LAB University of Applied Sciences

Advanced Smart Home and City Technologies for Sustainable and Intelligent Living

Smart City Development in Vietnam

LAB University of Applied Sciences
Bachelor of Business Administration, Business Information Technology
2025
Han Dang

Abstract

Author(s)	Publication type	Completion year
Han Dang	Thesis, UAS	2025
	Number of pages	
	xx	

Title of the thesis

Advanced Smart Home and City Technologies for Sustainable and Intelligent Living

Degree, Field of Study

Bachelor of Business Administration, Business Information Technology

Name, title and organisation of the client

N/A

Abstract

This thesis is about how smart cities are developing in Vietnam today. Smart cities in Vietnam, focus on technological, social, and economic developments. With rapid urbanization and digital transformation, Vietnam is currently implementing smart city models to address urban challenges, improve citizen quality of life, and enhance government efficiency. Through qualitative analysis and case studies, the research provides insights into the opportunities and challenges facing Vietnam as it moves toward building fully smart cities. The results show that while there has been a lot of achievement progress, there are still primary challenges to achieving the objectives of smart city development, especially a shortage of digital literacy, different availability of technology, and infrastructural issues.

Keywords

Smart Home, Smart City, Internet of Technology

Contents

1 Introduction

1.1 Background

Cities have witnessed an increase in population and are expected to increase soon (Ritchie & Roser, 2018), due to high economic growth and a better life compared to rural settlements (United Nations, 2019). This population growth has its advantages, but its downsides are difficult to avoid, including traffic congestion, pollution, housing shortages, among other problems. Traditionally, humans have always sought ways to enhance information, make it faster, simpler, and more portable to satisfy human needs, thus creating the information age and with it, smart devices (McKinsey & Company, 2018). These devices form a connection between wherever they are set up, whether at home, in the office, on the street, or in the city's transportation system (European Commission, 2021).. Technology companies have come up with solutions to provide sustainability to the city and improve the lives of its citizens through the idea of a smart city (McKinsey & Company, 2018; Hitachi Social Innovation, 2024).

Building smart cities is becoming a trend in urban areas around the world, and Vietnam is also taking the first steps towards it (Prime Minister of Vietnam, 2018). However, this is a model of applying information technology and artificial intelligence to manage and improve living standards, using energy sources and natural resources effectively. Smart City is a model of a city that applies the most modern technologies to improve the quality of life, serve the government, and improve conditions in all aspects (Mapsted, n.d.).

Vietnam is a small area with a population of over 90 million (World Population Review, 2025). With economic growth, smart cities need to be built with benefits and development for citizens. This is the main reason for the thesis, which is to analyze the solutions the government uses to develop the country and compare them with other developing countries in the area.

1.2 Research Objectives, Research Question, and Limitations

The general topic of the study is the smart city. This thesis still has a study limitation. However, the thesis cannot cover all of the issues within this discipline. Smart City is the idea that is centre stage. This includes how Smart City improves citizens' lives and the components of Smart City. The scope of the research is limited since it cannot be compared with all other elements of the perspective; it only includes objects that provide a broad perspective. Vietnam is researched in this thesis. Because the research subject is unique,

it will be more accurate for this study, but the result may not be applied to other countries. Research Objectives of the thesis are:

- Analyze the role of digital technology in the development process
- Evaluate the current situation, identify challenges, and provide solutions to improve the process of building smart cities in Vietnam.

Research questions are necessary for the data collection and analysis process. A valid research question is straightforward and can be researched. (White 2009, 33.) The main point of the thesis is to answer the following main question and sub-questions:

Main question:

- What is the status and the development of Smart City in Vietnam?

Sub questions:

- What is " Smart City"?
- What are the solutions for the development of a Smart City in Vietnam?

1.3 Research Methodology and Collecting Data

There are two frequently used research approaches:

- Quantitative method
- Qualitative method

Quantitative research methods handle numerical variables, results, and statistical data analysis that can be collected through surveys and polls to determine relationships between multiple factors.

The qualitative method of study focuses on figuring out a research problem. This usually requires extensive research and a view of the problem from numerous perspectives, with interviews providing a common example.

This study only uses a qualitative phenomenological approach to analyse the lived experiences of Vietnamese residents living in or connecting with the growth of smart cities in Vietnam. Phenomenology is ideal for this topic because it focuses on how people understand, see, and make sense of their daily lives in challenging and changing settings. This is an opportunity to investigate the real-life experiences of Vietnamese people who live in or deal with the idea of smart cities in Vietnam as it grows. Vietnam is chosen for the case

study. The case study method adds to the phenomenological framework by grounding participants' lived experiences in an individual social, cultural, and technical environment. Vietnam makes an excellent case because of its fast digital revolution and ambitious national strategy for smart city development. Due to its broad context and complexity, the qualitative aspect required the analysis of several smart cities and frameworks for identifying challenges and solutions. The thesis collects qualitative data through interviews with citizens in developing cities in Vietnam, Ho Chi Minh City, and Ha Noi. Through direct interviews or phone/video calls, chat with four individuals living in a developing city, including a stranger. Each participant will be asked separate open-ended questions based on the interview answers. For those who have not heard/do not know or are unclear about the content of the smart city construction policy, or the research purpose of the author group, the team will explain and collect opinions after explaining specifically about the research content. For those who already know about the smart city construction policy, the research continues to survey the level of understanding and assessments of interview participants about their personal feelings about the goals and solutions for smart city construction and using quantitative data from the government's public data and collecting the data from the internet. To explain the current status in Vietnam, it includes articles from local publications, academic publications, and document papers. The research carefully identifies all documents used in it and mentions them in the Reference section.

Artificial Intelligence (AI) tools were primarily integrated into this research process as support technologies to enhance efficiency throughout the study. And using AI needs to be done carefully and managed to ensure that the core analytical work and academic standards are met. AI was used to translate text from images. These visuals were photographed or collected during the research process and contain important details, making it easier for the reader to understand. Additionally, AI can translate images into images. In this study, there is a picture of the application that is only available in Vietnamese, and AI created a new one using English. The researcher manually reviewed all translations.

1.4 Thesis structure

This thesis is divided into the following five chapters:

- Introduction: an overview of the thesis topics, provides a basic concept, and introduces the main goals and understanding of the background of Smart City.
- Smart City: focuses on defining the essential term " Smart City" and the components of smart cities, as well as analyzing what is essential to becoming a smart city.

- Current Situation of Smart City in Vietnam: Analyzing the current state of smart cities in Vietnam to understand local challenges and opportunities.
- Interview: Analyzing results from interviewing people to find out their thoughts and feelings about living in a Smart City in Vietnam.
- Solution and Summary: summarizes findings and answers to the research questions

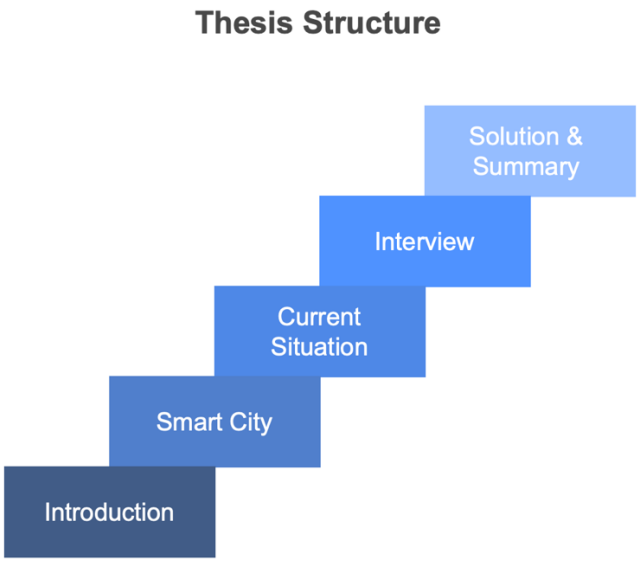

Figure 1: Thesis Structure

2 Smart City

2.1 What is “Smart City”

In recent years, the idea of smart cities has become popular worldwide as urban areas take steps to improve the quality of life for their residents (McKinsey & Company, 2018). Smart cities use modern technologies and focus on data solutions to improve urban infrastructure, services, and resource management. This change deals with the issues of a growing population and enhancing sustainable development (Grand View Research, 2023).

"Smart city" is an idea and model that uses modern technologies, including the Internet of Things (IoT), cloud computing, big data, and combining geographic and location information, to improve designing, constructing, managing, and providing innovative services faster in cities. Smart city development has been beneficial in the synchronous development, industrialization, informationization, urbanization, and sustainability in urban development. Cities have a long history of changing with societal developments, along with their residents' expectations and needs. (European Commission, n.d.)

The main objectives for building a smart city are:

- Convenience of public services (health, education, …)
- Safety and security in the living environment
- Intelligent transportation systems
- Growth economic

The smartness of a city is not about what technology is used, but instead on how technology is used. Technology is a tool for developing citizens’ lives via cooperation between the government’s plan and citizens’ demands. (United Nations, 2018)

2.2 Definitions

The concept of a "smart city" was first introduced in 1994 (Dameri & Cocchia, 2011). However, the term "smart city" is still defined in many ways in the literature (Nam & Pardo, 2011; Mohanty et al., 2016). Since 2010, the European Union has started using the term "smart" to describe sustainable development and activities in urban areas. The word "smart" might have been inspired by the development of smartphones, which have marked a critical point in modern social life (Dameri & Cocchia, 2011).

