheses that must be tested at a statistical significance level of 5%. the hypothesis result show in table13 below.

Table 13. Hypothesis Result

Hypothesis	Outer Weight	T Statistics	P Values	Result
TTSafe -> Safe & Security (H1a)	0.707	7.798	0.000	Supported
TTSecure -> Safe & Security (H1b)	0.446	4.435	0.000	Supported
PTD -> Comfort & Convenience (H2a)	0.160	1.815	0.070	***Not supported***
ACC -> Comfort & Convenience (H2b)	0.316	3.132	0.002	Supported
CA -> Comfort & Convenience (H2c)	0.193	2.196	0.028	Supported
INF -> Comfort & Convenience (H2d)	0.423	4.104	0.000	Supported
SEA -> Comfort & Convenience (H2e)	0.041	0.455	0.649	***Not supported***
VS -> Gov & Eng (H3a)	0.518	3.991	0.000	Supported
CP -> Gov & Eng (H3b)	0.376	3.179	0.001	Supported
EGOV -> Gov & Eng (H3c)	0.209	1.574	0.116	***Not supported***
H1 <- CSE (H1)	0.272	7.404	0.000	Supported
H2 <- CSE (H2)	0.339	9.186	0.000	Supported
H3 <- CSE (H3)	0.288	10.797	0.000	Supported
CSE1 <- CSE	0.258	12.007	0.000	Supported
CSE2 <- CSE	0.245	8.718	0.000	Supported

The SEM estimation results show Citizen Satisfaction Expectation in mobility has a positive relationship and correlation with safety and security, comfort & convenience, and E-governance and citizen engagement. The result of safety and security show β coefficient = 0.272; t-value = 7.404, and this estimate is statistically significant at $p = 0.000$. This was followed by comfort & convenience with $\beta = 0.339$; t-value = 9.186; $p = 0.000$; e-governance and citizen engagement with $\beta = 0.288$; t-value = 10.797; $p = 0.000$. Three constructs have proven to have a significant relationship with citizen satisfaction expectations. Thus, H1, H2, and H3 are supported.

In this study, the analysis result shows that all the first-order variables are used to evaluate the second-order variable. Under the safety and security construct, we find both hypotheses were accepted because the path coefficient of transport and transit safety were $\beta = 0.707$; $p = 0.000$; $t = 7.798$ and transit and transport safety were $\beta = 0.446$; $p = 0.000$; $t = 4.435$, hence, those two hypotheses H1a, H1b were supported.

Meanwhile, three variables under comfort and convenience were supported with the result for accessibility $\beta= 0.316$; $p = 0.002$; $t = 3.132$; comfort and amenities $\beta = 0.193$; $p = 0.028$; $t = 2.196$; and information $\beta = 0.423$; $p = 0.000$; $t = 4.104$; therefore hypothesis H2b, H2c, H2d were supported. Meanwhile, two variables under comfort and convenience were not supported because of the value for public transport and density $\beta = 0.160$; $p = 0.070$; $t = 1.815$; and social equity and affordability with $\beta = 0.041$; $p = 0.645$; $t = 0.455$; so it is not statistically significant. Thus, hypotheses H2a and H2e were not supported.

The last was the result of the construct of governance and citizen engagement. The vision and strategy have $\beta = 0.518$; $p = 0.000$; $t = 3.991$; and the citizen participation $\beta = 0.376$; $p = 0.001$; $t = 3.179$; therefore, both of these hypotheses, H3a and H3b were accepted and had a significant impact, but one of the hypothesis for H3c, e-government and transparency were not supported because of the insignificant result with $\beta = 0.209$; $p = 0.0116$; $t = 1.574$.

4.10 Analysis Result Summary and Discussion

This study showed that the construct of our model has a significant result, where all three main hypotheses for the impact of safety and security, comfort and convenience, and governance and citizen engagement were accepted. Some indicators are still rejected (public transport and density, social equity and affordability, and e-government and transparency). Even though the result was insignificant, the indicator was not removed because the impact of the p-value and original sample based on outer loading computation were all higher than 0.7.

The analysis result summary is divided into two; supported and rejected results as below:

a. Supported Result

- The supported result is a guide to the government and public transportation providers as a minimum standard in smart mobility transportation systems based on citizen satisfaction expectations. Even though each mode of transportation serves a unique function, public transportation facilities must be accessible and meet their citizens' needs to succeed (Chauhan et al., 2021)
- Future mobility systems must guarantee the availability of transport and transit safety, transport and transit security, accessibility, information, comfort and amenities, vision & strategy, and citizen participation. These

findings will shed new light on the service quality of multimodal hubs and assist the government, transport planners, and operating companies in formulating policies that increase passenger satisfaction, enhance the hub's mobility, accessibility, and facilities, and make the transfer and use public transportation more comfortable for the citizens (Chauhan et al., 2021)

b. Not Supported Result

The finding of this study shows some rejected/unsupported results. It means government and public transport providers must focus on providing this gap.

- Public transport density, social equity & affordability, and e-government and transparency. It means the new capital government must guarantee the availability of transportation to an adequate number.
- Social equity and affordability; government must provide a mobility system that guarantees the rights of vulnerable people like women, children, the elderly, and people with disability. It means all citizens have equal access to mobility facilities. Even though each transportation facility has been constructed for a specific purpose, it must be user-friendly so that citizens can select their preferred mode, and services must meet their expectations (Chauhan et al., 2021)
- E-government and transparency; It means citizen trust in government is low. The government's predominant ambition in using ICT is to improve the relationships between the citizens and the state through e-government channels inclusively, transparent, open, and collaborative, and stimulate citizen participation actively (Twizeyimana & Andersson, 2019a) the good

response of e-government can create service, quality, and trust where the government can sustain their performance and make citizen satisfied (Yotawut, 2018). The primary goal of government websites is to provide value to the public. It makes government services more efficient, practical, quick, and simple. This goal-oriented perspective of e-government studies contributed to discovering new relationships between government and citizens as partners in co-creating public value in networked governance, focusing on citizens' roles. Transparency, information suitability, service quality, security, and citizen engagement are the five essential factors in e-government

Chapter 5. Discussion and Policy Implication

5.1 Discussion

In cities all over the globe, officials aim to use innovation to improve the urban landscape and enhance citizens' quality of life. To achieve positive transformations, local and national governments must be agile and responsive to citizens' needs. In recent years, this has involved governments introducing digital services. Generally, governments’ main ambition in providing digital services is to improve the relationship between citizens and the state through e-government channels that are inclusive, transparent, open, and collaborative, and that can stimulate citizen participation (Twizeyimana & Andersson, 2019a). Positive citizen responses to e-government can improve service, quality, and trust, such that the government can sustain its performance and satisfy citizens (Yotawut, 2018).

