

SMART SUSTAINABLE URBAN DEVELOPMENT FOR THE NEW CAPITAL CITY OF INDONESIA

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Abstract: Research on the concept of Smart Sustainable Urban Development and its implementation is critical to support the urban future and urban governance. This research analyses the implementation of the smart sustainable urban development concept to support the urban future through the New Urban Agenda and Sustainable Development Goals, and urban governance in Nusantara Capital City, Indonesia. We collected data through in-depth interviews and focus group discussions with the policy stakeholders and agencies relevant to the development plan of the city, supplemented with field surveys. The results show that the urban future from the national government is envisaged through six domain services encapsulating the sustainability and smart city elements. In the regional and local level, challenges are met including the environmental and social impact but through government collaboration and devising Information and Communication Technology, the authority has been able to design the solution. Sustainability, Information and Communication Technology, smart city, and urban governance constitute critical elements in the process of urban development, especially for the development of a new capital city.

Keywords:

smart city;
sustainable
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Introduction

The discussion on smart sustainable urban development begins with a description of the smart city concept and its implementation, the concept of sustainable urban development and urban future (Hatuka et al. 2018). With the emerging complexities and challenges to the urban area such as climate change, inclusivity, technological disruption and big data, and ecological vulnerability, smart sustainability would be more and more crucial (Bibri and Krogstie 2017, Alagirisamy and Ramesh 2022). The planning and development of cities should be navigated to a more sustainable way powered with the smart elements or ICT components. ICT can facilitate cities to achieve the climate targets in battling climate change (Kramers et al. 2014, Ahad et al. 2020), ensuring collaboration among stakeholders (Park and Yoo 2023, Shah 2023), and enhancing well-being (Carro-Suárez et al. 2023).

As the debate for the urban future and its relationship with the smart city and village continues, several notions and concepts have been put into the spotlight under the framework such as liveability (Sofeska 2017), the New Urban Agenda (NUA), or the Sustainable Development Goals (Kasinathan et al. 2022). The former has become a grand concept that encompasses several elements, and it intertwines with the smart city elements. For this part, we still focus on the service domains in Nusantara Capital City and how it is related to liveability as one of the main purposes of the urban future. In the praxis realm, sustainable urban development should be at the centre of global policy formulation to respond to social and environmental challenges (Corsi et al. 2022, Keith et al. 2022), in accordance with the goal 11 of SDGs committed to "making cities and human settlements inclusive, safe, resilient and sustainable" (United Nations 2023).

The urgency of sustainable urban development is also mandated through the New Urban Agenda framework (Satterthwaite 2016, Caprotti et al. 2017, Kaika 2017). Coordinated by UN Habitat, NUA aims to strengthen Goal 11 of SDGs and to provide a clear and concise urban planning guideline for the city planner and government to refer to. With the emergence of technology, the combination of 'smart' and 'sustainable' enables policy makers to manage, monitor, adapt, and create effective interventions for city development (Haarstad 2017, Sugandha et al. 2022). The implementation of sustainable urban development could be done through several strategies incorporating SDGs or smart services (Benites and Simões 2021, Clement et al. 2023).

The rise and development of the new city are inevitable parts of planetary urbanisation that states that this planet is heading to be a global urban area (Ruddick et al. 2018, Jain and Korzhenevych 2022). Development, economic growth, and increasing population induce new city development to be the consequences. For the last decades, several new city developments demonstrate how cities emerge as economic and global culture hubs while responding to the flow of capital and investment, as seen in Sadat, Egypt (El-

Shakhs 1994), Shenzhen (Zacharias and Tang 2010), and several other cases in China (Zhao et al. 2021). Intensified cities make the needs for smart sustainable urban development more relevant. Along with the business hub and economic cities that emerge at the impact of global economic growth, the new capital cities also rise to balance and facilitate the development of a country.

Smart sustainable urban development for the new capital city is required due to the capital city functioning as the administrative centre of its country (Rachmawati et al. 2021a). Experiences from two capital cities of Lagos and the New Administrative Capital City of Cairo illustrated how the smart and sustainable elements provide help in managing the settlement, the infrastructure and the identity of the capital city (Soyinka et al. 2016, Abusaada et al. 2023). The smart strategy made to support the new capital city is prepared in the form of planning products, spatial and environmental plans, physical infrastructure, Information and Communication Technology (ICT), as well as through local communities (Rachmawati et al. 2021b). The infrastructure that is important to be available for the urban development to become a capital city consists of ICT, social and regional development, and physical and environmental aspects as well (Rachmawati et al. 2021c). In relation to ICT, in the future it is also necessary to develop the concept of urban governance, metaverse and digital twins (Jaynes et al. 2003, Duan et al. 2021, Lee et al. 2021). Metaverse is a new social network in which people can interact as if they were real without any constraints of physical space in the 3-dimensional virtual reality (Mir et al. 2020). Digital twins describe the utilisation of physical and virtual spaces simultaneously on two sides (Weil et al. 2023).

Nusantara Capital City, Indonesia, as a newly developed city, requires a strong urban governance as the governmentality of the city will be highly privileged to implement the smart sustainable urban development (Sulistyaningsih et al. 2023). The amalgamation of urban governance with the smart element may result in smart governance and it becomes an underlying factor for urban planning (Meijer and Bolívar 2016, Tomor et al. 2019).

There are various backgrounds underlying the relocation of the capital city, from supporting and inhibiting factors, both internal and external, to supporting the development of complete and modern infrastructure, having given a significant impact to Nusantara Capital City (Rachmawati et al. 2021b). Smart sustainable urban development for the Nusantara Capital City is imperative as the manifestation of the government's vision (Nusantara Capital Authority 2024). As mandated by the Act Number 3 Year 2022 on the Capital City, the government expects that the Nusantara Capital City will be a forest city, sponge city, and smart city. This mandate and directive could be achieved through the implementation of smart sustainable urban development. The sustainability stands above the three main pillars of social, economy, and environment, which align with the objective of Nusantara Capital City (Nusantara

Capital Authority 2024). Furthermore, as the relocation of the capital city is due to Jakarta's burden as the centre of government and business, a more sustainable and technology based urban planning is necessary to avoid similar problems arise.