A "smart city" is where human, digital, and physical systems work well together in a previous environment to build a prosperous, equitable, and sustainable future for its residents (BSI, 2014). In a European Commission research report, a smart city is a place where services

and requirements are connected for the benefit of companies and citizens via electronic devices and telecommunications. Smart cities agree to go faster by decreasing emissions and using better technologies. Smart cities can be defined:

> *"A smart city is a city that combines science, technology, and policy to improve the quality of the community" (George et al., 2017).*

The "Smart City" is an idea about how to build cities using information and communication technology (ICT) to effectively manage a city's infrastructure and make services run more smoothly for everyone (McKinsey & Company, 2018). A smart city not only helps the people who live there but also attracts funds from companies and organisations worldwide. (United Nations, 2018).

2.3 The development stages of a smart city

According to Cohen (2015), the three stages of a smart city show how cities accept new technologies and development, guide the global economy, and control the people. Smart towns 1.0 is the first step. Technology is in charge now, and companies that sell technology to cities provide solutions. People struggle to understand how the smart city improves their lives. There may not be a clear picture of how the city should work with its residents.

Smart City 2.0 is managed by governments and made possible by technology. During this time, city managers are responsible for the city's future and innovative technologies. The main focus is on the technical solutions that benefit the quality of life. In the third stage, smart cities 3.0, people work together to develop solutions. Now, the focus is on fairness and problems with fitting in with others. The goal is to improve everyone's quality of life, so things that aren't being used to their full potential are made the most of by getting people to participate. It is welcome to help build the next wave of smarter towns (Ripla, 2024).

According to Yun & Lee (2019), Smart City 4.0 is “an automated, information-optimized smart city with the ability to anticipate and customize.” In this stage, cities are becoming innovative systems, able to collect and analyze data in real time, predict future problems, and automatically provide suitable solutions. Smart City 4.0 can change how devices are managed from inactive to proactive and even predictive. AI, machine learning, and data analytics are essential elements at this stage. The city turns into a "Smart" city when it learns and grows along with its people, improving its functions all the time to meet new needs and skills, and it provides this almost without any direct help from people.

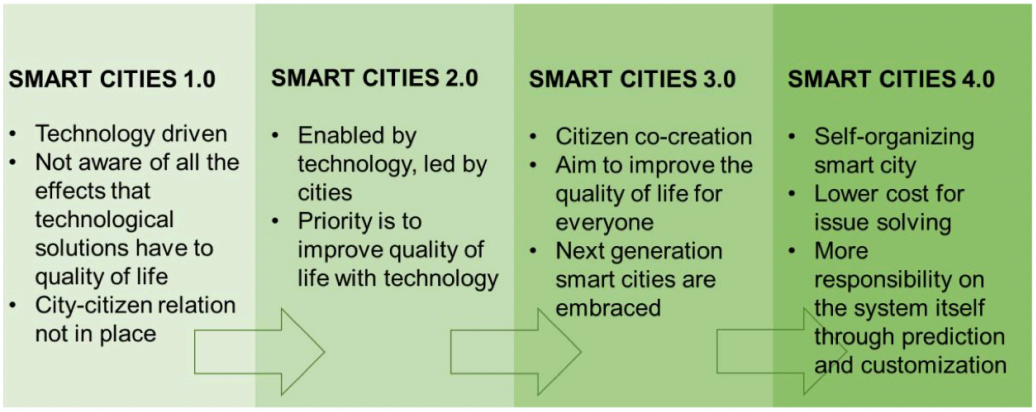

Figure 2: Smart city development stages (Hautamäki, 2021)

2.4 The characteristics of a smart city

The concept of a smart city has six main elements: smart economy, smart mobility, smart environment, smart people, smart living, and smart governance (Lee et al. 2013).

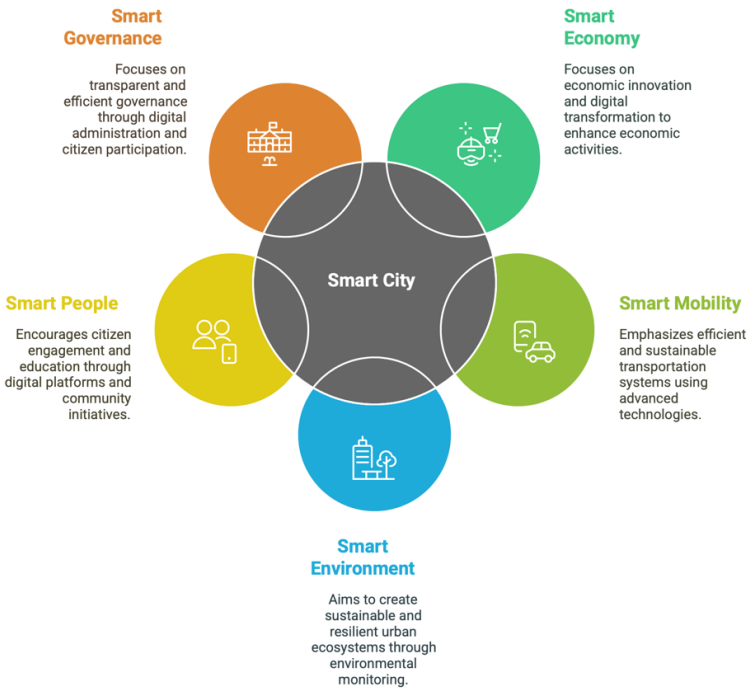

Figure 3: Building a Connected and Sustainable Smart City

2.4.1 Smart Economy

The smart economy is characterised by innovation, creativity, and the promotion of new ideas and technological advancements. The contribution of startups is significant, since new businesses develop and become successful, contributing to economic growth (Apostol, Tóth, & Kádár, 2022). In addition, the financial and brand of the city are enhanced by policies to support businesses and attract investment. At the same time, labor productivity reflects economic efficiency and the ability to apply technology in production. Developing economic changes are made easier by the city's flexible job market, and the city's international connections open up many opportunities for collaboration and hiring resources from outside. Finally, changing ability is essential for a Smart City's economy to be intelligent, sustainable, and effective when faced with quick modifications in the market, technology, and global trends (Deloitte US, n.d.).

2.4.2 Smart mobility

Smart mobility is one of the essential components of a Smart City, helping to improve connectivity, improve transportation efficiency, and ensure sustainable development (European Commission, 2023). A successful public transportation system, modern road infrastructure, and flexible personal mobility solutions consisting of electric bicycles, automatic buses, or ride-sharing services are all necessary for a smart city to ensure local accessibility and make it easier for citizens to travel around the city (International Association of Public Transport [UITP], 2020). The ability to connect with other cities and countries also plays a vital role in connecting the city with the main economic regions, facilitating trade, tourism, and interregional cooperation through highways, high-speed rail systems, modern airports, and interregional transport (United Nations Economic Commission for Europe [UNECE], 2022). Additionally, the availability of information and communication technology (ICT) infrastructure is important in improving the ability to monitor, manage, and operate the urban transport system. 5G telecommunications networks, IoT sensors, Big Data, and Artificial Intelligence (AI) make it possible to gather and analyse data in real time, optimizing vehicle movements, reducing traffic, and enhancing passenger travel experience (European Commission, 2020). Also, automatic vehicle delivery systems, artificial intelligence applications in traffic light management, and smart parking solutions improve smart transportation networks and reduce traffic jams (McKinsey & Company, 2018). The development of transportation systems that are not only safe, intelligent, and sustainable but also very important to ensure the long-term growth of the cities (KONE Corporation, 2023).

2.4.3 Smart people

A smart city depends not only on technology but also on the citizens' education to ensure they have enough knowledge and skills to take the opportunities that the city offers quickly (Höjer & Wangel, 2015). With different backgrounds, create a place where culture, thinking, and ideas can live together, allowing for creativity and teamwork between communities (Anthopoulos, 2019). People can adapt to fast changes in the economy, technology, and living conditions if they can think and act flexibly. Creativity fosters new ideas in all areas. In globalisation, people living in smart cities need to think bigger and be open to other cultures. They also need to be open to new technologies and want to increase collaboration between countries (Komninos, 2013). In addition, taking part in community life is the key to making a long-term society where everyone has a say and helps the group change (European Commission, 2025). When all of this comes together, people who live in Smart City are not only smart citizens but also a big part of making the city develop sustainably.

2.4.4 Smart environment

A smart environment ensures that growth is safe and citizens enjoy a good quality of life (Ahvenniemi et al., 2017). Natural conditions play an important role in creating a comfortable city, with peaceful landscapes, a good climate, and high natural resources. A smart city has some natural benefits. However, it also has to deal with many problems, such as pollution in the air, water, noise, and trash (Bibri & Krogstie, 2020). To reduce pollution, strict laws must be set, and modern technology must be used to track down and deal with pollution sources. Besides, environmental protection is a core issue; it helps the city maintain a balanced ecosystem, reducing harmful effects from urbanization and industrialization. This includes making buildings more environmentally friendly, adding more green space, using renewable energy, and ensuring that people living in this environment have good health (Ameen, Mourshed, & Li, 2025). The Earth can especially increase in age.