Smart mobility is a fundamental aspect of the smart city concept, and can help connect various features of smart city development. Understanding the characteristics of smart mobility is important in the initial stages of smart city creation, especially for cities being built from scratch. As smart city ideas have become more widespread, a variety of innovative mobility services and new types of vehicle have been introduced, with more predicted to be available shortly. Such services are viewed not only as innovations but also as disruptive.

New public transportation infrastructure requires tremendous amounts of money and time (J. Lee et al., 2020b). Transport policymaking is thus accustomed to long implementation periods. Yet the development period for new mobility services is shorter, and policymaking must therefore be adaptable to new innovative services, such as MaaS and connected, autonomous and electric vehicles (CAEVs), that arise through technological advancement (Shibayama & Emberger, 2020).

This study combined expert judgment with assessment of citizen expectations to inform the development of a smart city in Indonesia’s new capital. For any public transportation system, user satisfaction is a crucial indicator of service quality (Mandhani et al., 2020). Thus, by understanding citizens’ expectations, the Indonesian government can consider optimal strategies to optimize development of the transportation system in the new capital. Findings from this study will assist decision-makers in implementing suitable public transportation strategies and enhancing service quality (Chauhan et al., 2021; R. de Oña et al., 2014). Unfortunately, many cities appear to be pursuing urban mobility development without giving sufficient thought to the actual needs of their citizens. It is crucial that all stakeholders have a better understanding of the characteristics of smart transportation and of the factors that affect service quality (Chauhan et al., 2021). Collaboration among stakeholders will reduce gaps in knowledge and improve smart mobility implementation.

To bridge and make smart mobility strategy more comprehensive, citizen satisfaction expectations can contribute as an insight for the government. The result of this study show three indicators were rejected: public transport and density, social equity and affordability, and e-government and transparency. Since most of the variables are used in the previous study, accepted hypotheses give insight to the government for developing smart mobility projects and services based on citizen expectations. Still, let us focus more on the not supported hypotheses. Since this is about citizen satisfaction expectation, not supported means, the government and the transportation authorities need to focus on this area because of low trust and need a lot of improvement to provide a better of smart mobility system.

Table The result from chapter 3 show about expert judgment result will link with the result of chapter 4 from the citizen side, and discuss in the sub-chapter below.

Table 14. The link between expert judgement and citizen satisfaction expectation

No	Government	Citizen Satisfaction Expectation	Discussion Focus
a)	Infrastructure Availability and Accessibility characteristics	Public Transport Density, Social Equity and Affordability	Availability, Accessibility, and Equity
b)	Political & Regulatory and Socio Economic factors	Public Transport Density and Social Equity & Affordability	Political & Regulatory Factors
c)	Delivery Channel, Digital Divide, Socio	E-governance & Transparency	The Digital Divide and

	Economic factors		Citizen Engagement

5.1.1 Availability, Accessibility, and Equity

Physical infrastructure is the starting point for every smart city project (Appio et al., 2019b), and appropriate public transport infrastructure enhances accessibility (E. Sdoukopoulos et al., 2016a). Lack of basic infrastructure causes weaker service performance, while better infrastructure encourages faster and more radical changes in socio-economic development (Altmann et al., 2017). Public transportation density is related to citizen comfort and convenience, especially in relation to mass transportation such as metro/subway and Bus Rapid Transit (BRT) networks. The implementation of BRT is supposed to improve service quality and rider satisfaction, as it has the potential to offer a better service than regular bus lines. Factors contributing to higher service quality include bus-only lanes, fare prepayment systems, customer information, limited stops, and high-capacity vehicles. By incorporating these features, BRT is typically superior to traditional bus networks in terms of travel time, passenger comfort, frequency of service, and schedule dependability (Zheng et al., 2021).

Citizens expect public transportation to be convenient and not overcrowded, particularly during peak hours. Recent assessments of transportation conditions in Indonesia indicate that the new transportation system may not provide the drastic changes citizens expect. More serious government attention is required to achieve adequate levels of availability and convenience. Failure to do this will cause resistance among people considering using public transport. Concern must also be given to availability and accessibility for vulnerable people including women, children, the elderly, and those with disabilities, to ensure these individuals can access services equitably. Policymakers must put more effort into facilitating transport for vulnerable citizens. Another important consideration is cost, as people will only use public transportation if it is affordable.

5.1.2 Political and Regulatory Factors

A vast range of economic, social, and political factors impact urban mobility (Zheng et al., 2021). Governments must collaborate with all transportation stakeholders to formulate policies and guidelines to improve service quality, which will ultimately lead to increased user satisfaction (Chauhan et al., 2021). When formulating an urban smart mobility strategy, policymakers must provide a detailed action plan that outlines how its transport system will offer citizens convenience. The vision and strategy of smart urban mobility must guarantee affordability and social equity, and regulation and guidance should be put in place to ensure inclusivity. As Ibrahim et al. (2018) mention, the most critical aspects of a smart city development roadmap are readiness and design of the city blueprint. Before agreeing on a vision of city transformation and associated strategies and aims, any proposed roadmap should examine the city's economic, environmental, social, and political state and evaluate the city's current features (Ibrahim et al., 2018).

Smart mobility services are a disruptive innovation that can impact the socio-economic and political status quo and cause a number of controversies. Success factors in implementing smart mobility services differ between countries. A key issue is whether national governments view new technologies as advantageous or not. Another issues in the introduction of smart mobility services is regulation. Many governments have shown themselves to be inflexible when faced with new forms of smart mobility services, and lack of adequate regulation has impacted economies as well as citizen satisfaction (J. Lee et al., 2022)

5.1.3 The Digital Divide and Citizen Engagement

Digital transformation and industrial automation over the last few decades have caused unprecedented changes to every aspect of human life and society. The world has most certainly gone digital, and the widespread adoption of technology continues to increase. As part of this, governments have been forced to transform how they serve citizens. This new era of digital government is referred to as e-government. The main goal of e-government is to deliver public value (T. (David) Lee et al., 2021; Lee-Geiller & Lee, 2019). Government websites should provide service more efficiently, practically, and accessibly. Ideally, these services should strengthen relations between government and citizens, producing public value through collaboration and participation (Jaspers & Steen, 2021).