The implementation of the smart city can be adapted to the characteristics of Indonesian cities that have their own unique archipelagic nature and culture of the people. One of the ways is by initiating the Nusantara Smart City model (Arief et al. 2022). In urban management, it is important to support and apply the concept of smart city (Rachmawati 2019). The same case is what needs to be implemented in the Nusantara Capital City. The most important element of the smart city in the preparation of a new capital city in Indonesia is the smart urban governance, particularly in establishing effective and efficient public services (Rachmawati et al. 2021a), and supporting the data openness by the government as well (Sunindyo and Amrita 2019). The initial framework of cyber security for Nusantara Capital City is focused on a smart and liveable city along with its critical infrastructure to maintain confidentiality, integrity, availability, security, and privacy (Sensuse et al. 2022). Furthermore, it is necessary to apply various smart strategies to support the achievement of a smart city.

The concept of smart city is also expected to enhance the quality of life in a city. In the case of Nusantara Capital City, the smart city is proposed to avoid similar problems as it happened in the old capital city of Jakarta, such as annual floods, land subsidence, and traffic congestion, while increasing the inclusivity and empowerment to the vulnerable members of the community (Vanolo 2014, Lee et al. 2023, Lepore et al. 2023). This could be achieved by fostering innovation, and particularly the digital one (Kerimoglu and Ekinci 2021). Innovation of the smart city will also help the urban expansion and managing the adverse effects which it may induce to the periphery area (Ortiz-Báez et al. 2022, Dragan et al. 2024), while being considered as a new city, the Nusantara Capital City will be very likely to expand to its vicinity.

Smart sustainable urban development firmly exists in the middle of SDGs and the NUA streams, and the Nusantara Capital City in Indonesia, as a new rising city, means to follow those streams and to be the role model for new city development. Conducting research in this case will provide additional empirical evidence to the concept of smart city (Kitchin 2015, Sikora-Fernandez 2018). For this reason, this research is aimed at reasoning and developing a scenario to implement the concept of smart sustainable urban development that is suitable to support the urban future and urban governance in Nusantara Capital City. The Nusantara Capital City as our focus provides a good example of how a smart sustainable urban development can be implemented. There are two main concepts of which we channelled our focus: the New Urban Agenda as the concept of urban development, and urban governance as the framework for collaboration between the stakeholders and inter-regional authorities. The relation of Nusantara Capital City with its partner region in developing smart sustainable urban

development also becomes our focus. We expect that this research could have a wider contribution to urban and regional science by providing empirical evidence on the implementation of smart sustainable urban development in the new capital city and the challenges that appear on maintaining regional interaction between one administrative region with the other.

Methodology

The method applied in this research is a case study because it involves selecting contemporary cases or new issues (Yin 2018), namely the Nusantara Capital City as the new capital of Indonesia in East Kalimantan (Figure 1). The facts found in the research area were then collected because the research of the case study is naturalistic (a real-life context) (Gerring 2016). In this research, the focus is on the future urban development needs related to its function as the state capital. The arising questions in this research are about how and why, characterising the research of the case study, leading to an in-depth, more explanatory, research (Yin 2018).

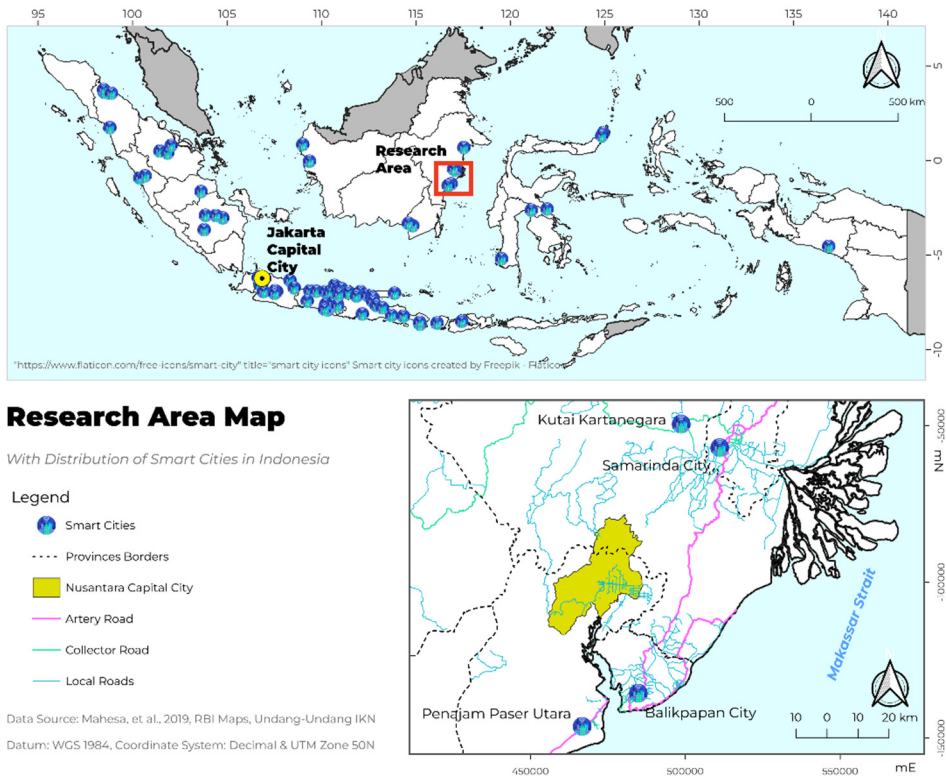


Figure 1. The research area with the distribution of Smart Cities. Source: Modified from Mahesa et al. (2019)

The digging for data in this research was done by conducting in-depth interviews (Gerring 2016). In addition, the data were also obtained by doing observation and conducting focus group discussions (FGD). The concept of triangulation (multiple sources of evidence) (Gerring 2016) is used to obtain the accuracy of data. In-depth interviews and FGDs were conducted with the stakeholders who have authority, and they are related to the concept and implementation of the topic of Smart Sustainable Urban Development in Nusantara Capital City in relation to the regional apparatus (Mack et al. 2005, Skovdal and Cornish 2015).