2.4.5 Smart Living

Housing needs to use environmentally friendly building supplies that reduce negative impacts on the ecosystem. It is known as a Smart Home with energy-saving products and modern technologies, helping make life convenient and comfortable (Sadowski & Pasquale, 2015). Smart living isn't just about technology; it requires ensuring people have a good quality of life via their physical and mental health (Albino, Berardi, & Dangelico, 2015). Cultural facilities (museums, theaters, libraries, and art spaces) always need to be maintained to promote creativity and improve the spiritual lives of citizens (Townsend,

2013). Besides mental health, health is the most important thing. It must be ensured through an advanced healthcare system, applying modern technology to provide remote healthcare services and enhance disease prevention when training AI in healthcare to have exact results (Ristevski & Chen, 2018).

2.4.6 Smart governance

The decision-making process is one of the most important things. It allows residents to develop strategies and the relationship between the government and society (Nam & Pardo, 2011). Additionally, digital technology must be used to its maximum to improve the quality of public and social services. This will make routine tasks easier and improve health care, education, and public transportation (Batty et al., 2012). To build trust, open government is essential. This works by sharing information, using open data, and using new technology to make the government a better manager and less crooked (Janssen, Charalabidis, & Zuiderwijk, 2012). Also, a Smart City needs a clear plan and political perspective. It should aim for long-term growth and be able to quickly adapt to changes in technology, society, and the economy (Kitchin, 2014). Innovative governance in Smart City is about applying technology in management and ensuring it creates fair, efficient community participation (Meijer & Bolívar, 2016).

2.5 Why do we need to build Smart Cities?

City populations that are so high that they have difficulty accommodating extra people are happening more often in all big cities worldwide. Because there are too many people, the public transportation, housing, healthcare, and school systems are all stressed. This makes it harder for city authorities to provide for citizens' basic needs. The growing pressure on social services and facilities caused by a rise in urban population choice requires the development of Smart Cities (Shach-Pinsly, 2021)

Environmental pollution is another big problem that keeps getting more difficult in cities. Pollution of the air, water, and land is getting worse because of more cars on the road, additional manufacturing facilities, and bad waste management systems (OECD, 2020). This environmental damage affects ecosystems and creates essential health risks, especially for children, the elderly, and people with health problems (WHO, 2016). Modern cities confront current issues in the city and enduring ones, such as global warming. Increasing temperatures already affect several regions globally, resulting in increased heat waves, variable weather conditions, and ecosystem pressure (IPCC, 2021). Cities must take essential steps to reduce greenhouse gas emissions to deal with the effects of climate change. (Tokoro, 2016) As important centres of people and industry, cities are essential in

tackling this challenge. Developing green infrastructure, supporting clean energy, and promoting environmentally friendly behaviours are all critical strategies to reduce the effects of global warming and ensure that the future is safe (European Commission, 2020). More and more cities are resorting to Smart City projects to deal with the everyday challenges of daily life in cities. These towns use smart devices, apps, and data systems to make services like drinking water, trash collection, transportation, and energy more reliable and efficient (Nam & Pardo, 2011). The goal is to improve the quality of life in cities by making them more environmentally friendly, healthy, and sustainable, primarily by reducing harmful greenhouse gas emissions. Thousands of individuals believe that developing Smart Cities worldwide is an effective means to promote environmentally friendly habits and make real progress in fighting global warming.

Many municipal governments deal with the challenge of dwindling financial resources. Government funds frequently become thin because more people want to use public services and infrastructure (United Nations, 2019). The absence of funds obstructs investment in long-term urban development projects and the enhancement and maintenance of existing resources (OECD, 2020). In some cases, municipalities have to reject or abandon essential changes, reducing the general quality of urban life. Poor infrastructure continues to be an ongoing issue, especially in emerging and rapidly growing cities (World Bank, 2020). Outdated or insufficient infrastructure, such as inadequate road networks, unreliable public transportation, poor waste treatment facilities, and limited accessibility to clean water, can seriously affect a city’s functioning (European Commission, 2020). This leads to everyday disruptions for people and adversely affects economic productivity and social well-being.

Many cities are also having trouble with their economies growing slowly. Some do well, but others stay the same or go into an economic depression because the economy is changing, factories are closing down, and there aren't enough jobs. This worsens poverty, wealth inequality, and social conflict in cities.

In conclusion, development in the 21st century is like a double-edged sword: it offers both chances and big problems. As cities continue to grow, communities, urban planners, and governments need to work together to devise new ways to solve these challenges and make cities flexible, welcoming, and long-lasting.

3 Smart City in Vietnam

3.1 Background

The developmental background of cities in Vietnam is defined by rapid development and a low starting point. While other countries with advanced economies aim to improve their cities with an environment of strong infrastructure, Vietnam offers many opportunities to construct new urban areas, and it has just achieved 35% of its growing cities' ability compared to the 70% target (World Bank & MPI, 2016). The growth rate has decreased in recent years but remains at 3% per year, so it still qualifies as fast development. In the next decades, this rate will continue and focus on large urban centres.

Vietnam has begun implementing hundreds of smart city development projects, especially in major cities like Hanoi, Ho Chi Minh City, Da Nang, and Binh Duong. In addition, in 2018, the Government of Vietnam promulgated the "Smart Urban Development Program," aiming for 20% of major cities in the country to deploy smart technology solutions by 2025 (Ministry of Information and Communications, 2020).

By the end of 2024, Vietnam had about 43 cities and towns establishing smart city solutions. Smart developments for cities are additionally being carried out in 48 of the 63 provinces and cities across the country. (Market Research Vietnam, 2024)

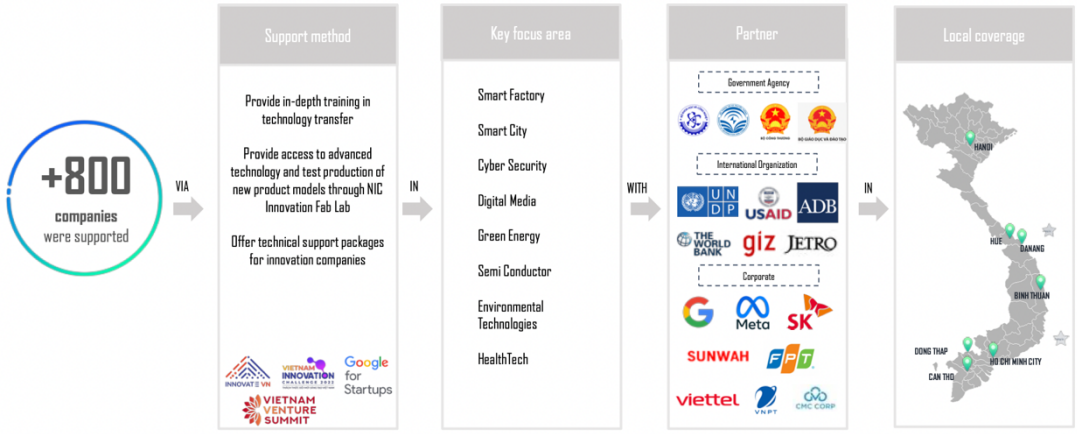

Figure 4: Funding and supporters for building a Smart City in Vietnam

Vietnam's smart city projects get money from many different sources, but the government's budget is the main one. This is where most of the money comes from for building basic infrastructure like smart operation centres, collaborative information systems, and IT infrastructure (Ministry of Information and Communications, 2020). It's just that the government's finances are small and have to be broken up between many areas, so it can

only cover some of the money that big projects need. In addition, Vietnam takes a lot of help from foreign groups in the form of loans or aid that doesn't have to be paid back (ODA). The World Bank (WB), the Asian Development Bank (ADB), JICA (Japan), USAID (United States), KOICA (Korea), and other groups have given money to many projects that seek to improve city planning, create green energy, make public transport better, and make cities better able to deal with climate change (World Bank, 2023; Asian Development Bank, 2021; USAID Vietnam, 2022). The loans give Vietnam money and help it gain knowledge, experience, and cutting-edge technology from more developed nations (JICA, 2021). Through the public-private partnership (PPP) strategy, getting money from the private sector is becoming a more effective way to move forward (Nguyen et al., 2022). Many big companies in Vietnam, like Viettel, VNPT, FPT, Vingroup, and others, have invested in and put smart solutions into place in areas like healthcare, education, electronic transfers, and handling cities (FPT Corporation, 2023). While private companies participate, the government can reduce some of its financial stress and all benefit from innovation, adaptability, and rapid technological advancement. Vietnam also has an ecosystem of startups growing quickly, which could be useful for smart city projects (Nguyen & Hoang, 2022). Venture capital and innovation funds, both locally and globally, are giving money to many new businesses working on high-tech solutions for things like managing waste, telling people about natural disasters, and making smart traffic systems work together. If these new ideas are properly backed up, they will make a big difference in modernising cities in the country (Circular Cities and Regions Initiative, 2024).