There are now two delivery channels through which governments deliver their services: traditional, including telephone call center services, or face-to-face appointments; and digital, including websites and mobile devices. Digital channels can be used as medium for governments to increase public trust (C. Reddick et al., 2020; C. G. Reddick & Turner, 2012). A critical factor in the uptake of digital channel among citizens is technological capacity, meaning whether individuals have internet access, skills, trust in the internet, and acceptance of new technology. Encouraging citizens to utilize government channels is essential because it facilitates participation. Governments should aim to configure and adapt services based on demographic factors such as as age and gender to ensure they are effective and inclusive. Regarding government adoption of mobile channels, termed m-government, it should be acknowledged that uptake will not be automatic. The design and implementation of digital tools that are engaging for users is essential (Rodriguez Müller et al., 2021).

5.2 Policy Implication

Cities struggling with high populations face difficulties in providing adequate transportation. New ideas are required to meet public transportation needs, as these difficulties will not be solved through expanding traditional transport infrastructure such as roads. Innovation in mobility and transportation as an effect of smart city development, like ride-hailing, car-sharing, car-pooling, Mobility as a Service, electric vehicles, autonomous vehicles, and so on, seems to be a panacea of this mobility issues (J. Lee et al., 2020b). Unfortunately, most innovation is not supported by policy and regulation. Public transport authorities may find it too difficult to diversify or extend their role in the new agenda of smart mobility, and it cause of the transformation could take years. The public transport authorities frequently may take less time to regulate to enable the smart mobility concept, and like many other public authorities, transport authorities' bureaucracy may slow down the penetration of mobility innovation (Kamargianni & Matyas, 2017b)

Through attaining expert judgments, this study outlines the most notable characteristics of smart mobility and highlights factors that can support smart mobility systems. Citizen expectations about smart mobility in the new capital have also been assessed. These indicators provide insights for the national government to create a strategy or improve its existing strategy based on citizen needs. We found that citizens did not rate e-government services and transparency as significant factors affecting their satisfaction. It may be alarming to the government that many citizens do not have high trust in the government, though the finding is consistent with that of a previous study which concluded that governments should improve policy communication with citizens to promote integrity and foster collaboration. To enhance the precision and effectiveness of policy communication, governments should establish transparent procedures to disseminate government information. This will gradually increase partners' and citizens' confidence in engaging with the government and working collaboratively on the creation of new public policies and services. For collaborative governance and data-driven economic growth, policy measures to improve publicly available information literacy and civic knowledge are needed (T. Lee et al., 2020).

Governments tend to respond slowly to new technology, both in terms of adoption and regulation. Smart mobility concepts are no different. The dynamic and fast-changing smart mobility ecosystem and associated business models require a rapid and flexible government response, yet it could take years for such a shift to occur. Current systems of bureaucracy will likely slow smart mobility innovation and penetration (Kamargianni & Matyas, 2017b). Another consideration is that many public transport authorities are not-for-profit organizations. As such, they may not have sufficient incentives to adapt, or may be constrained by law in their capacity to develop mobility services that could enhance citizens' travel experience (Kamargianni & Matyas, 2017b).

Based on the study results, some policy recommendations to the government:

- The government must establish a smart mobility ecosystem. Smart mobility is a huge project involving various stakeholders. The government must support it with adequate infrastructure and planning, and aim to collaborate with all stakeholders working in this area.
- Smart mobility projects will require large budgets to implement. Public-private partnerships are one mechanism through which to generate large funds (Chauhan et al., 2021).
- The government must create an economic environment that is conducive to investment.
- The government needs to convince citizens to participate in government actively through an education campaign.
- An incentive program should be developed for government officials and citizens. The government should offer incentives to citizens who actively participate in government projects or policies. Similar incentives could be provided to government officials encouraging this participation.

5.3 Limitation & Future Research

The findings of this study provide a foundation for governments, policymakers, managers, and others involved in designing and formulating smart city and smart mobility projects in developing countries such as Indonesia. Nonetheless, some limitations of the study should be noted:

1. Findings were derived through the opinions of experts and specialists. Future studies could modify the sample size, structure, and questions to reduce the impact of any biases that may be inherent in expert opinion.
2. Different Multi-Criteria Decision Methods (MCDM), or other alternative methods of utilizing expert judgment opinion such as the Q-Method could be applied to the same research problem. Future studies could apply these methods and compare findings with those of this study.
3. Regarding the citizen expectation survey, respondents were all located on Java island and concentrated in Jakarta and Bandung. Different expectations may be expressed by people living outside Java. People living in Jakarta may have a more developed view of future mobility issues as transportation in the current capital is more complex and well-established.
4. Citizen satisfaction expectations reported here are based on Indonesian perspectives, and a limited number of factors are reported. Future research may reveal additional factors, and may consider more complex models of analysis including moderator variables based on data from more diverse samples.

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Appendix 1: Smart Mobility Characteristics Questionnaire