We conducted a semi-structured interview with the Deputy for Green and Digital Transformation of the Nusantara Capital City Authority from the National Capital Authority because this stakeholder has the authority to deal directly with the construction and development of the smart city and the urban sustainability of Nusantara Capital City. To obtain comprehensive results and for the triangulation, the selected resource persons and FGD participants came from the administrative areas that directly border Nusantara Capital City and they will be directly affected by the development of the capital city. They include Balikpapan City, Samarinda City and the Regency of North Penajam Paser.

The main criteria to select the FGD participants is their role toward the implementation of smart sustainable urban development in the capital city (Table 1). Their knowledge on the regional development in their respective region is another consideration. We held four FGDs for each administrative authorities and the local communities to gather the perspective and the cooperation on pursuing smart sustainable urban development in Nusantara Capital City. During the FGDs, we gathered the informant's perspective, knowledge, and challenge in their region led by the facilitators. Each participant was asked to present their thoughts and the current situation to be responded to by other participants. That way, we expect that we could capture the current situation and how they position themselves toward the smart sustainable urban development notion of Nusantara Capital City.

The primary data resulting from interviews and FGDs were then reinforced with the secondary data in the form of policies, regulations, and previous research results. The existing master plan of smart city, spatial planning, and regional planning document constitute those documents. The data having been collected were then analysed to explore the elements of Smart Sustainable Urban Development that have been, are being, and will be implemented by those stakeholders. Exploration is done by taking important information and synthesising and analysing the relationships between the key information to obtain a complete understanding of the research purposes. The FGD method and the multi-stakeholder interviews are also one of the triangulation techniques for cross-checking the data obtained from one informant to the others.

Table 1. Stakeholders' investigation on Smart Sustainable Urban Development

Method	Apparatus	Roles
In-Depth Interview at national level	Deputy for Green and Digital Transformation of the Nusantara Capital City Authority	Directing the implementation of smart city and urban sustainability of Nusantara Capital City
	Staff in the Directorate of Urban Areas and State Borders, Ministry of Home Affairs and as an activity in the ASEAN Smart City Network	Reviewing, formulating policies, and preparing recommendations for development plans for the implementation of smart cities and urban sustainability in the Nusantara Capital City
	Head of Indonesian Association of Urban and Regional Planners	Reviewing, formulating policies, and preparing recommendations for development plans for the implementation of smart cities and urban sustainability in the Nusantara Capital City
	Chief Executive Officer, ASECH - Centre of Executive on Smart City	Reviewing, formulating policies, and preparing recommendations for development plans for the implementation of smart cities and urban sustainability in the Nusantara Capital City
	Chairman of the Association of the Indonesian Information Technology Consultants	Providing consultation and relevant technology solutions to support national capital planning for the implementation of smart city and urban sustainability
FGD at national level	Director of Government Administration Control and Development Licensing, Authority of State Capital City	Directing the implementation of smart city and urban sustainability of Nusantara Capital City
	Director of Engineering Development for Housing and Settlement, Directorate General of Cipta Karya, Ministry of Public Works and Public Housing	Directing the implementation of smart city and urban sustainability of Nusantara Capital City
	Chairperson of the Smart Indonesia Initiatives Association	Reviewing, formulating policies, and preparing recommendations for development plans for the implementation of smart cities and urban sustainability in the Nusantara Capital City
	Experts in the urban and ICT fields relevant to the development plans for the Nusantara Capital City	Designing cities that are efficient, sustainable, and environmentally friendly
	Agency for National Research and Innovation	Carrying out research to support infrastructure development that supports technological innovation relevant to sustainable development in the archipelago's capital city

Method	Apparatus	Roles
FGD at regional level	Agency for Communication and Information Services, Regional Secretariat, Agency for Environmental Services, Board for Regional Disaster Management, Agency for Regional Development Planning, Department of Public Works and Spatial Planning, Department of Manpower and Transmigration, Department of Population and Civil Registration, Department of Population and Civil Registration, Department of Education and Culture, Department of Social Affairs, Department of Industry and Trade, Department of Food Security, Department of Food Security, Investment and Integrated One-Stop Service Agency, Department of Transportation, Department of Community Empowerment and Village Development in Balikpapan City, Samarinda City and the Regency of North Penajam Paser (The FGD activities for each region invited 15 related OPDs, so the total number of FGD participants for the three regions was 45 people)	Regulator and executive for each smart dimension related to the sustainable urban development (disaster, environment, urban planning)
FGD at local level	Head of Regency of North Penajam Paser Community Representative	Implementation of Local Scale Central Policy for the implementation of smart city and urban sustainability in the Nusantara Capita City The directly impacted community

The technical and bureaucratic process becomes an obstacle and it limits the data we may gather. In addition, as the development and the Nusantara Capital City issues were subjected to change rapidly, the data and perception were also limited to the period we conducted the FGD (August 2023). For the research area, we excluded Kutai Kartanegara in this paper due to the availability of data and its preparation in the context of smart sustainable urban development (Rachmawati et al. 2023).

Results

The main concept of Nusantara Capital City planning

The smart city in the development of Nusantara Capital City is interpreted as a process of planning the development, operation and maintenance of a city that has made use of digital technology to improve the quality of life of the city residents. At present, the smart city in the development of Nusantara Capital City in terms of infrastructure is divided into two: 1). The passive infrastructure development – construction of multi-

purpose panels for underground utilities, such as fibre optics, electrical cables, water pipe networks, etc. In the future, with the development of the passive infrastructure, the Central Government Core Area (KIPP) that is under construction will have no hanging cables so that all cables will be underground; 2). The active infrastructure development – done by building 4G BTS and data collection. An integrated data centre and command centre will be built, and they will later manage 6 domain service apps for fulfilling the needs of Nusantara Capital City as mentioned by our informant from the Nusantara Capital City Authority:

There are six domains that have been planned: e-governance, transportation and mobility, smart living, natural resources and energy, smart industry and human resources, and the last is smart built environment and infrastructure. How we will utilise metaverse, digital twin, satellite monitoring is included in the object information, therefore these six domains are the ones that we are currently building to make Nusantara Capital City a smart city. It is all included in our masterplan.