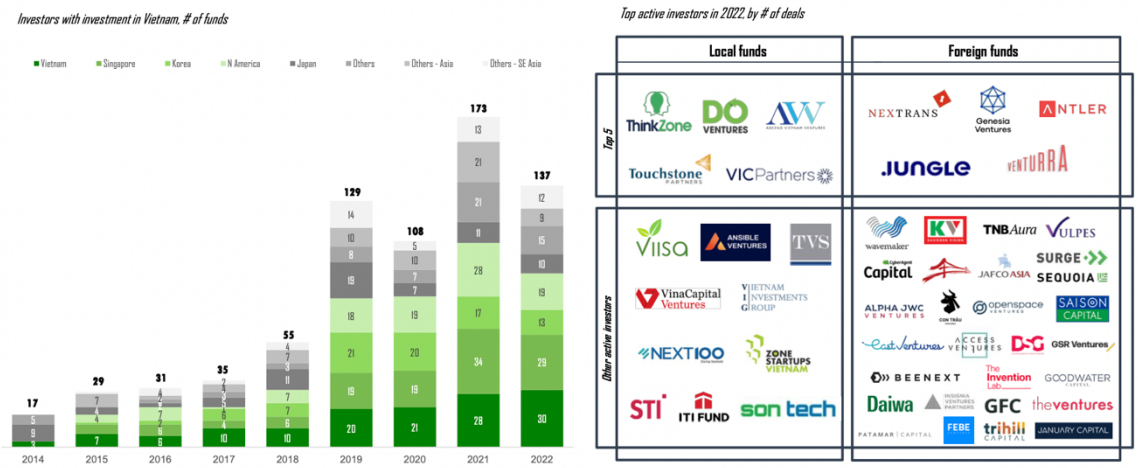

Figure 5: Investors with investment in Vietnam (Vietnam innovation & tech investment report, 2023)

3.2 Vietnam's Smart City development strategy and development plan

To build a modern, sustainable, and smart city, the Government of Vietnam published "The Plan for Developing Vietnamese Smart City to 2030" (Prime Minister of Vietnam, 2018). The following goals are in this plan:

- Improve the quality of life: The plan's ultimate goal is to provide residents with a friendly, safe, and comfortable living environment through information and communication technology. It also ensures the growth of such public services as health, education, and smart transportation, thus raising the quality of life for people.
- Enhancement of public services: Prepare the best way forward to improve the management and delivery of public services to Vietnamese nationals. Smart transport management systems and mobile solutions enable residents to get information and services more easily.
- Enhancement of public services: Prepare the best way forward to improve the management and delivery of public services to Indian nationals. Smart transport management systems and mobile solutions enable residents to get information and services more easily.
- Promote sustainability: Inclusion of renewable energy, green technology, and solutions to reduce pollution is a step towards economic development without destroying the environment.
- Improved connectivity: A strong information technology framework connects services and systems (helps collect data accurately, which improves urban management).
- Human resource training: One of the key focuses of the plan is training qualified human resources in information technology and smart urban management. This is through partnerships with education and industry to create appropriate training.

3.3 Current Situation of Smart City in Vietnam

3.3.1 Internet and 5G

According to data from the Viettel Group, a favorable factor for developing smart cities in Vietnam is the high ratio of Internet users to total population in Vietnam, ranking in the top

10 in Asia. Vietnam currently has about 72.1 million Internet users, reaching a penetration rate of 73%. Some cities with suitable conditions to apply the smart city model are Hai Phong, Da Nang, Thanh Hoa, Thai Nguyen, Ha Long, Hue, Can Tho, Rach Gia, Phu Quoc, Nha Trang, and Quy Nhon (Data Reportal, 2024).

The rising level of Internet usage shows people's developed access to technology and an essential transition from traditional activities to online settings, including e-commerce, distance learning, digital entertainment, and online public services. Vietnam has a lot of people who use both regular and mobile Internet. About 99% of the population has a mobile connection. This means that, on average, every person has at least one phone SIM or mobile connection device. This makes it easier for digital services and mobile apps to be built on each other later. (Vietnam innovation & tech investment report, 2023)

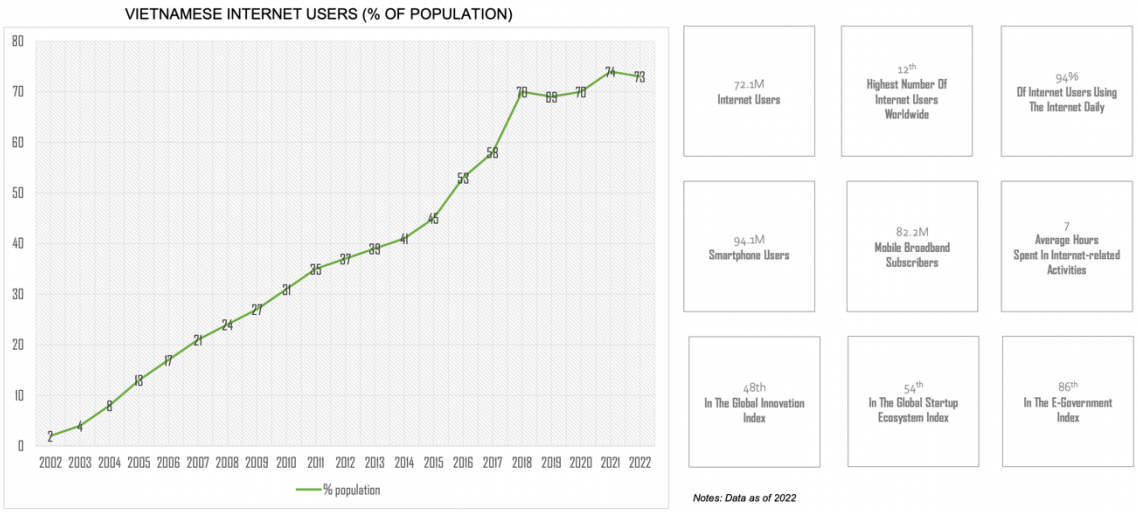

Figure 6: Vietnamese internet user (Vietnam innovation & tech investment report, 2023)

Applying 5G into use and making it popular is not only an improvement to communication technology, but it also sets the foundation for the growth of cutting-edge fields like AI, IoT, self-driving cars, remote healthcare, high-quality online education, and brilliantly built environments. 5G's very fast transmission speed and very low latency will help connect millions of devices at once, making sure that the digital environment has the performance and security it needs to last. (World Economic Forum, 2020).

Although 5G has been tested and commercially tested by Vietnamese telecommunications enterprises (Viettel; Vinaphone; MobiFone), up to now there has not been any comprehensive assessment study on the 5G picture in Vietnam, in which the consideration of deploying which applications and services is suitable for the conditions, circumstances and habits of

Vietnamese people has not been specifically studied. (World Economic Forum, 2020; GSMA, 2021; Deloitte, 2020).

3.3.2 Electronic Identification and collecting data (VneID - Vietnam Electronic Identification)

The Vietnamese Ministry of Public Security created the VNeID electronic registration app, which was launched on July 18, 2022. Vietnam recently set up a national digital identification platform for the first time. This means that citizens can use their electronic accounts instead of physical ID cards with chips for many government and private tasks. (Vietnam News Agency, 2022)

VNeID is a mobile application built on a database platform of identification, population, and electronic authentication, connecting with state administrative agencies and social organizations. Up to now, the VNeID electronic identification application has begun to develop into a national digital transformation "super application", bringing many practical benefits to people, businesses, and the government.

An application created to take the place of traditional documentation and offer useful tools for digital people, the digital government, and the digital society. VNeID is also very important for managing the government because it cuts down on trash and mistakes that happen when paper records are used. This saves time and money for both people and the state. People must first download the VNeID app to their smartphones to use it. This is for people who have signed up for an electronic identification and authentication account and are now waiting for approval and the account to be sent to them, as well as for people who have finished the steps needed to get an account.

Figure 7: Interface of VNeID application (Chat GPT)

Using and replacing different kinds of personal documents in daily life is one of the most remarkable and ground-breaking features of the VNeID app. People only need to use the VNeID app on their phones to show who they are and make transactions, instead of carrying around a lot of different types of paper information. Notably, the VNeID app has, up until now, made it possible to show and use information from many different basic and important papers:

- Chip-embedded citizen identification card: fully digitized with basic information including full name, date of birth, identification number, and portrait photo.
- Driving license: Allows finding and using instead of the original when driving or going through the steps at government offices.
- Health insurance card: This card lets people get medical care and see a doctor without carrying it around with them.
- Individual tax code: can submit their taxes electronically and quickly meet their financial responsibilities.
- Information about COVID-19 vaccinations and medical history: The Department of Health provides information about vaccinations, medical exams, and treatment history. This information helps with medical action, travel, and work during and after the pandemic.

- Residence registration and residence data. This feature checks if someone is living in a permanent, temporary, or temporary place and also makes it easy to change address, in line with the rule that gets rid of paper family registration books in 2023.

In the next step, from 2025 to 2026, VNeID will continue to develop more important documents that can be added:

- All levels of graduation certificates
- Student card
- Bank accounts
- Information on personal details like vehicle names, vehicle registration numbers

With VNeID, people can easily send documents and check on the status of administrative processes from their phones, instead of having to go to department offices in person as they used to. Online forms make it easy and quick to do common things like choosing temporary residence, temporary absence, permanent residence, renewing documents, reporting lost documents, and more (Vietnam Ministry of Public Security, 2024).

One unique feature is that people can check on the status of their documents and get updates, comments, and extra information at the right time if the authorities ask for it. This helps to cut down on delays and mistakes and makes the work process clearer. To make things better, working time is cut down, document touch is greatly reduced, and administrative agencies are no longer overloaded.