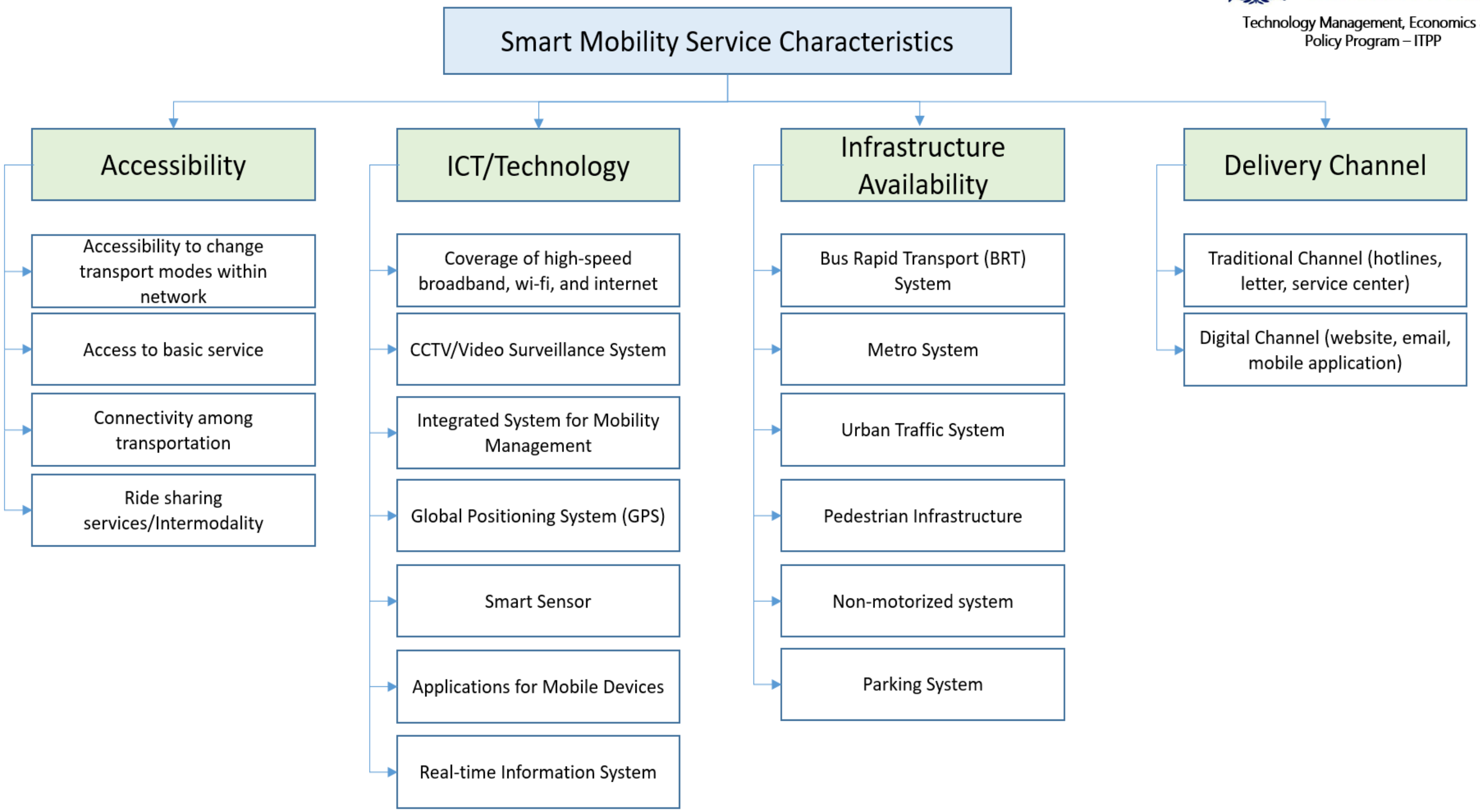
Smart Mobility Characteristics to develop the implementation of smart mobility project in the new capital of Indonesia:

Dear respondents:

Thanks for participating in this survey, which is designed for a thesis entitled "A Study of Readiness and Maturation of Smart City Development: Implementing New Smart Capital of Indonesia" This thesis is undertaken by **Yuri Olivia**, under the supervision of Professor **Junseok Hwang**.

This survey is in order to study the characteristics and factors of smart mobility project that feasible to implement in the new capital of Indonesia by collect the specialist's opinion. In this respect, four main characteristics and 19 sub-characteristics have been identified, and the Analytical Hierarchy Process model has been employed to prioritize them. Therefore, the specialists answered the pair-wise questions to compare the primary and sub-criteria relative importance to seek their judgement.

All your response to this survey will be confidential and used only for academic purpose. The information provided by the participants will not be disclosed. If you have any comments, suggestions or questions about this survey are welcome, kindly contact us via email at yuri_olivia@snu.ac.kr or uwi_cumil@yahoo.com


Smart Mobility Service Characteristics
Accessibility
Accessibility to change transport modes within network
Access to basic service
Connectivity among transportation
Ride sharing services/Intermodality
ICT/Technology
Coverage of high-speed broadband, wi-fi, and internet
CCTV/Video Surveillance System
Integrated System for Mobility Management
Global Positioning System (GPS)
Smart Sensor
Applications for Mobile Devices
Real-time Information System
Infrastructure Availability
Bus Rapid Transport (BRT) System
Metro System
Urban Traffic System
Pedestrian Infrastructure
Non-motorized system
Parking System
Delivery Channel
Traditional Channel (hotlines, letter, service center)
Digital Channel (website, email, mobile application)

Guideline to fill the questionnaire

Selecting numerical scales for pair-wise comparisons was presented in Table 1

Table 1. Selecting numerical scales for pair-wise comparisons

Explanation	Numeric scale
If A is EXTREMELY MORE IMPORTANT than B	1
If A is VERY STRONGLY MORE IMPORTANT than B	2
If A is STRONGLY MORE IMPORTANT than B	3
If A is MODERATELY MORE IMPORTANT than B	4
If A and B are EQUALLY IMPORTANT	5
If B is MODERATELY MORE IMPORTANT than A	6
If B is STRONGLY MORE IMPORTANT than A	7
If B is VERY STRONGLY MORE IMPORTANT than A	8
If B is EXTREMELY MORE IMPORTANT than A	9

How to make the pair-wise comparison? An empirical example

According to the scales shown in Table 1, please select the relative weight of your chosen characteristic.

Option A	**Extremely**	**Very Strongly**	**strongly**	**Moderately**	**equally**	**Moderately**	**strongly**	**Very Strongly**	**Extremely**	**Option B**
Accessibility	1	2	3	4	5	6	7	8	9	Infrastructure Availability

Option A (Accessibility) is Extremely important characteristic for smart mobility services to option B (Infrastructure Availability)

Option A (Accessibility) and option B (Infrastructure Availability) are equally important characteristic for smart mobility services

Option B (Infrastructure Availability) is extremely important characteristic for smart mobility services to option A (Accessibility)

Pair-Wise Comparison (Level 1)

Please rank the following main characteristic in order of importance

The rank of the importance of the main characteristic

Characteristics	Rank
Accessibility	( )
ICT/Technology	( )
Infrastructure Availability	( )
Delivery Channel	( )

What is the more important factor of smart mobility that contribute in smart mobility project?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Accessibility	1	2	3	4	5	6	7	8	9	ICT/Technology
Accessibility	1	2	3	4	5	6	7	8	9	Infrastructure Availability
Accessibility	1	2	3	4	5	6	7	8	9	Delivery Channel
ICT/Technology	1	2	3	4	5	6	7	8	9	Infrastructure Availability
ICT/Technology	1	2	3	4	5	6	7	8	9	Delivery Channel
Infrastructure Availability	1	2	3	4	5	6	7	8	9	Delivery Channel

Pair-Wise Comparison (Level 2)

Please rank the Accessibility sub-characteristic of smart mobility project/service in order of importance.