For the designation of the future Nusantara Capital City, in terms of the smart dimension, the authority enlists six service area domains. These domains serve as the main focus of development, and they consist of:

1. E-governance: digital registration, integrated command centre, smart registration, licensing process services, public services, transportation, and mobility.
2. Transportation and mobility: in 2024, there will be a trial showcase for passenger drones, technology development, and building a joint research centre so as to become a pioneer in transportation mobility. Accessibility is one of the supporting factors that enables the interaction among regions to take place. In the future, a new bridge will be built, and it will connect Balikpapan City to the area of Nusantara Capital City.
3. Smart living: health, security, air pollution monitoring, installation of sensors, CCTV, use of AI, and telemedicine collaboration for the availability of medicines, doctor consultations, etc.
4. Natural resources and energy: Nusantara Capital City is mandated to become a zero-carbon city where 65% of it will be returned to tropical forests including city parks and smart farming, while 25% of it will be built up by urban areas whose development is established. Meanwhile, it is 10% for green areas. The Board for Nusantara Capital City Authority issued scenarios for the achievement of renewable energy.
5. Smart industry and human resources: it is realised in digital MSME

activities through high tech industry and CIPS computers. Besides, it is expected that it can complement the existing industries in Indonesia, especially in the area of KEK (Special Economic Zone). In addition, from the side of human resources, to reduce the gap in facilities, all schools and universities can access the Nusantara Digital Library.

6. Smart built environment and infrastructures: intelligent environmental infrastructure packaged in the concept of metaverse, digital games, satellites, and sensor interfaces. Further, according to the smart building guideline of Nusantara Capital City, the buildings must be integrated within the Integrated Building Management System (IBMS) (Nusantara Capital Authority 2023)

The Nusantara Capital Authority (2021) has incorporated these 6 service area domains into the Nusantara Capital City Smart City Masterplan (Figure 2). Each service domain would be fully supported by the smart city elements including the programs and targets. The connection between the service domains and the smart elements is required to ensure that the service deliveries are at their best.

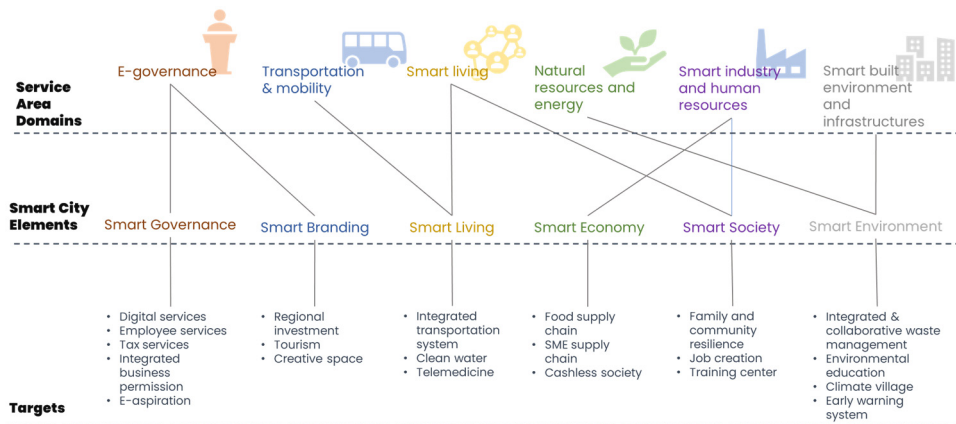


Figure 2. Relation of service area domains, smart city elements, and targets of Nusantara Capital City.
 Source: Nusantara Capital Authority (2021), In-depth interview (2023)

Additionally, there are six development areas in the area of Nusantara Capital City, such as: 1) financial centre designation; 2) tourism deduction areas or areas used for tourism activities (ecotourism, forests, music festivals); 3) renewable energy development for logistics and industry; 4) food security (smart farming and agriculture); 5) research and development; and 6) innovation and education areas. To serve as an economic generator, Nusantara Capital City has 6 planning areas including: financial centre; tourism and leisure; renewable energy; logistics and industry; food; research and development. The construction of the Ministerial Site Houses at

Nusantara Capital City consists of two types, namely Type 105 with twelve houses and Type 104 with 24 houses planned to have been completed by June 8, 2024.

A study on ducting as a form of spatial planning, especially on cable network infrastructure at Nusantara Capital City has been done, and there are two PLN as infrastructure support. A ducting study is a study in the form of analysis and design planning for a cable utility network system, where in this case the cable network infrastructure being built at Nusantara Capital City will use an underground system (electrical cables, fibre optics, etc. are underground). In addition, the presence of Worker Residential Areas is one of the government's concerns, especially for the workers in the area of Nusantara Capital City (Figure 3). The Worker Residential Area is presently occupied by 3,000 workers spreading over 22 towers. In the future, those worker residential areas that are no longer in use can be converted into public health centres and Islamic boarding schools.

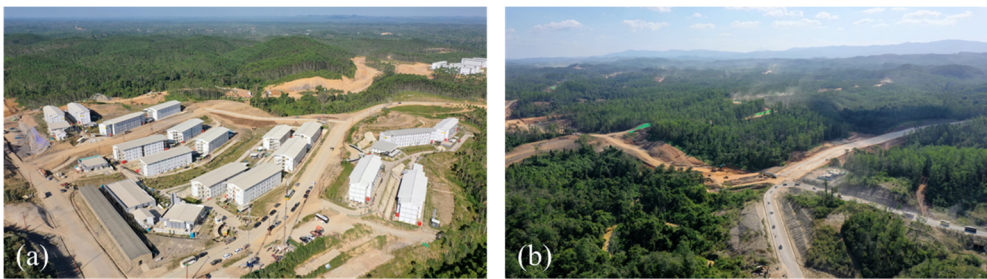


Figure 3. (a) Worker's housing; (b) The construction of road in Nusantara Capital City: utilities are grounded