People often have to pay fees to use government services like getting and changing documents, registering permanent residence, making citizen ID cards, and more. You no longer have to wait in line to pay cash at the bank or transaction counter. Now, make all of these payments on the VNeID app with just a few easy steps on your phone. Many people like that they can pay traffic fines online, which is very useful. People who are fined don't have to go to the state's finance or police offices to pay. Instead, they can use VNeID to see the most recent decision on their fine and pay it directly. This saves time and makes things easier for the people in charge of administration. (Vietnam Ministry of Public Security, 2022)

With VNeID, users can also pay their regular bills like rent, utilities, health insurance, social insurance, personal income tax, etc., through links to banks or well-known e-wallets like VNPT Pay, MoMo, and Viettel Money. People who sync their account information are more likely to check, watch, and pay their bills on time, which lowers the risk of late payments, fines, and service interruptions. VNeID lets you use a unique QR code for every transaction and a payment identification code that links to your account. This helps make sure that the

payment process is safe, clear, and highly reliable. One of the biggest worries people have about internet payments is that their information could be stolen or changed without their knowledge. Two-way encryption technology helps lower this risk. When you pay with VNeID, the whole process is done on a national standard security platform that uses two-layer authentication, which uses both passwords and biometrics (like fingerprints or faces). Also, all transactions are saved, records can be viewed, and electronic receipts can be sent out. This makes it simple for people to check and file a complaint if something is wrong (Vietnam Ministry of Public Security, 2024).

In the future, VNeID will keep focusing on making the user experience more personalised, improving advanced security layers, and making it easier to connect with new technologies, for example, AI, blockchain, and big data, to better serve.

3.3.3 The Ho Chi Minh City Smart City Project

Over US$1.8 million has been invested in smart transport systems in Ho Chi Minh City. The City People's Committee hopes these methods will produce measurable results earlier than 2025. The project partnered with several domestic and international partners to set up central traffic control systems and install CCTV cameras, traffic sensors, and modern technological equipment to enhance urban traffic management and synchronisation. (Vietnam Ministry of Information and Communications, 2024).

Ho Chi Minh City is now the most populated city in Vietnam, with over 9 million citizens (excluding temporary residents) and a growing number of personal vehicles, particularly motorcycles and automobiles. Traffic jams have become an important issue, regularly manifesting on several essential roads, especially during busy times. Traffic jams not only waste time and fuel but also cause air pollution and noise, and seriously affect public health and quality of life (Vietnam Ministry of Information and Communications,2024).

In this project, intelligent traffic solutions are anticipated to substantially solve the problem of jams by employing technology to analyse traffic trends, automatically modify traffic signals, and automate reactions to unusual conditions on the roads. Cameras and sensors provide real-time traffic density monitoring, while also supplying vital data for traffic predictions, issuing early alerts, and assisting individuals in selecting optimal routes.

For extra convenience, smart traffic systems are linked to digital technology platforms such as online maps, traffic alerts, and mobile apps. This makes it easy to get traffic information, helps to balance out traffic, and makes main roads less crowded. The city is slowly getting in place smart traffic lights, computer screens that show information in real-time, and an emergency fast reaction system.

Smart traffic systems are an important part of making Ho Chi Minh City a smart, sustainable, modern, and liveable city. Investing in and building them is a good way to deal with the ongoing problem of traffic jams. The main objective of the project is to reduce traffic, and it also wants to help the growth of environmentally friendly ways to get around, including electric cars, better public transportation, and car-sharing services. This builds a strong foundation for long-term and wide development and makes it easier for the city to become deeply connected with the world's best smart cities.

3.3.4 Vinhomes Smart City- Ha Noi

Vinhome Smart City is a smart supercity located in the Nam Tu Liem District of Ha Noi. Vingroup Corporation built and invested in it (Hanoi Real Estate, n.d.). With a strategic vision and methodical investment, Vinhome Smart City has become an identity for a modern, developed, sustainable lifestyle associated with technology and a green environment.

Vinhomes Smart City is on a huge scale that occupies hundreds of hectares and features several high-rise apartment towers, each of which has approximately 39 floors and provides more than 100,000 apartments of varying types (Hanoi Real Estate, n.d.). The project is right on Thang Long Highway, one of the capital's main roads (Asia Prop, 2023). This makes it easy for people to get to the city centre, Noi Bai airport, and the western regions of Hanoi, which are growing quickly, like My Dinh, Cau Giay, and Nam Tu Liem. It is not only a city for living; in fact, Vinhomes Smart City is an inclusive living ecosystem. This means that all residents will be able to take pleasure in a complex, modern, and convenient way of life directly in the setting in which they spend their daily lives. The project was planned and built by Vingroup Corporation using the "city inside a city" model. It includes everything needed for modern life, including living, shopping, healthcare, education, culture, technology, and the environment. (Vinhomes Land, n.d.)

An important feature of Vinhomes Smart City is the large-scale theme park system, which is designed to be a green space in the middle of Hanoi. The project includes up to three parks that are linked and cover a total area of tens of hectares. These parks will provide cool, fresh green space for the whole city (Vinhomes Land, n.d.; Asia Prop, 2023). The 6.1-hectare Japanese Zen Park is one of them. It has become known as a place of peace and relaxation, with typical Japanese features like a Koi fish pond, wooden bridge, pine garden, stone tower, bamboo forest, and thousands of cherry blossom trees (Vinhomes Land, n.d.). Zen Park is where people can walk, practice meditation, and "heal their souls" from their busy lives. Vinhomes Smart City cares not only about the environment but also about people's quality of life. It does this through a system of modern services that work together:

- Vincom Mega Mall is a huge shopping, dining, and entertainment complex that offers international-level shopping, eating, and entertainment (Vinhomes Land, n.d.). Residents don't have to go far to get to hundreds of popular shops, movie theatres, play places for kids, and restaurants serving a variety of foods.
- The Vinmec International General Hospital is a place that provides excellent healthcare with a group of highly skilled doctors, up-to-date tools, and processes for exams and treatments that are in line with international standards (Vinhomes Land, n.d.). This means that people can feel safe about their health and the health of their families right where they live.
- Vinschool is a chain of schools that goes from kindergarten to high school (Vinhomes Land, n.d.). It is known for its advanced training program, dedicated teachers, and state-of-the-art buildings (Vinhomes Land, n.d.). This helps build a strong base for the future by letting residents' children go to a regular school.

Smart technology is used in every part of city life, which is the most significant change and the principal value of Vinhomes Smart City. Residents of cities will feel safe just by deciding to walk into the area because of the modern, multi-layered security system that includes electric card entry control, automatic recognition of faces, and thousands of AI cameras that look at pictures in real time (VinBigData, n.d.). Keeping an eye on things 24 hours a day, seven days a week helps stop strange behaviour early and protects residents. Also, the smart internal traffic system includes cooperation and guidance apps that make it easier for people to find their way, book a car, park their car, and get around. Even parking is controlled by CCTV and sensors, so there is no more traffic and time wasted looking for a spot (VinBigData, n.d.). Residents of Vinhomes Smart City can also use the "VinID" app, the private home management app (VinBigData, n.d.). This app combines all utilities, so residents can use their smartphones to control their water and energy, pay their bills, schedule services, and report technological problems (VinBigData, n.d.). Residents can handle everything with just a few touches, so they don't have to move or wait. This is quick, easy, and saves a lot of time.

4 Interview

4.1 Interview Questions

Q1: How would you evaluate Vietnam's existing infrastructure state in developing a smart city?

Q2: What do you think are the main challenges to Vietnam's smart transport system development?

Q3: Can the smart city model be supported by Vietnam's ongoing 5G and telecommunications infrastructure deployment?

Q4: How has the city used renewable energy and smart grids in urban infrastructure development?

Q5: What recommendations do you have to improve smart city technology connectivity and infrastructure?

4.2 Interview from a government perspective

According to him, an urban planner, the process of developing smart cities still faces many challenges that need to be solved, especially in terms of infrastructure and connectivity. He analysed that although some large cities such as Ho Chi Minh City, Hanoi, and Da Nang have developed smart city projects, the current infrastructure system is still not synchronous. Residential areas, factories, and government centres are not connected since many parts of the same urban area are developing at different rates. Because of this, applying innovative ideas successfully is challenging. He underlined the necessity for a longer-term perspective in Vietnamese urban planning to prevent unplanned growth and a lack of collaboration through management organisations. One of the biggest challenges that he pointed out is the transportation system. In real life, roads still struggle with travel expectations, although the development of several smart traffic solutions, including AI CCTV cameras and automated traffic lights, has occurred. Using these solutions is challenging because of limited space for public transport, narrow roads, and high private vehicle traffic. In addition, people are not highly aware of traffic, which keeps technology from working to its maximum ability. He thinks that creating a smart city refers to not just developments in technology but also changes to planning laws and social behaviour. Given the telecommunications infrastructure, Mr. Minh said that 5G technology will be essential in creating smart cities and supporting the smooth operation of IoT (Internet of Things) devices. However, he also noted that creating smart cities will still be challenging if we only

focus on developing 5G networks without synchronising with others, including urban management or transportation systems. Smart cities are an innovation and a long-term development strategy, requiring strong collaboration between the government, businesses, and the community. The creation of smart cities will become a reality and provide many helpful benefits to citizens if Vietnam can resolve its energy, transportation, and infrastructure development issues.