The rank of the importance of Accessibility sub-characteristic

Characteristics	Rank
Accessibility to change transport modes within network	( )
Access to basic service	( )
Connectivity among transportation	( )
Ride sharing services/Intermodality	( )

What is the more important component of the accessibility sub-criteria that contributes to the success of smart mobility project

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Accessibility to change transport modes within network	1	2	3	4	5	6	7	8	9	Access to basic service
Accessibility to change transport modes within network	1	2	3	4	5	6	7	8	9	Connectivity among transportation
Accessibility to change transport modes within network	1	2	3	4	5	6	7	8	9	Ride-sharing services/ Intermodality
Access to basic service	1	2	3	4	5	6	7	8	9	Connectivity among transportation
Access to basic service	1	2	3	4	5	6	7	8	9	Ride-sharing services/ Intermodality
Connectivity among transportation	1	2	3	4	5	6	7	8	9	Ride-sharing services/ Intermodality

Please rank the ICT/Technology sub-characteristic of smart mobility project/service in order of importance

The rank of the importance of ICT/Technology sub-characteristic

Characteristics	Rank
Coverage of high-speed broadband, Wi-fi, and internet	( )
CCTV/Video Surveillance System	( )
Integrated System for Mobility Management	( )
Global Positioning System (GPS)	( )
Smart Sensor	( )
Applications for Mobile Devices	( )
Real-time Information System	( )

What is the more important component of the ICT/Technology sub-criteria that contributes to the success of smart mobility service/project?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Coverage of high-speed broadband, wi-fi, and internet	1	2	3	4	5	6	7	8	9	CCTV/Video Surveillance System
Coverage of high-speed broadband, wi-fi, and internet	1	2	3	4	5	6	7	8	9	Integrated System for Mobility Management
Coverage of high-speed broadband, wi-fi, and internet	1	2	3	4	5	6	7	8	9	Global Positioning System (GPS)
Coverage of high-speed broadband, wi-fi, and internet	1	2	3	4	5	6	7	8	9	Smart Sensor
Coverage of high-speed broadband, wi-fi, and internet	1	2	3	4	5	6	7	8	9	Applications for Mobile Devices
Coverage of high-speed broadband, wi-fi, and internet	1	2	3	4	5	6	7	8	9	Real-time Information System
CCTV/Video Surveillance System	1	2	3	4	5	6	7	8	9	Integrated System for Mobility Management
CCTV/Video Surveillance System	1	2	3	4	5	6	7	8	9	Global Positioning System (GPS)
CCTV/Video Surveillance System	1	2	3	4	5	6	7	8	9	Smart Sensor
CCTV/Video Surveillance System	1	2	3	4	5	6	7	8	9	Applications for Mobile Devices
CCTV/Video Surveillance System	1	2	3	4	5	6	7	8	9	Real-time Information System
Integrated System for Mobility Management	1	2	3	4	5	6	7	8	9	Global Positioning System (GPS)
Integrated System for Mobility Management	1	2	3	4	5	6	7	8	9	Smart Sensor
Integrated System for Mobility Management	1	2	3	4	5	6	7	8	9	Applications for Mobile Devices
Integrated System for Mobility Management	1	2	3	4	5	6	7	8	9	Real-time Information System
Global Positioning System (GPS)	1	2	3	4	5	6	7	8	9	Smart Sensor
Global Positioning System (GPS)	1	2	3	4	5	6	7	8	9	Applications for Mobile Devices
Global Positioning System (GPS)	1	2	3	4	5	6	7	8	9	Real-time Information System
Smart Sensor	1	2	3	4	5	6	7	8	9	Applications for Mobile Devices
Smart Sensor	1	2	3	4	5	6	7	8	9	Real-time Information System
Applications for Mobile Devices	1	2	3	4	5	6	7	8	9	Real-time Information System

Please rank the Infrastructure Availability sub-characteristic of smart mobility project/service in order of importance

The rank of the importance of Infrastructure Availability sub-characteristic

Sub - Characteristics	**Rank**
Bus Rapid Transport (BRT) System	( )
Metro/Subway System	( )
Urban Traffic System	( )
Pedestrian Infrastructure	( )
Non-motorized system	( )
Parking System	( )

What is the more important component of the Infrastructure Availability sub-criteria that contributes to the success of smart mobility service/project implementation?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Bus Rapid Transport (BRT) System	1	2	3	4	5	6	7	8	9	Metro/Subway System
Bus Rapid Transport (BRT) System	1	2	3	4	5	6	7	8	9	Urban Traffic System
Bus Rapid Transport (BRT) System	1	2	3	4	5	6	7	8	9	Pedestrian Infrastructure
Bus Rapid Transport (BRT) System	1	2	3	4	5	6	7	8	9	Non-motorized system
Bus Rapid Transport (BRT) System	1	2	3	4	5	6	7	8	9	Parking System
Metro/Subway System	1	2	3	4	5	6	7	8	9	Urban Traffic System
Metro/Subway System	1	2	3	4	5	6	7	8	9	Pedestrian Infrastructure
Metro/Subway System	1	2	3	4	5	6	7	8	9	Non-motorized system
Metro/Subway System	1	2	3	4	5	6	7	8	9	Parking System
Urban Traffic System	1	2	3	4	5	6	7	8	9	Pedestrian Infrastructure
Urban Traffic System	1	2	3	4	5	6	7	8	9	Non-motorized system
Urban Traffic System	1	2	3	4	5	6	7	8	9	Parking System
Pedestrian Infrastructure	1	2	3	4	5	6	7	8	9	Non-motorized system
Pedestrian Infrastructure	1	2	3	4	5	6	7	8	9	Parking System
Non-motorized system	1	2	3	4	5	6	7	8	9	Parking System

Please rank the Delivery Channel sub-characteristic of smart mobility project/service in order of importance

The rank of the importance of Delivery Channel Sub - characteristic

Characteristics	Rank
Traditional Channel (hotlines, letter, service center)	( )
Digital Channel (website, email, mobile application)	( )

What is the more important component of the Delivery Channel sub-criteria that contributes to the success of smart mobility service/project implementation?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Traditional Channel (hotlines, letter, service center)	1	2	3	4	5	6	7	8	9	Digital Channel (website, email, mobile application)

Demographic Information (Please check (√) for the answer)