The roles of regional partners in the Smart Sustainable Urban Development

As big cities are located around the area of Nusantara Capital City, in this case Balikpapan City and Samarinda City, they have their own roles. The Regency of North Penajam Paser with the branding Serambi Nusantara certainly has a role in supporting the acceleration of infrastructure and growth of MSMEs. Due to its branding Serambi Nusantara, the Regional Head of the Regency of North Penajam Paser has a priority to improve human resources through various informal trainings and to develop food agriculture, especially in freshwater fisheries along with its infrastructure (providing clean water, dams, and intakes). The regional governments in the area of Nusantara Capital City are at present in the transitional process of relocating or transferring authority to Nusantara Capital City. At this point, several State Civil Servants from the Regency of North Penajam Paser were withdrawn by the central government to be placed to work for the Nusantara Capital City Authority Agency. The Regency of North Penajam Paser, in this case, has prepared a regional concept to make it a satellite city (Table 2).

Table 2. Interregional Comparison Matrix

Potential Factors	Cities and Regency			
	Samarinda City	Balikpapan City	Regency of North Penajam Paser	Regency of Kutai Kartanegara
City Branding	Buffer zone As the heart of Nusantara Capital City	Buffer zone As the nerve of Nusantara Capital City	Serambi Nusantara	Mitra & Kukar Asia Wonders (tourism promotion media)
Priorities of Nusantara Capital City Support Program	Community development and empowerment programs (Pro Bebaya)	Availability of industrial areas Availability of transportation	HR (operators, programmers, and administrators) Food agriculture (Village of Cultivation Fisheries) Infrastructure	IT Human Resources Development
Strategic Roles	Provincial capital The airport located in Samarinda City will be redeveloped	The airport located in Balikpapan City Balikpapan as an economic centre	VIP Airport located in the area of the Regency of North Penajam Paser The construction of the Balang Island bridge and toll road makes it easy to access the area of Nusantara Capital City	Directly bordering the area of Nusantara Capital City A forest zone found in the area of Kutai Kartanegara

For their smart development readiness, there are still several areas, especially in the Regency of North Penajam Paser, with blank-spot zones causing delays in the digitalization process, particularly in giving government services to the community. One of the good examples of digitalization is the program PERISAI SIDIK 112 which allows disaster management on a digital-based system. Another effort for digitalization derives from the digital signature program as part of the smart city e-government. There are 28 out of 35 OPDs already equipped with electronic signatures for piloting the Bukit Raya Village project as a Digital Village. In addition, there are 20 other villages included in the plan for developing smart areas. The development of Nusantara Capital City will surely have an impact on the open market potential to absorb natural resources through various e-commerce platforms, inducing an urgency to develop the smart economy.

From the FGD result, we conclude that the community as the subject of development and direct recipient of it becomes an important aspect in the implementation and the sustainability of government’s programs. There are 3 villages located in the Central

Government Core Area (KIPP): Bumi Harapan, Pemaluan and Sepaku. One of the villages in the area of Nusantara Capital City, namely Bumi Harapan, generally supports the presence of Nusantara Capital City. However, there is still a small percentage of people involved in Nusantara Capital City activities due to salaries below the minimum wage and the limited number of people taking part in the training that the government has provided. These are the challenges in themselves. The maximum age limit for training the participants (35-40 years of age) means that those over 40 years old do not have the opportunity to take part in the training. In addition, the on-going massive development has had an impact on the environmental aspects, especially air pollution, as well as it concerns those around the area of Nusantara Capital City that it is not child-friendly because of the presence of a large number of construction vehicles. Furthermore, the people around the area of Nusantara Capital City hope that there will be workforce trainings suitable with their potential and competency certificates in line with the development of Nusantara Capital City and that there will be an absorption of workers from the local community, as it can be found from one of our participants in the FGD with the local communities:

Basically, people in here support the Nusantara Capital City program from the government, especially the training and education for an effort to enhance the human resources in welcoming the Nusantara Capital City. What we want from the training are also the jobs. The age restriction in training forbids the people who are older than 40 years old to participate.

The local people at Sepaku District encounter difficulties in accessing jobs and work in the construction site due to the lack of education certificates. They also feel that the salary does not meet their end because it is below the regional minimum wage. Although many capacity buildings and workshops have been organised by the government, the locals think that they are not enough. For them it would be better if the government also provided a job soon after they finished the training. The local people are anxious about the relocation issue. As the authority intensifies the physical construction, an unrestful feeling lurks, and it encroaches the people. They do not object to the relocation, but the government must ensure that, in the case if relocation really happens, their assets and livelihood are brought.

In general, smart and sustainable urban development is in line with several frameworks that lead to an urban future such as the 2030 Sustainable Development Agenda. However, the successful implementation of the Smart Sustainable Urban Development in the Nusantara Capital City cannot be separated from the involvement and participation of various stakeholders. From the FGD results, we conclude that the Nusantara Capital Authority (IKN) becomes a model for implementing the Sustainable Urban Development concept. Development and implementation in IKN are generally much easier because it is a new area so that various obstacles in IKN can be minimised

or anticipated. The implementation of the Smart Sustainable Urban Development needs to be adjusted to regional planning documents, IKN master documents, and other documents (Table 3), as stated by several other informants in the FGD: “IKN’s spatial planning and master plan already regulate the sustainable principles, however, it needs to be examined further regarding the implementation of IKN’s smart sustainable urban development”. Furthermore, “smart sustainability involves: government (making regulations), OPD (stakeholders in implementing activity programs), and society (strengthening capacity building)”.