4.3 Interview from a business perspective

The director of a telecommunications company- Viettel Ho Chi Minh- said that smart cities cannot work smoothly without a strong telecommunications system, especially a 5G network and data infrastructure. Vietnam faces many challenges in deploying and improving this technology on a large scale. Although cities like Hanoi and Ho Chi Minh City are beginning to develop innovative city solutions, many locations do not have stable connectivity, especially in low-income regions and the suburbs. As a result, innovative city services, security monitoring, and intelligent traffic management systems are less successful. The 5G network is one of the most essential elements of a smart city because it allows real-time data processing through connecting millions of IoT (Internet of Things) devices into a single system. She thinks the government should help telecom companies develop the network because the cost of implementing 5G is still quite high. 5G will only be installed in a few critical places without a sensible investment plan, reducing the smart city's synchronisation and quality. 5G broadcasting stations use a lot of electricity, putting more pressure on the energy system if they only take power from the national grid. Therefore, wind and solar energy in telecommunications systems, especially, help to protect the environment and lower operating costs. To ensure sustainable development for smart cities, she believes the government needs to establish rules that promote telecom companies' use of green energy. She suggested that to maximise urban management, it is essential to set up cloud computing and Big Data infrastructure in addition to increasing 5G connectivity. At the same time, the government has to establish higher-quality privacy and security laws because cyberattacks are becoming more common while cities get smarter.

4.4 Interview for a Citizen perspective

The residents and workers in smart cities represent a long-term government strategy and unique changes affecting day-to-day living. A resident of Hanoi shared her common views on the conveniences and challenges that the innovative city model brings. She thinks many modern technological applications have improved people's quality of life. In addition, smart parking lots, security camera systems, and digital traffic map applications have made it

easier for individuals to travel around and find parking spots. She found out that these apps are not always synced and that the data they provide is sometimes wrong, especially during high traffic. For example, users can feel annoyed when the application shows that the parking lot is empty, but on departure, they realise that the space is taken. This points out that the traffic data system still needs improvement to ensure reliable and on-time updates. Traffic jams are one of the issues that she is most concerned about. Although the government has established several solutions, including smart traffic lights or smarter traffic flow, increasing the number of private vehicles is an important challenge. She argues that the public transport infrastructure must be completely developed and ready to deal with people's travel needs before smart transport can be looked at for it to be truly successful. But at the moment, Hanoi's buses and trains aren't well enough serviced to take the place of private vehicles. With flexibility, motorbikes continue to be a popular choice, which leads to unresolved traffic problems. It's an excellent plan to use solar energy or other green energy sources, but many homes find it impossible to pay for the high installation costs. Installing solar power systems can not only reduce the load on the national grid but also help build a more sustainable city if the government offers incentives or support programs. Although there are still many issues that need to be improved, she believes that smart cities are a positive trend, helping to improve the quality of life for people. She hopes that the government will have appropriate policies so that smart solutions can truly serve the real needs of residents.

4.5 Interview from a student perspective

A student who is researching smart city models, an exciting topic, also raises many questions about the future of cities and how technology can change our daily lives. A successful software system that helps in fixing urban issues, including traffic, the environment, and energy, is more important to a smart city than just having a lot of modern technology. While many people deal with traffic issues every day, he is especially interested in how technology may help. He noticed via the study process that many smart traffic solutions, including automated public transportation, traffic signal systems that change to traffic flow, and real-time traffic maps, have been used in significant cities worldwide. However, in Vietnam, these technologies have not been deployed synchronously, causing traffic jams to continue. He realized that if he only focused on building technological infrastructure without paying attention to the energy source used, the city would not be environmentally friendly. Many countries are currently using smart grid technologies, solar energy, and wind energy to cut back on traditional electricity consumption. Because Vietnam has a climate that is suitable for the growth of renewable energy, he suggests that the country also needs an improved plan for

developing renewable energy, especially for utilising solar energy. HE also thinks about how technology can help people live more conveniently. However, he also understands that smart cities need to improve citizen awareness and behaviour, as well as depend on technology. Regardless of how modern the city is, he feels it will be hard to develop sustainably if people do not know environmental protection, ignore traffic laws, or fail to apply technology successfully. In his opinion, education is key for supporting the next generation in learning about smart cities and how they can help create a better city.

4.6 Analyze

Individuals interviewed all agreed on one thing: they knew how crucial and critical smart cities were. Today, this idea is a real way to solve problems like traffic jams, pollution, overloaded infrastructure, and poor city management. During conversations, it has been evident that Vietnam's implementation process remains messed up, with different areas and industries not working together.

All interviewees said that traffic was the most important problem in cities today. This is also where people think things will be "smartened" first. For a long time, traffic jams, pollution from car emissions, and a lack of control over traffic activity in big cities have all been problems that affect not only the business but also the health and quality of life of the people who live there. Some places are setting in place smart traffic solutions like automatic signal systems, digital maps, and quick traffic warnings. However, these methods are still very new and generally don't work very well. A study of the views reveals that smart traffic isn't just about new technologies. The issue also needs new ways of thinking about planning for cities, better public transport systems, and, most importantly, changes in how people move. People are open to change if there are better solutions. But people still must depend on motorbikes and private cars when buses are full; metros are not complete. This is what causes traffic jams. That's why smart transport needs to go hand in hand with smart and easy public transport. Building a smart city requires a strong digital infrastructure that includes elements like fast internet, lots of sensors, and especially, big data. However, Vietnamese telecommunications businesses are still having trouble setting up a stable and effective network across the whole country. It's hard to collect and manage data because of the differences between cities and rural areas, management domains, and provinces and cities. The problem of sharing data between both public and private organizations has also not been fully solved. This is a big problem when using data to make decisions and analyze things. Smart cities won't be "smart" until they build an identical digital infrastructure. The "fuel" that keeps smart cities running is data. In reality, data sets have been split up, not changed often, and not shared between the government and the company. New problems

are also coming up, such as security and private issues. The information collected can't be used "just for display" or for no clear reason. Residents are beginning to wonder how technology affects their lives, especially when there is no answer to it.

The respondents were very realistic: the city would have too much high-tech stuff, which was not nice. They didn't need apps that "created more activities," but tools that "solved problems." This feeling was 100% correct, proving that smart cities should not focus on "showing off" technology but on making life easier for the citizens who live there. The important thing to note is that the opinions of individuals are growing: they no longer want to be passive observers of city development. Instead, they are interested in participating in it. The co-design solution between the government, businesses, and the community has an excellent opportunity to be successful. People can't live in a smart city if they don't "understand, trust, and use" the technology in use. A city that is easy to live in, has a clear government, and is friendly for residents is more important than one that has a lot of cool technology. They like apps that save them time, make their trips easier, or help them find routine information. On the other hand, they also point out many problems that happen when technology isn't updated, and older people aren't able to use it easily. That's an alert: smart cities will turn into cold and faraway places if citizens aren't put first. Combining technology must go together with making the user experience better, solving problems more clearly, and getting more individuals interested in building the city.

The young generation is the future workers who will be running and managing smart cities. They will have a hard time dealing with a fully digital complex city if they don't learn how to think seriously and be good digital citizens now. To prepare students for smart and sustainable city life, general and university education courses should include smart education, digital citizenship, and global ideas. This demonstrates that smart city education is not only about teaching technology. It also teaches kids how to use technology intelligently. The government and schools need to fix the problem immediately of not having courses for students to take part in experiments, hackathons, or creative groups. In the future, we may have modern tools but not have citizens with the knowledge that can use them in ethically helpful methods if we don't teach young people the right skills sooner.

With all of this information, we can say for sure that Vietnam is on the right track to building smart cities. But the road ahead is long and difficult, and governments, businesses, technology, and human thought will all need to come up with new ideas.

5 Solution and Summary

While population growth in the 21st century can help the economy grow and make things more modern, it also comes with several serious problems. Overpopulation is one of the most important issues right now. Cities all over the world are getting more and more crowded, often in addition to what they can handle. Population growth puts a lot of stress on public transportation, housing, healthcare, and schools, making it harder and harder for local governments to provide for the basic needs of their people.

People are moving from rural places to cities at a rate that has not previously been seen before, and cities are seeing record-breaking population growth. This large-scale movement has caused a lot of difficult problems that city authorities are now working hard to solve. To manage and improve the quality of life for residents, these city officials are looking for sustainable and effective answers to the most common and important issues that come with cities growing quickly.

The creation of smart cities has become an important solution to promote national development and social progress. Human society has entered the intelligent era supported by information technology. Cities around the world are capable of adopting new digital tools. The use of digital tools is expected to provide solutions to urban challenges and play an important role in promoting the construction of smart cities. Smart cities have completed digitalization and networking, and are moving towards intelligence. The development of smart cities cannot be separated from the core idea of sustainable development for people. Smart cities are places where citizens are civilized, law-abiding, and honest.

Building smart cities has the effect of promoting technological and social innovation. The construction and development of smart cities must be viewed from the perspective of long-term sustainable social welfare. Smart cities are built to enhance the connection between big cities and rural areas, Digital infrastructure must be used to strengthen rural areas, which can alleviate the problems faced by cities. At the same time, citizens will be able to participate more in digital action areas.

The world is changing quickly because of digital technology. In many countries, smart cities have become an important and urgent way to grow. Building and using a smart city model in Vietnam, a country that is fast urbanising, is more than just using new technology. It is also a strategic choice to solve serious problems in traffic, data, city planning, and the quality of life. It can be confirmed that knowledge of smart cities in Vietnam has begun to spread widely in society. It's important to note that all of the interviewees agree on how important digital change is and how technology can make life better in cities.