1. Specify your gender?

   ☐Male ☐Female

2. Specify your age group?

   ☐18-25 ☐26-40 ☐41-60 ☐> 60

3. What is the highest level of education you have completed?

   ☐High school ☐Bachelor ☐Master ☐Doctorate

4. What is the nature of organization you are working for?

   ☐Academia ☐Private sector ☐Government ☐Self Employed

5. What is the name of your organizations?

   ____

6. What is your position in your organizations?

   ____

7. How much working experience do you have?

   ☐1~years ☐3~5 years ☐5~8 years ☐8~10 Years ☐More than 10 ye

Appendix 2: Smart Mobility Factors Questionnaire

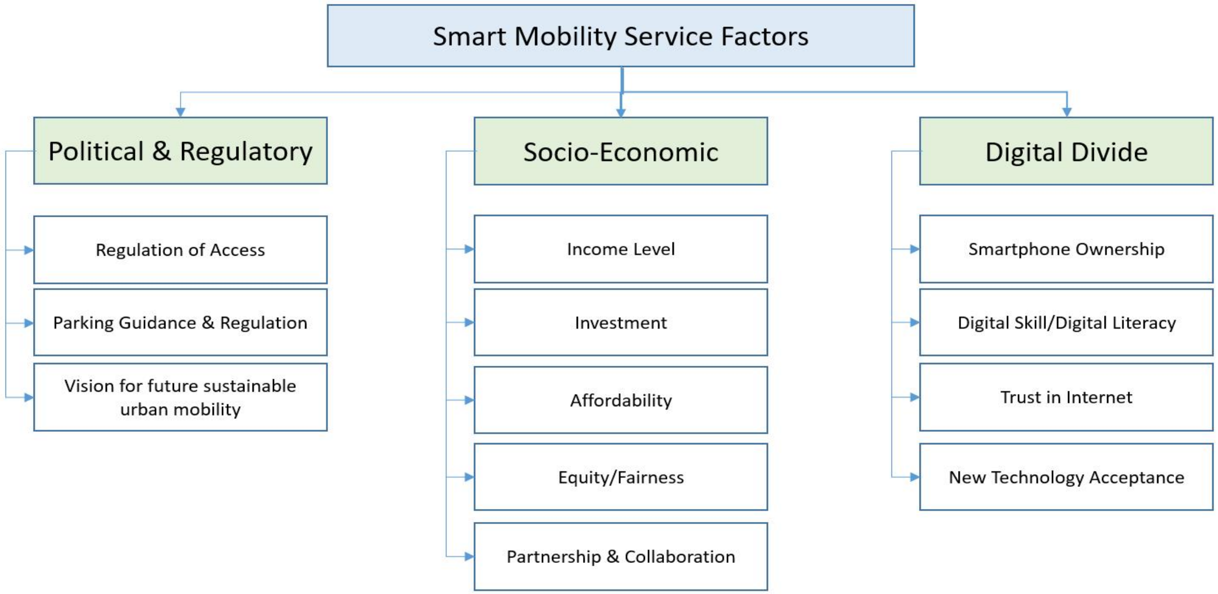
Smart Mobility Factors to develop the implementation of smart mobility project in the new capital of Indonesia:

Dear respondents:

Thanks for participating in this survey, which is designed for a thesis entitled "A Study of Readiness and Maturation of Smart City Development: Implementing New Smart Capital of Indonesia" This thesis is undertaken by **Yuri Olivia**, under the supervision of Professor **Junseok Hwang**.

This survey is in order to study the factors of smart mobility project that feasible to implement in the new capital of Indonesia by collect the specialist's opinion. In this respect, three main factors (12 sub-factors) have been identified, and the Analytical Hierarchy Process model has been employed to prioritize them. Therefore, the specialists answered the pair-wise questions to compare the primary and sub-criteria relative importance to seek their judgement.

All your response to this survey will be confidential and used only for academic purpose. The information provided by the participants will not be disclosed. If you have any comments, suggestions or questions about this survey are welcome, kindly contact us via email at yuri_olivia@snu.ac.kr or uwi_cumil@yahoo.com


Smart Mobility Service Factors
Political & Regulatory
Regulation of Access
Parking Guidance & Regulation
Vision for future sustainable urban mobility
Socio-Economic
Income Level
Investment
Affordability
Equity/Fairness
Partnership & Collaboration
Digital Divide
Smartphone Ownership
Digital Skill/Digital Literacy
Trust in Internet
New Technology Acceptance

Guideline to fill the questionnaire

Selecting numerical scales for pair-wise comparisons were presented in Table 1

Table 1. Selecting numerical scales for pair-wise comparisons

Explanation	**Numeric scale**
If A is EXTREMELY MORE IMPORTANT than B	1
If A is VERY STRONGLY MORE IMPORTANT than B	2
If A is STRONGLY MORE IMPORTANT than B	3
If A is MODERATELY MORE IMPORTANT than B	4
If A and B EQUALLY IMPORTANT	5
If B is MODERATELY MORE IMPORTANT than A	6
If B is STRONGLY MORE IMPORTANT than A	7
If B is VERY STRONGLY MORE IMPORTANT than A	8
If B is EXTREMELY MORE IMPORTANT than A	9

How to make the pair-wise comparison? An empirical example

According to the scales that have been shown in Table 1, please select the relative weight of your chosen characteristic.

Option A	**Extremely**	**Very Strongly**	**strongly**	**Moderately**	**equally**	**Moderately**	**strongly**	**Very Strongly**	**Extremely**	**Option B**
Accessibility	1	2	3	4	5	6	7	8	9	Infrastructure Availability

Option A (Accessibility) is Extremely important characteristic for smart mobility services to option B (Infrastructure Availability)

Option A (Accessibility) and option B (Infrastructure Availability) are equally important characteristic for smart mobility services

Option B (Infrastructure Availability) is extremely important characteristic for smart mobility services to option A (Accessibility)

Pair-Wise Comparison (Level 1)

1. Please rank the following main characteristic in order of importance

The rank of the importance of main characteristic

Characteristics	Rank
Political & Regulatory	( )
Socio - Economic	( )
Digital Divide	( )

2. What is the more important factor of smart mobility that contribute in smart mobility project?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Political & Regulatory	1	2	3	4	5	6	7	8	9	Socio - Economic
Political & Regulatory	1	2	3	4	5	6	7	8	9	Digital Divide
Socio - Economic	1	2	3	4	5	6	7	8	9	Digital Divide

Pair-Wise Comparison (Level 2)

Please rank the Political & Regulatory sub-factor of smart mobility project in order of importance

The rank of the importance of Political & Regulatory sub-factor

Characteristics	Rank
Regulation of access	( )
Parking guidance & regulation	( )
Vision for future sustainable urban mobility	( )