Table 3. Preparation of Smart Sustainable Urban Development of Nusantara Capital City

Stakeholder (level)	SSUD Dimension		
	Economy	Environment	Social
Nusantara National Capital Authority (national)	<ul style="list-style-type: none"> • Passive and active infrastructure • Capturing captive market from Samarinda and Balikpapan (productivity) • Nusantara will serve as an “economic generator” in the region • Objected to city productivity (measured from the GDP) 	<ul style="list-style-type: none"> • Smart building • Land resources • Implementation of ESG framework • Reforestation by replanting and preservation of forest cover (>65%) 	<ul style="list-style-type: none"> • Well-being and sharp increasing labour numbers • Hardware, software, and brainware constitute the human resources development • Nusantara digital library
Balikpapan City (regional)	<ul style="list-style-type: none"> • Adjusting spatial planning in the northern area • Dedicated industrial area • E-permit and OSS system 	<ul style="list-style-type: none"> • Mitigating environment impact on traffic management 	<ul style="list-style-type: none"> • Increasing population • “Rumah Layak Huni” program • Settlement Masterplan (RP3KP)
Regency of Penajam Paser Utara (regional)	<ul style="list-style-type: none"> • Development of industrial area 	<ul style="list-style-type: none"> • MoU with Korean investors in waste management (processing waste with salt water into chemicals) 	<ul style="list-style-type: none"> • Enhancing workforce and labour skills
Samarinda City (regional)			
Local community at Sepaku District (local)	<ul style="list-style-type: none"> • Training and enhancing capability • Involving in small and medium enterprise to support Nusantara Capital City 	<ul style="list-style-type: none"> • Maintaining land cover and water quality 	<ul style="list-style-type: none"> • Ensuring social cohesion at the grassroot level • Participating in Nusantara Capital City development

As the Nusantara Capital City is situated in the interior area of the Province of East Kalimantan, Balikpapan City and the Regency of North Penajam Paser seize the opportunity to promote themselves by the branding of “Beranda Nusantara Capital City” for Balikpapan City and “Serambi Nusantara” for North Penajam Paser. This program is not only beneficial for promotion purposes, but it is also stealing the spotlight from the Central Government. Both Balikpapan City and the Regency of North Penajam Paser envisage a special industrial area. Balikpapan City has appointed Kariangau as the location of the industrial area while North Penajam Paser tries to adjust the industrial area to support the Nusantara Capital City. A city or region branding can also be helped by smart branding, and it could attract investors to come and boost the regional economy while also helping the tourism sector to gain visitors.

Discussion

The growing awareness and concern for the environment, urbanisation and technological advances result in an urgent need and opportunity in managing a city, which can also be seen in the case of Nusantara Capital City. In general, there are two approaches to Smart Sustainable Cities. They are inductive/bottom-up (seeing and synthesising how other people define the concept in theory and/or in practice) and deductive/top-down approaches (definition development starts with a hypothesis or statement normative about what Smart Sustainable Cities should be) (Höjer and Wangel 2015). Smart Sustainable Urban Development is a unified concept of smart technology, sustainability, and cities. Smart Sustainable Urban Development can be materialised when these 3 aspects are implemented harmoniously. Connecting the concepts of sustainable and smart cities can also increase awareness about the potential of making use of ICT to promote urban sustainability (Höjer and Wangel 2015). The Smart Sustainable Urban Development concept can be used as a joint framework to elaborate new collaborations and models especially in urban development. This effort is reflected toward urban governance and the e-governance as the smart element to support the governance.

The Nusantara Capital City Authority, regional government, and local communities have elaborated their perspectives. From the constellation of those three, it could be perceived that the Nusantara Capital City Authority has a larger contribution in planning and implementing the plan through its own body. Their planning shows ambition in catapulting Nusantara Capital City far into a future version. At the regional level, the regional governments of Balikpapan City, Samarinda City, and Penajam Paser Utara Regency have shown their response by presenting the challenges and their own planning for the surrounding region of Nusantara Capital City. At the local level, local communities highly hope for the positive impact of Nusantara Capital City, including job creation, improvement of life quality, and their right to land and

livelihood resources. Further, we will discuss the arguments toward the New Urban Agenda as the operational framework for sustainability and urban governance as concepts for the interrelation between the national, regional, and local level. Above all, we will see the context of smart city and ICT implementation into NUA and urban governance.

Smart City and ICT Implementation for Urban Governance in Nusantara Capital City

Our findings provide an empirical ground for the smart city concept and its linkage to urban governance in the case of Nusantara Capital City. The New Capital City realises that the application of smart cities and ICT in urban governance needs to be viewed further and deeper than just e-government or digitalization that is seen merely as a reflection of the city because a city is not only reflected by its data and the supporting infrastructure (Xiao and Xie 2021). One of the foundations that can be established through the application of smart city dimensions in urban governance is how smart cities are able to identify urban issues and to place them in an appropriate context and within the main spatial, institutional, and technological elements. The intersection of these three key elements is of primary importance in implementing urban governance to support the urban future vision in Nusantara Capital City. As a city viewing the future and taking technocratic and cyber-utopianism as one of its imaginations, Nusantara Capital City needs to prepare urban governance structures to achieve the expected achievement of urban future.

In its implementation, one of the requirements to support the implementation of smart city elements in establishing urban governance is the availability of data and information (Allam et al. 2022). The implementation of smart cities for urban governance can be viewed in the governance structure of certain cities. One of the case studies where the smart city dimension can strengthen urban governance is represented by Italian cities (Caselli et al. 2022). The structure of urban governance can be in the forms of projects, administrative structures, and public communication by applying certain platforms (Song et al. 2023).

As the implementation of urban governance, there are several programs set to be launched. One of the programs as the implementation of public communication is the digital public services. In the Masterplan for Smart City Development, the public services consist of six main programs including integrated business permission, tax service, e-aspiration, employees service, and civil administration. The latter will be implemented in collaboration with the regional government. To foster a stronger regional cooperation, the authority designs an affirmative program where it recruits the regional and local government into the administrative structure of Nusantara Capital City Authority (Table 4).