The most significant difference between what people expect and what happens can be seen in city transportation, which has been one of the main areas where innovative technology has been used. Many places have put in place technologies like smart traffic lights, security cameras, GPS apps, and traffic cameras. However, it's still not very successful, mostly because infrastructure planning isn't synchronized, and people don't change how they drive. Adding technology alone won't solve the problem of traffic in cities. Instead, the way cities are planned needs to change, public transportation needs to grow, individual driving habits need to change, and people need to pay attention to traffic culture.

Vietnam is still having trouble growing its 5G network, even though it has had a lot of good results. These include high prices for building new infrastructure, strict security rules, and differences in how people in different areas can access technology. Also, services and apps are still in the early stages of being improved and moved over to the 5G platform. To effectively promote the 5G network and speed up the digital transformation of the whole country, the government needs to keep making policies better, supporting investment, supporting public-private partnerships, and focusing on developing digital human resources. On the other hand, people and companies need to actively seek out, use, and benefit from new technologies to boost output, efficiency, and quality of life.

Smart cities will be run by young people in the future. If young people don't learn how to know their purposes, think strategically, and be good digital citizens now, it will be difficult for them to get together in a difficult, fully digital city. To prepare individuals for a smart and sustainable city life, school and university education classes should include smart education, digital citizenship, and global thinking.

Particularly, those who live in cities are actively looking for modern technology methods to improve their lives, which is different from the idea of a passive community. However, they were also worried about how complex and unfriendly many current technology apps are. Smart cities are more than just high-tech ones; they also "know how to serve" and "know how to use." The success of a solution doesn't depend on how hard it is to use, but rather on how easily it works into everyday life and how useful it is.

Up to now, Vietnam has been building and operating an e-government, applying many innovative technologies in public services, and managing human resources. Most government agencies have built their websites, applied electronic information portals, and organized administrative activities on the Internet in the form of providing online public services. This will create favorable conditions for people to grasp information, reduce transaction costs, and improve the adaptability of the whole society in the era of technology

4.0, which will help to form the necessary social foundation for the construction and development of smart cities in Vietnam.

References

Ahvenniemi, H., Huovila, A., Pinto-Seppä, I., & Airaksinen, M. 2017. What are the differences between sustainable and smart cities? Retrieved on 14 March 2025. Available at https://www.sciencedirect.com/science/article/abs/pii/S0264275116302578

Albino, V., Berardi, U., & Dangelico, R. M. 2015. Smart Cities: Definitions, Dimensions, Performance, and Initiatives. Retrieved on 16 March 2025. Available at https://www.researchgate.net/publication/267038770_Smart_Cities_Definitions_Dimensions_Performance_and_Initiatives

Anthopoulos, L. G. 2017. Smart city emergence: Cases from around the world. Retrieved on 14 March 2025. Available at https://www.researchgate.net/publication/335159751_Smart_City_Emergence_-_Cases_From_Around_the_World

Ameen, R. F. M., Mourshed, M., & Li, H. 2025. Smart cities with smart environment: A systematic review. Smart Cities and Society. Retrieved on 14 March 2025. Available at https://www.sciencedirect.com/science/article/pii/S2664328625000051

Asian Development Bank. 2021. Smart cities development in Asia: Overview and examples. Retrieved on 19 March 2025. Available at https://www.adb.org/annual-report/editions/2024

Asia Prop. (2023). Vingroup officially launched Vinhomes Smart City. Retrieved on 10 April 2025. Available at https://asia-prop.com/en/column/vingroup-officially-launched-vinhomes-smart-city/

Apostol, M., Tóth, G., & Kádár, B. 2022. Smart economy and startup enterprises in the Visegrád countries. Retrieved on 10 March 2025. Available at https://www.mdpi.com/2624-6511/3/4/70

Bates, D. 2017. The 3 generations of smart cities from 1.0 to 3.0. Smart Cities Library. Retrieved on 7 March 2025. Available at https://www.smartcitieslibrary.com/the-3-generations-of-smart-cities/

Batty, M., Axhausen, K. W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., ... & Portugali, Y. 2012. Smart cities of the future. Retrieved on 16 March 2025. Available at http://www.complexcity.info/files/2013/08/BATTY-EPJST-2012.pdf

Bibri, S. E., & Krogstie, J. 2020. The emerging data–driven Smart City and its innovative applied solutions for sustainability: The cases of London and Barcelona. Retrieved on 14

March 2025. Available at https://energyinformatics.springeropen.com/articles/10.1186/s42162-020-00108-6

Circular Cities and Regions Initiative (CCRI). 2024. Developing smart, sustainable urban ecosystems. Retrieved on 19 March 2025. Available at https://circular-cities-and-regions.ec.europa.eu/

Chronic gridlock grips HCMC's busiest roads. Retrieved on 20 April 2025. Available at https://e.vnexpress.net/news/news/traffic/chronic-gridlock-grips-hcmc-s-busiest-roads-4809430.html

Cohen, B. 2015. 3 Generations of Smart Cities. Fast Company. Retrieved on 13 March 2025. Available at https://www.fast- company.com/3047795/the-3-generations-of-smart-cit-ies.

Dameri, R. & Cocchia, A., 2011. Smart City and Digital City: Twenty Years of Terminology Evolution, p.4. Available at Smart City and Digital City.pdf

Data Reportal. 2024. Digital 2024: Vietnam. Retrieved on 13 March 2025. Available at https://datareportal.com/reports/digital-2024-vietnam

Deloitte US. (n.d.). Smart economy. Retrieved on 10 March 2025. Available at https://www2.deloitte.com/us/en/pages/consulting/solutions/smart-economy-in-smart-cities.html

Deloitte. (2020). 5G: The chance to lead for a decade. Retrieved on 30 March 2025. Available at https://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-5g-deployment-imperative.pdf

European Commission. (n.d.). *Smart cities*. European Commission. Retrieved on 13 March 2025. Available at https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

European Commission. 2023. The European Commission's 100 Intelligent Cities Challenge. Circular Cities and Regions Initiative. Retrieved on 10 March 2025. Available at https://circular-cities-and-regions.ec.europa.eu/associated-partners/european-commissions-100-intelligent-cities-challenge

European Commission. 2021. *A citizen-centred approach to smart cities*. Research and Innovation. Retrieved on 7 March 2025. Available at https://projects.research-and-innovation.ec.europa.eu/en/projects/success-stories/all/citizen-centred-approach-smart-cities

FPT Corporation. 2023. Smart city solutions from FPT. Retrieved on 10 March 2025. Available at https://fpt.com/en/news/fpt-news/fpt-announces-strategic-partnership-and-investment-with-sumitomo-corporation-and-sbi-holdings

GSMA. (2021). The Mobile Economy 2021. Retrieved on 19 March 2025. Available at https://www.gsmaintelligence.com/research/the-mobile-economy-2021

Grand View Research. 2023. Smart cities market size, share and growth report, 2030. Retrieved on 7 March 2025. Available at https://www.grandviewresearch.com/industry-analysis/smart-cities-market

Hanoi Real Estate. (n.d.). Vinhomes Smart City Apartment for Rent, Your Smart Home in Hanoi. Retrieved on 10 April 2025. Available at https://hanoirealestate.com.vn/tu-liem-apt-complex/vinhomes-smart-city-apartment.63.html

Hautamäki, I. 2021. Sustainable Tourism Opportunities in European Smart Cities. Retrieved on 13 March 2025. Available at https://www.theseus.fi/Hautamaki_Iida.pdf

HCMC traffic jams exasperate but also intrigue foreign tourists. Retrieved on 10 April 2025. Available at https://e.vnexpress.net/news/travel/hcmc-traffic-jams-exasperate-but-also-intrigue-foreign-tourists-4841029.html

Hitachi Social Innovation. 2024. How smart cities help you live better. Retrieved on 7 March 2025. Available at https://social-innovation.hitachi/en-us/think-ahead/smart-spaces/how-smart-cities-help-you-live-better

Höjer, M., & Wangel, J. 2015. Smart sustainable cities: Definition and challenges. In ICT innovations for sustainability (pp. 333–349). Retrieved on 14 March 2025. Available at https://www.researchgate.net/publication/265594929_Smart_Sustainable_Cities_Definition_and_Challenges

International Association of Public Transport. 2020. Sustainable and smart mobility. Retrieved on 12 March 2025. Available at https://cms.uitp.org/wp/wp-content/uploads/2020/09/20200924_UITP_contribution_EUSSMS_final.pdf

IPCC. 2021. *Climate Change 2021: The Physical Science Basis*. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Retrieved on 18 March 2025. Available at https://www.ipcc.ch/report/ar6/wg1/

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. 2012. Benefits, adoption barriers and myths of open data and open government. Retrieved on 18 March 2025. Available at https://www.researchgate.net/publication/262276711_Benefits_Adoption_Barriers_and_Myths_of_Open_Data_and_Open_Government

JICA (Japan International Cooperation Agency). 2021. Vietnam smart city cooperation projects. Retrieved on 19 March 2025. Available at https://www.jica.go.jp/english/overseas/vietnam/others/__icsFiles/afieldfile/2025/03/10/general_05_01_en.pdf