What is the more important component of the Political & Regulatory sub-factors that contributes to the success of smart mobility project?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Regulation of access	1	2	3	4	5	6	7	8	9	Parking guidance & regulation
Regulation of access	1	2	3	4	5	6	7	8	9	Vision for future sustainable urban mobility
Parking guidance & regulation	1	2	3	4	5	6	7	8	9	Vision for future sustainable urban mobility

Please rank the Socio-Economic sub-factor of smart mobility project in order of importance

The rank of the importance of Socio-Economic sub-factor

Characteristics	Rank
Income Level	( )
Investment	( )
Affordability	( )
Equity/Fairness	( )
Partnership & Collaboration	( )

What is the more important component of the Socio-Economic sub-factors that contributes to the success of smart mobility project?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Income Level	1	2	3	4	5	6	7	8	9	Investment
Income Level	1	2	3	4	5	6	7	8	9	Affordability
Income Level	1	2	3	4	5	6	7	8	9	Equity/Fairness
Income Level	1	2	3	4	5	6	7	8	9	Partnership & Collaboration
Investment	1	2	3	4	5	6	7	8	9	Affordability
Investment	1	2	3	4	5	6	7	8	9	Equity/Fairness
Investment	1	2	3	4	5	6	7	8	9	Partnership & Collaboration
Affordability	1	2	3	4	5	6	7	8	9	Equity/Fairness
Affordability	1	2	3	4	5	6	7	8	9	Partnership & Collaboration
Equity/Fairness	1	2	3	4	5	6	**7**	8	9	Partnership & Collaboration

Please rank the Digital Divide sub-factor of smart mobility project in order of importance

The rank of the importance of Digital Divide sub-factor

Characteristics	Rank
Smartphone ownership	( )
Digital skill/digital literacy	( )
Trust in internet	( )
New technology acceptance	( )

What is the more important component of the digital divide sub-factors that contributes to the success of smart mobility project?

Option A	Extremely	Very strongly	strongly	Moderately	equally	Moderately	strongly	Very strongly	Extremely	Option B
Smartphone ownership	1	2	3	4	5	6	7	8	9	Digital skill/digital literacy
Smartphone ownership	1	2	3	4	5	6	7	8	9	Trust in internet
Smartphone ownership	1	2	3	4	5	6	7	8	9	New technology acceptance
Digital skill/digital literacy	1	2	3	4	5	6	7	8	9	Trust in internet
Digital skill/digital literacy	1	2	3	4	5	6	7	8	9	New technology acceptance
Trust in internet	1	2	3	4	5	6	**7**	8	9	Trust in internet

Demographic Information (Please check (√) for the answer)

1. Specify your gender?

   ☐Male ☐Female

2. Specify your age group?

   ☐18-25 ☐26-40 ☐41-60 ☐> 60

3. What is the highest level of education you have completed?

   ☐High school ☐Bachelor ☐Master ☐Doctorate

4. What is the nature of organization you are working for?

   ☐Academia ☐Private sector ☐Government ☐Self Employed

5. What is the name of your organizations?

   ____

6. What is your position in your organizations?

   ____

7. How much working experience do you have?

   ☐1~3 years ☐3~5 years ☐5~8 years ☐8~10 Years ☐More than 10 years

Appendix 3: Citizen Satisfaction Expectation Questionnaire

Dear respondents,

Thanks for participating in this survey. My name is Yuri Olivia, and I am a Ph.D. candidate in the International IT Professional Program at Seoul National University. As part of my smart city research, I am collecting data to continue my research. It will be an honor to have your invaluable participation.

This survey is to study the citizens' satisfaction and expectations of the new mobility system in the new capital of Indonesia. It will help us provide a policy recommendation based on your expectations of how the new mobility system will be developed in the new capital of Indonesia. This survey will take approximately 10 to 15 minutes. All your response to this survey will be confidential and used only for academic research purposes. The information provided by participants will not be disclosed. Thank you for your time and participation in this survey.

To improve the quality of this survey, please share your concerns, comments, recommendations, and question with us through the following email address: yuri_olivia@snu.ac.kr. Thank you for your time and participation in this survey

Citizen Satisfaction Expectation with Future Mobility in new capital

Part I – Respondent Demographic

Q1. How old are you?

☐ 16 – 24 ☐ 25 – 34 ☐ 35 – 44 ☐ 45 – 55 ☐ above 55

Q2. What is your gender?

☐ Male ☐ Female

Q3. What is the highest level of education you have completed?

☐ Senior High School ☐ Undergraduate ☐ Master ☐ Doctoral

Q4. How much is your monthly income?

☐ < 4.000.000 ☐ 4.000.000 – 8.000.000 ☐ 8.000.000 – 12.000.000 ☐> 12.000.000

Q5. How much does your monthly travel cost?

☐ < 250.000 ☐ 251.000 – 500.000 ☐ 501.000 – 1.000.000 ☐ > 1.000.000

Q5. What is your transport mode?

☐ Private Vehicle (Car/Motorbike) ☐ Trans Jakarta (BRT) ☐ Commuter (Metro)

☐ Bus ☐ non-motorized transport (Bicycle) ☐ other : -----

Q6. What is the purpose of your travel?

☐ Work ☐ Education ☐ Social/gathering ☐ Recreational/Tourism

Q7. How often do you travel?

☐ Less than once a month ☐ 1 – 3 times a month ☐ 1 -2 times a wee

☐ 3 – 5 times a week ☐ > 5 times a week

Furthermore, the survey below will assess your expectation regarding the new mobility system. It will be implemented in the new capital of Indonesia. Please answer the following sentences according to your opinion (SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Part II – Citizen Satisfaction Expectation on the Future Mobility

Scales:

SD : Strongly Disagree

D : Disagree

N : Neutral

A : Agree

SA : Strongly Agree

Safety & Security

This section is used to measure how the expectation level of smart mobility system gives the assurance of safety and security to citizen

No	Statement	Measurement				
		SD	D	N	A	SA
Safety & Security (H1)						
1.	Public transportation safety and security will be more secure and convenient in the new capital					
Transport & Transit Safety (H1a)						
1.	It will be convenient to use public transportation modes because of the smooth and safe ride					
2.	It will be convenient to use public transportation modes during the day and night because they ensure of safety					
3.	It will be convenient to use public transport stop during the day and night because they ensure the safety					
Transport & Transit Security (H1b)						
1.	An adequate number of lights during night and day will guarantee to protect the citizen against theft, robberies, and assault while accessing public transportation, bus stop, transit area, and terminal					
2.	An adequate number of CCTV cameras will guarantee to protect the citizen against theft, robberies, and assault while accessing public transportation, bus stop, transit area, and terminal					
3.	The availability of security guards will guarantee to protect the citizen against theft, robberies, and assault while accessing public transportation, bus stop, transit area, and terminal					

Comfort & Convenience

This section is used to measure how the expectation level of citizens regarding the comfort and convenience of the smart mobility system.