Table 4. Implementation in supporting Urban Governance

Structure of Urban Governance	Implementation
Public communication via certain platforms	<p>The launch of the website: www.ikn.go.id, containing the latest information and updating the condition of Nusantara Capital City.</p> <p>Public services: taxes, aspirations, civic administration, business permission, and employee’s administration.</p>
Administrative structure	<p>The Authority institution of Nusantara Capital City has a deputy for digital transformation as the implementer of the concept of smart city.</p> <p>Recruiting regional government to administrative structure of Nusantara Capital City Authority.</p>
Project smart city	<p>The preparation of a smart city master plan for the Nusantara Capital City.</p>

The integration of smart city components into the planning of Nusantara Capital City by the Capital City Authority could be read as an effort to initiate the sustainable development through a ‘smart’ approach. As urban challenges such as climate change, disaster, urban injustice, and urban inclusivity are emerging and the problems are getting more intense, a firm governance is required to overcome them. One of the future urban governance ready to be implemented in the Nusantara Capital City is the digital twin. Nusantara Capital City Authority plans to apply digital twins featuring spatial information of development, disaster simulation, and traffic congestion simulation (Weil et al. 2023). Digital twins will help urban governance by mediating civil society and the government through the virtual world. Digital twins will stand above infrastructure and the “urban brain” to support service delivery and to strengthen the one-stop service from the government (Deng et al. 2021). To ensure the data security and the implementation of city decentralisation, digital twins provide a blockchain system for the supporting nodes of urban governance. The utilisation of a blockchain system is predicted to be the future of urban governance due to its reliability, transparency, and traceability (Khanna et al. 2021, Zheng 2022, Zygiaris et al. 2023).

An advanced smart urban governance, backed by several instruments such as digital twins and blockchain systems will be fruitful for the implementation of smart sustainable urban development. The Nusantara Capital City Authority intends to open 6 service area domains as the backbone of new urban governance in the new capital city. At least three service domains will have direct benefit, including e-governance, transportation & mobility, and smart industry. For e-governance, technological application will help to close the wide gap between the government and the people.

Furthermore, in the initial state, the Nusantara Capital City is expected to bring about 1.5 million people to the region, consisting of civil servants along with their family. This exodus will invoke an unplanned migration as the increasing population will significantly stimulate economic growth through supply-demand mechanisms.

As for nowadays, Balikpapan City has started to feel exasperated by the traffic congestion in the weekend as the newcomers flood this city, speculating on the information and the promise of the Nusantara Capital City. The newcomers are usually unequipped with the necessary skills to access the job market. Hence, they are frequently stranded in the street, and they become homeless. The Balikpapan City authority perceives them as a social problem that needs to be addressed. Often, the authorities have to send them back home. This phenomenon will wreak an administrative civil havoc on the Nusantara Capital City and its vicinity causing, in time, the government failure to deliver its basic service to the residents. A quick, reliable, and strong administration function of e-governance is highly required to ensure the civic registration for the people who flock to the new capital city. This phenomenon could be triggered by the presence of activity centres such as the university, as well as of central business districts (CBD), inducing a local migration (O'Brien et al. 2023).

For the preparation of the new capital city, the Indonesian government made a promise not to burden the national budget by using investment and capital from the corporations. It strongly reflects the government's intention to make Nusantara Capital City a growth pole in the eastern part of Indonesia, particularly in the East Kalimantan Province. For the execution, the central government along with the regional government from Penajam Paser Utara and Balikpapan City have prepared a designated industrial area in, respectively, Buluminung and Kariangau.

These industrial areas are expected to open the floodgate of investment to Nusantara Capital City under high-tech industry including petrochemical and green energy. Powered by the ICT, smart industry in Nusantara Capital City will also address the SMEs and it will involve them in the big scheme of the industrial sector in the capital city and its vicinity. The government also launched an integrated business permission online. It will help to attract the Foreign Direct Investment as the main financial source. Respectively, the FDI could also aid the development of smart city in the case of Nusantara Capital City, circularly enforcing the numbers of FDI (Turnock 2005, Jayathilaka and Park 2022). To ensure that the flow of capital and investment is held accountable, an open system of governance using ICT is necessary. This is the point where e-government weighs in as the reformation and future of urban governance.

The constellation of Nusantara Capital City between Balikpapan City, Samarinda City, and Penajam Paser Utara Regency is also a critical point in addressing the interregional

interaction. The Nusantara Capital City is situated in the centre of Balikpapan as the centre of economy; Samarinda works as the capital city of Kalimantan Timur; and Penajam Paser Utara as the centre of agriculture and food. The smart city concept and ICT will enable the interaction to head toward competition within this region as studied by several works (Brenner 2009, Vesalon and Crețan 2020). However, the administrative structure of Nusantara Capital City as part of the urban governance shows otherwise. All partner regions and the Nusantara Capital City Authority direct the smart city development towards collaboration instead of competition, hence it fosters interregional collaboration rather than competitiveness. This is also indicated by the development of smart branding from Balikpapan and Penajam Paser Utara which is closely related to the theme of Nusantara Capital City. The integrated business permission online is also an evidence of how smart development increases collaboration.

Underpinning the Urban Future: the liveability of a city

The Nusantara Capital City Authority set the course to make the new capital city both lovable and liveable. To implement this ambition, the liveability of Nusantara Capital City stands on six service domains to deliver the necessary services for its future residents. Transportation and mobility in the New Capital City become a main focus for the Nusantara Capital City while this topic is also considered as a hot one for the discussion on urban governance. For the best practice, Spain has stolen the world's attention for the advancement of Smart Mobility due to the 80% of its population (Song et al. 2023). The first service domain, smart transportation, is a fundamental element to increase the quality of the residence in a city (Benevolo et al. 2016). As the main driving force for the relocation, traffic congestion in Jakarta severely takes the toll on its residents, impacting not only the economy sector but also the population mental and physical health (Yudhistira et al. 2016, Ghazali et al. 2019). Smart mobility with a better public transportation system and its derivatives should increase the quality of life for Nusantara's future residents.

Another key element to increase the liveability of the Nusantara residents is the Green Open Urban Space (Kusuma et al. 2023). Without a doubt, the Nusantara Capital City will have greenery at all of its corners since the government has declared this future capital city as the 'forest city' and 'sponge city'. The role of Green Open Urban Space is also critical in the context of the NUA. United Nations (2017) envisaged that the future city and urban area will have at least six principles foundations, including: (i) socially functioned; (ii) participatory; (iii) gender equality; (iv) sustainable economic growth; (v) integrated and boundless; (vi) inclusive mobile; (vii) disaster-resilience; and (viii) ecological. Nusantara Capital City is running toward NUA by implementing service domains such as transportation & mobility, and natural resources & energy. For the latter, the Nusantara Capital City Authority enacted that 65% of its urban area must be green or forested, encapsulating the point numbers vii) and viii) of the NUA.