Kitchin, R. 2014. The real-time city? Big data and smart urbanism. Retrieved on 18 March 2025. Available at https://www.researchgate.net/publication/262276711_Benefits_Adoption_Barriers_and_Myths_of_Open_Data_and_Open_Government

Komninos, N. 2013. Intelligent cities: Innovation, knowledge systems and digital spaces. Retrieved on 14 March 2025. Available at https://www.researchgate.net/publication/347494731_Intelligent_Cities_Innovation_Knowledge_Systems_and_Digital_Spaces

KONE Corporation. 2023. Designing and adapting the stations of the future. Retrieved on 12 March 2025. Available at https://www.kone.com/en/news-and-insights/stories/station-design-future-transport.aspx

LawNet, 2023. What is VNeID? How to distinguish the VNeID accounts level 1 and level 2 of Vietnamese citizens? Retrieved on 7 April 2025. Available at https://lawnet.vn/en/laws/what-is-vneid-how-to-distinguish-vneid-accounts-level-1-and-level-2-of-vietnamese-citizens-81154.html

Mapsted. (n.d.). IoT in smart cities: Transforming urban living with innovations. Retrieved on 7 March 2025. Available at https://mapsted.com/blog/how-iot-solutions-are-transforming-smart-cities

Meijer, A., & Bolívar, M. P. R. 2016. Governing the smart city: a review of the literature on smart urban governance. Retrieved on 18 March 2025. Available at https://www.researchgate.net/publication/276155721_Governing_the_smart_city_a_review_of_the_literature_on_smart_urban_governance

McKinsey & Company. 2018 Smart cities: Digital solutions for a more livable future. Retrieved on 7 March 2025. Available at https://www.mckinsey.com/capabilities/operations/our-insights/smart-cities-digital-solutions-for-a-more-livable-future

Market Research Vietnam, 2024. Vietnam Smart City Projects Driving Future Growth. Retrieved on 7 April 2025. Available at

https://marketresearchvietnam.com/insights/articles/vietnam-smart-city-projects-driving-future-growth

Ministry of Information and Communications. (2020, November 6). Vietnam needs better smart city management, implementation. Retrieved on 18 March 2025. Available at https://english.mic.gov.vn/vietnam-needs-better-smart-city-management-implementation-197145217.htm

Nam, T., & Pardo, T. A. 2011. Smart city as urban innovation: Focusing on management, policy, and context. Retrieved on 16 March 2025. Available at https://www.researchgate.net/publication/221547712_Smart_city_as_urban_innovation_Focusing_on_management_policy_and_context

OECD. 2020. The governance of land use in OECD countries: Policy analysis and recommendations. Retrieved on 18 March 2025. Available at https://www.oecd.org/content/dam/oecd/en/publications/reports/2017/05/the-governance-of-land-use-in-oecd-countries_g1g74afc/9789264268609-en.pdf

Prime Minister of Vietnam. 2018. Decision No. 950/QD-TTg: Approving the scheme for development of smart sustainable cities in Vietnam in the 2018–2025 period with orientations toward 2030. Retrieved on 7 March 2025. Available at https://vietnamlawmagazine.vn/plan-on-sustainable-development-of-smart-cities-nodded-6359.html

Ritchie, H., & Roser, M. 2018. *Urbanization*. Our World in Data. Retrieved on 7 April 2025. Available at https://ourworldindata.org/urbanization

Ristevski, B., & Chen, M. 2018. Big Data Analytics in Medicine and Healthcare. Retrieved on 16 March 2025. Available at https://www.researchgate.net/publication/325076139_Big_Data_Analytics_in_Medicine_and_Healthcare

Ripla, A. 2024. Smart Cities 3.0: The future of urban innovation and transformation. LinkedIn. Retrieved on 7 March 2025. Available at https://www.linkedin.com/pulse/smart-cities-30-future-urban-innovation-andre-ripla-pgcert-6gqre

Sadowski, J., & Pasquale, F. 2015. The Spectrum of Control: A Social Theory of the Smart City. Retrieved on 16 March 2025. Available at https://firstmonday.org/ojs/index.php/fm/article/view/5903

Shach-Pinsly, D. 2021. Digital Urban Regeneration and Its Impact on Urban Renewal Processes and Development. Retrieved on 7 April 2025. Available at urbanplanning/article/view/pdf

Tokoro, N. 2016. The Smart City and Co-Creation of Value: A Source of New Competitiveness in a Low-Carbon Society. First Edition. Springer Publishing. Retrieved on 7 April 2025. Available at https://www.researchgate.net/The_Smart_City_and_the_Co-creation_of_Value

Townsend, A. M. 2013. *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia*. Retrieved on 16 March 2025. Available at https://ssir.org/books/excerpts/entry/smart_cities_big_data_civic_hackers_and_the_quest_for_a_new_utopia

United Nations. 2018. The New Urban Agenda. Retrieved on 7 March 2025. Available at https://habitat3.org/the-new-urban-agenda/

United Nations, Department of Economic and Social Affairs, Population Division. 2019. World urbanization prospects: The 2018 revision. Retrieved on 7 March 2025. Available at https://www.un.org/en/desa/around-25-billion-more-people-will-be-living-cities-2050-projects-new-un-report

United Nations Economic Commission for Europe. 2022. Guidelines on tools and mechanisms to finance smart sustainable cities projects. Retrieved on 10 March 2025. Available at https://unece.org/housing-and-land-management/publications/guidelines-tools-and-mechanisms-finance-smart-0

Vietnam innovation & tech investment report, 2023. Retrieved on 7 April 2025. Available at reports/vietnam-innovation-and-tech-investment-report-2023-1680151007.pdf

Vietnam Ministry of Information and Communications. 2024. Ho Chi Minh City plans new elevated roads to combat traffic congestion. Tuoi Tre News. Retrieved on 10 April 2025. Available at https://news.tuoitre.vn/ho-chi-minh-city-plans-new-elevated-roads-to-combat-traffic-congestion-10382274.htm

Vietnam Ministry of Information and Communications. 2024. Vietnam needs better smart city management, implementation. Retrieved on 10 April 2025. Available at https://english.mic.gov.vn/vietnam-needs-better-smart-city-management-implementation-197145217.htm

Vietnam News, Vinhomes Smart City - A modern, ideal, and diverse living hub. Retrieved on 7 April 2025. Available at https://vietnamnews.vn/vinhomes-smart-city-a-modern-ideal-and-diverse-living-hub.html

Vietnam Ministry of Information and Communications. 2024 . Digital signatures available on VNeID app. Retrieved on 10 April 2025. Available at https://english.mic.gov.vn/digital-signatures-available-on-vneid-app-197241030084918314.htm

Vietnam News Agency. 2022. E-identification app makes debut. VietnamPlus. Retrieved on 10 April 2025. Available at https://en.vietnamplus.vn/e-identification-app-makes-debut-post233976.vnp

Vietnam Ministry of Public Security. 2022. *VNeID officially becomes national digital citizen app*. SGGP English Edition. Retrieved on 10 April 2025. Available at https://en.sggp.org.vn/vneid-officially-becomes-national-digital-citizen-app-post96666.html

VINHOMES SMART CITY TÂY MỖ ĐẠI MỖ. Retrieved on 7 April 2025. Available at https/vinhomes-smart-city-tay-mo-dai-mo-sp40.html

Vinhomes. (n.d.). Vinhomes Smart City – The international city for global citizens. Retrieved on 10 April 2025. Available at https://vinhomes.vn/en/Vinhomes-Smart-City

VinBigData. (n.d.). Smart surveillance cameras in 3 Vinhomes megacities. Retrieved on 10 April 2025. Available at https://vinbigdata.com/en/case-studies/smart-surveillance-cameras-in-3-vinhomes-megacities.html

VNeID is expected to become Vietnam's super app. Retrieved on 10 April 2025. Available at https://news.tuoitre.vn/vneid-expected-to-become-vietnams-super-app-10383389.htm

World Health Organization (WHO). 2016. Preventing disease through healthy environments: A global assessment of the burden of disease from environmental risks. Retrieved on 18 March 2025. Available at https://www.who.int/publications/i/item/9789241565196

World Bank & MPI 2016, Vietnam 2035, Toward Prosperity, Creativity, Equity, and Democracy, Washington DC, USA. Retrieved on 7 April 2025. Available at https://openknowledge.worldbank.org/server/api/core/bitstreams/d1abecbc-bb61-5358-9e19-71b02ca7ad80/content

World Bank. 2020. Infrastructure for Development. Retrieved on 18 March 2025. Available at https://www.worldbank.org/en/topic/infrastructure

World Bank. 2023. Vietnam and smart urban development initiatives. Retrieved on 19 March 2025. Available at https://www.worldbank.org/en/country/vietnam/overview

World Economic Forum. 2020. The Impact of 5G: Creating New Value across Industries and Society. Retrieved on 25 March 2025. Available at https://www3.weforum.org/docs/WEF_The_Impact_of_5G_Report.pdf

World Population Review. Retrieved on 13 March 2025. Available at https://worldpopulationreview.com/countries/vietnam

Yun, Y. & Lee, M. 2019. Smart City 4.0 from the Perspective of Open Innovation. Journal of Open Innovation: Technology, Market, and Complexity. Available at https://www.mdpi.com/2199-8531/5/4/92

Retrieved on 10 April 2025. Available at