No	Statement	Measurement				
		SD	D	N	A	SA
Comfort & Convenience (H2)						
1.	Public transportation will be more comfortable and convenient in the new capital					
Public Transport & Density (H2a)						
1.	It will be convenient to use public transportation because citizens can predict the arrival time and time duration of public transportation					
2.	It will be convenient to use public transportation because of the punctuality of the arrival time					
3.	It will be convenient to use public transportation modes because the level of crowdedness is not high					
4.	It will be convenient to use public transportation modes because the operation hours well are set					
Accessibility (H2b)						
1.	Integrated public transportation will make citizen easy to change to other transportation modes					
2.	It will be convenient to use public transportation modes because it covers all areas of the city					
3.	It will be convenient to make a journey during the day and night because of the availability and the adequate number of transport modes					
4.	It will be convenient to use public transportation because the transfer distance between different modes as well as parking is adequate					
Social Equity & Affordability (H2c)						
1.	All citizens will be easy to access public transportation					

No	Statement	Measurement				
		SD	D	N	A	SA
	conveniently without worrying about their movement, even the impaired person					
2.	Using all modes of public transportation will be convenient for women, the elderly, children, and people with disability because of the availability of the facilities					
3.	It will be convenient for the citizen to use public transportation modes because the price fee is affordable					
Information (H2d)						
1.	It will be easy to find the information and guidelines needed for transportation service					
2.	It will be convenient to get updated information in real-time					
3.	It will be easy to understand transport information					
4.	Transport information will be accurate and trustworthy.					
Amenities/Comfort (H2e)						
1.	It will be convenient to use public transportation modes because of the availability of the internet					
2.	It will be convenient to use public transportation modes because of the availability of the seat					
3.	It will be convenient to meet people in public transport waiting areas because of the cozy environment (ATMs, cafes, shops, etc.)					
4.	It will be convenient to pay transport fare because it is available in many options					
5.	Integrated reservations and payments system in a single platform will make public transportation much more convenient					

Governance & Citizen Engagement

This section measures how you expect the government's performance in the future, especially with the new concept of a smart capital city.

No	Statement	Measurement				
		SD	D	N	A	SA
Governance & Citizen Engagement (H3)						
1.	Government Channel (email, website, hotlines, social media, etc.) will be valuable tools to allow effective collaboration between the citizen and the government					
2.	The availability of online and offline interactions between the government and citizens will be more accessible, clear, and understandable					
Vision & Strategy (H3a)						
1.	Government vision and strategy announce to the citizen					
2.	Information and services will be provided free of charge					
Citizen Participation (H3b)						
1.	Government Channels (email, website, hotlines, social media, etc.) will be a valuable tool for collecting citizens' opinions, ideas, and proposal					
2.	Government Channel (email, website, hotlines, social media, etc.) will be valuable tools to partake in the government's performance assessment					
3.	Citizens will be allowed to participate in public meetings					
E-government Services & Transparency (H3c)						
1.	E-government services will work with various applications					
2.	The e-government platform will provide a periodic performance report of government projects					
3.	The e-government platform will provide links to watch live broadcasting of the assembly and meetings					
Citizen satisfaction expectation						
1.	I am willing to try to use public transportation modes in the new capital					

No	Statement	Measurement				
		SD	D	N	A	SA
2.	Overall, I expect public transportation modes in the new capital will help citizens Mobility easily					

Abstract (Korean)

스마트 모빌리티 구현 전략: 시민의 특성, 요인 및 기대치에 기반 -인도네시아 사례 중심-

유리
기술, 경제, 관리 및 정책 프로그램
대학원
서울대학교

디지털 테크놀로지의 급속한 발전과 생산적인 프로세스에서의 정보 사용은 산업 4.0의 현재 상황에서 경제의 구조적 변화를 야기합니다. (Neves 등, 2020) 디지털 전환의 결과로, 스마트 시티는 기술, 조직 및 정치적 혁신 사이의 상호작용의 한 형태로 나타납니다.

스마트 시티 개발의 효과로서 승차감, 카셰어링, 카풀링, 서비스로서의 모바일성, 전기차, 오토노마스 차량 등 이동성·교통의 혁신은 이동성 문제의 만병통치약으로 보인다. (J. Lee 등, 2020a) 불행히도 대부분의 혁신은 정책과 규제에 의해 뒷받침되지 않습니다. 대중교통 당국은 스마트 이동성 개념을 활성화하기 위해 규제하는 데 시간이 적게 걸릴 수 있으며, 다른 많은 공공 기관과 마찬가지로 교통 당국의 관료주의는 이동성 혁신의 보급을 지연시킬 수 있다. (카마르지안니 & 마티아스, 2017a)

인구과잉 도시는 스마트 모빌리티 어젠다를 이행하는 데 있어

적절한 교통수단을 제공하는 데 어려움을 겪을 것이다. 그 주된 이유는 도로를 확장하고 새로운 교통 인프라를 구축하는 것만으로 대중교통의 부족을 해결할 수 없기 때문이다.

본 연구는 스마트 모빌리티 특성을 파악하여 시민의 기대치를 바탕으로 공공 가치를 창출하는 전략적 목표를 촉진하는 것을 목적으로 한다. 이 연구는 인도네시아의 사례에 초점을 맞추고 있다. 이 목적을 달성하기 위해 두 편의 에세이가 심층적인 문헌 검토를 통해 수행되었다.

첫 번째 에세이에서는 스마트 모빌리티의 특성과 요인을 조사했으며, 전문가의 판단과 의견이 가장 중요한 기준을 분류하기 위해 사용되었다. 그 결과 정부는 인도네시아의 새로운 수도에서 스마트한 도시 이동성을 구현하기 위한 전략을 설계할 수 있게 되었다. 동시에, 두 번째 에세이는 스마트 모빌리티에 대한 시민 만족 기대에 초점을 맞췄다. 두 결과 모두 새로운 수도 인도네시아의 미래 도시 이동에 대한 정부와 시민들의 기대 차이를 메우기 위해 결합될 것이다.

주요어 : 키워드: (스마트시티, 스마트 모빌리티, 시민, 공공가치, AHP, 만족도 기대, SEM)

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