With a green land coverage, annual hydrometeorological disasters that plague Jakarta, like floodings, will be deducted or even eliminated. Green land coverage is also beneficial for the hydrological cycle, securing the water resources and the natural habitat, while becoming a nature-based solution for urban living (McPhearson et al. 2023).

In the term of smart elements, the pursuit of liveability through nature-based solutions and the spirit of NUA can be fuelled by the smart environment. This element encapsulates the application of ICT to monitor land use and land cover change which is crucial to retain the percentage of land cover and also to supervise the air and water quality. In a wider extension, smart environments also include the smart infrastructure, as constructions and buildings have a heavy impact on the urban environment. It is related with a service domain of smart infrastructure and inherently with the smart grid that it accompanies.

Sustainability, as one of the strategic goals of smart cities, is an important concept in the development of the State Capital City. In general, the characteristics of the Smart Sustainable Urban Development Indicator can be approached by using the Smart Sustainable Cities indicator in accordance with the Key Performance Indicator of Smart Sustainable City (KPI SSC) from the United Nations Economic Commission for Europe (UNECE) and also from SDG 11, that is Sustainable Cities and Communities. The indicators of Smart Sustainable Cities according to the United for Smart Sustainable Cities (U4SSC) are divided into 3 main dimensions, namely: economic, environmental, and social dimensions. According to Lehtonen (2004), the economic dimension focuses on the aspects of urban production; the environmental dimension focuses on ecological aspects, the conservation of the natural environment, natural resources and energy; and, meanwhile, the social dimension covers equality, community autonomy, citizen welfare, and the satisfaction of basic human needs.

Since urbanisation is continuously increasing, the role of urban areas is getting more crucial. Urban areas do not merely serve as a living space but also as economic, political, and ecological nodes. At present, combining the issues of sustainable development, urbanisation, and sustainable city areas is becoming a new field of interest for research, education, and policy making. The 2030 Agenda for Sustainable Development Goals (SDGs) was developed through a bottom-up and comprehensive process in different aspects, namely social, economic, and environmental ones (Walker et al. 2019). In general, the transformation of urban development towards sustainable development is aimed at reviving the development of strategic cities. According to Cook and Nair (2021), the technological aspects of Smart Cities require in-depth scientific exploration and cutting-edge technology as well. The knowledge gaps faced by communities and the unequal fiscal capacity prevent the process of smart city development from growing (Viola and Fitrianto 2022). The concept of sustainability has been indirectly included in smart cities that highlight several aspects of sustainability, such as the need for

responsible resource management, energy efficiency, and citizen involvement. The concept of smart city has the potential to overcome the aspects of sustainability challenges by promoting people's participation, developing innovative and smart solutions for sustainability, increasing efficiency in city systems, and adopting the system of transparent and inclusive governance (Basiri et al. 2017).

Ensuring sustainable development is of primary importance for building systems that enable cities to analyse initiatives and to make decisions. Meanwhile, the goal of sustainable development is long-term economic and environmental stability that is achievable by integrating economic, environmental, and social dimensions (Basiri et al. 2017). Sustainable cities have become a goal desired for future urban development, especially in the Nusantara Capital City. The connection between the concept of sustainable cities and smart cities is one of the solutions in developing the Nusantara Capital City in the future. This is in line with what Caragliu et al. (2011) stated, where investment in human and social capital supported by transportation and digital infrastructure is able to encourage sustainable economic growth. Besides, the high quality of life along with the wise management of natural resources through participatory governance can also be achieved.

Conclusions

The Indonesian Government envisaged Nusantara Capital City to be a forest city, sponge city, and smart city. However, this research focuses on the smart city as linked to sustainability. The research question was related to how the concept of Smart Sustainable Urban Development will be implemented in the Capital City of Nusantara. As a framework that is constructed above sustainability and the implementation of ICT in urban planning, a smart sustainable city could aid Nusantara Capital City to achieve its objectives. Our results show that Nusantara Capital City has been designed to be a futuristic city through the smart city pillar. There are some fundamental service areas in the Nusantara Capital City that become the main issues and challenges for the future of urban life, including smart governance, smart mobility and transportation, smart living for supporting liveability, while the smart environment takes the form of balancing the use of natural resources and energy, and the smart society is achieved through increasing human resources and digital literacy, and smart infrastructures.

The smart sustainable urban development framework in Nusantara Capital City addresses the three main dimensions of economic, environment, and social aspects. The implementation of smart sustainable urban development in Nusantara Capital City will also permeate benefits through its boundaries and it will enhance cooperation between the new capital city and its partner region, facilitated by the ICT. The roles and presence of the partner region of Kutai Kartanegara, Penajam Paser Utara, Balikpapan, and

Samarinda, are crucial because these regions will accept benefits while simultaneously sustaining the effort to employ the smart sustainable urban development in the Nusantara Capital City. With massive development and enormous investments, it is important to encourage regional cooperation with the partner region for the Nusantara Capital City to accelerate a general economic development. Regional cooperation could be done through human resource development for the surrounding areas, while improving the infrastructure, and promoting the identity of the partner region. That way, the Nusantara Capital City can be a model for regional cooperation in Indonesia.

It is also imperative that the smart sustainable urban development needs to be enacted due to the urban area issues that the world has recently faced. Disaster risk, spatial and social injustice, economic stagnancy, to mention a few, have become impediments for the development of a region or urban area. Smart sustainable urban development also resonates with several frameworks that the urban future is heading to, such as the New Urban Agenda and good urban governance. Nusantara Capital City needs a clear and concise development plan and smart sustainable urban development may pave the way for this city to reach its full potential by providing general background, management guidelines, and measurable indicators. Apart from that, the results of this research can be a concept that is applied at the international level, especially in countries that move their capital to a completely newly built place.

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