Ph.D. Dissertation of Engineering

Study on Smart City Development in Vietnam Medium-Sized Cities: Stakeholder Approach

이해관계자 접근을 통한 베트남 중소도시의 스마트시티 개발에 관한 연구

February 2021

Graduate School of Environmental Studies
Interdisciplinary Program in Landscape Architecture
Seoul National University

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이 논문을 공학박사 학위논문으로 제출함

2021 년 02 월

서울대학교 대학원
협동과정 조경학 전공
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HOANG VIET BACH KHOA의 박사 학위논문을 인준함
2021 년 02 월

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Abstract

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After more than 30 years of renovation in economic and social aspects, Vietnam has brought many outstanding achievements. However, rapid urbanization is the defect of this development, accompanied by burly disturbance in planning that municipalities across the country be facing many problems. All of these challenges have put pressure on governance and infrastructure planning to shift the quality of life in cities. Can notice that urban development not only reflected in the growth rate but also harmony in all aspects, the urban development process accordingly must be handle by smart solutions. Smart city evolution is becoming a trend not only in mega-urban areas but also spread to many medium-sized cities in Vietnam. There is quite a lot of discussion on smart cities at an essential period, in particular, smart technology from the perspective of traditional urban policy. However, the ways of development focused on technology aspects have criticized because of removing different levels of elements surrounding smart cities. When the government does not

consider the various factors in the implementation of smart policy, it may not effectively provide quality services to citizens, because smart cities are not only concerned with technical factors, but also the intricate surroundings. As an end-user of public services, carrying out interactions between the physical system and human, stakeholders must also contribute ideas for policy-making processes and co-create successful city solutions. Establishing the role of stakeholders in smart city development journey has identified as the main challenge for all cities around the world. Prompt stakeholder participation in all steps, which can help regulators effectively collect and analyze data thence right decision making in smart city development process. Thus, the purpose of this thesis conducts scientific research on smart city development, providing integrated guidelines about the smart city development readiness for medium-sized cities in Vietnam by the stakeholder approach. The thesis begins with a review of documents related to the strategy for developing smart cities and estimate research factors. In this process, the study examines uses the Analytic Hierarchy Process to conduct ranking of factors. The result shows that a top priority of internal factors is citizen participation (0.4141) then administration (0.3625), infrastructure (0.2234). External factors took the order of political will (0.5093), stakeholders (0.3373), and the technology era (0.1535). The thesis continues to present survey results in three medium-sized cities in Vietnam including Da Lat, Nha Trang, and Bac Ninh. The study based on linear Structural Equation Modeling (SEM) conducted to identify factors that influence smart city development readiness (adjusted R^2=0.589) . The result shows that there are three main factors affecting the readiness to develop a smart city including; Technological Readiness, Organizational Readiness, and Environmental Readiness. In particular, Organizational Readiness has the strongest impact on Smart City

Development Readiness (β coefficient = 0.415; t-value = 8.960; p = 0.000). Finally, the thesis concludes with comprises the integrated framework of effective strategic guidelines, managerial, and operational principles that characterize successful smart city development from the foundation stage for Vietnam medium-sized cities.

Keyword: Smart City; Stakeholder; Urban Development; Medium-Sized Cities; AHP Analysis; TOE Framework; Structural Equation Model.

Student Number: 2017-32297

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Chapter 1. Introduction

1.1. Overview

We are living in the convergence of two important phenomena in human history: The rise of global urbanization and the digital revolution. According to the report of the United Nations, the world's population lives in urban areas will upper 55% and can increase to 68% in 2050. By the current population growth rate after 30 years, there will be more than 2.5 billion people living in urban areas especially in Asia and Africa (United Nations, 2019). Many cities are facing vast challenges by operating entirely different from the past urban model of the twenty century. Persistent urban problems over the past twenty years include urban development, changing family structure, slums spreading, and the challenge of public services (Cohen, 2006). Infrastructure overload has put a heavy burden on the existing cities' public systems, which has led to many issues of environmental problems and the livelihood of the peoples (Khoa & Kim, 2019).

Moreover, the current cities must improve their performance; enhance the competitiveness to attract high-quality human resources to promote sustainable development in the process of globalization and integration (Tallman & Fladmoe-lindquist, 2003). From these issues, smart cities flow is like an open trend in the fourth industrial revolution (Choongik et al., 2019). Rapidly development process from the fourth industrial revolution started in 2011 has prompted the development of technology in connecting things, big data, etc. The fourth industrial revolution base on the cornerstone of the digital era, which narrow the gap between the human world and the physical world (PricewaterhouseCoopers, 2016). Many keys to new technologies are becoming effective for deploying the construction of smart cities such as transportation, energy etc. (IHS, 2014; Mulligan & Olsson, 2013). Facing challenges of population growth and rapid urbanization, cities around the world have been actively applying technology solutions to enhance the capacity of IT applications to address issues of socio-economic development and urban management. Recent advances in information and communication technology are changing urban life; cities around the world are trying to take advantage of new technology to provide innovative services to attract capital and sustainable growth, address challenges in a modern globalized economy (Cohen, 2006).

Follow IHS forecast, within the next 10 years the number of smart cities will increase to 88 cities all over the world. Almost solutions have focused on technologies, this approach characterized by the city, the technology research community, and the city solution provider as an early stage of developing smart city (Bashynska & Dyskina, 2018). According to evidence from early European Commission (EC) assessments that smart city solutions have been lead to a positive increase in the efficiency of physical systems and improve the quality of life for everyone. In addition, the European community finds that there are many conditions, including citizens, city visions and the successful implementation of city programs can be significant in achieving the entire benefits of smart city initiatives. Social composition, especially stakeholder participation, is one of the most important conditions for the operational effectiveness of all smart city development programs because they are creators of city solutions, they can co-produce and co-create locally created solutions (European

Union, 2016). This is a feasible approach and one of the development directions of smart cities that researchers believe (Townsend & Calantone, 2014; Harding et al., 2014). Up to now, there have been more than 200 definitions of smart cities, typically as a city that finds the way to solve urban problems based on the development of information technology, enhance city competitiveness and upgrade the quality of people's lives towards sustainability (Albino & Dangelico 2015). A general definition of Sławomira Hajduk, 2016 argues that smart cities include factors such as urban management, education, health, public safety, real estate, transportation, and utilities connected and efficient by using computing technologies to create critical infrastructure components.

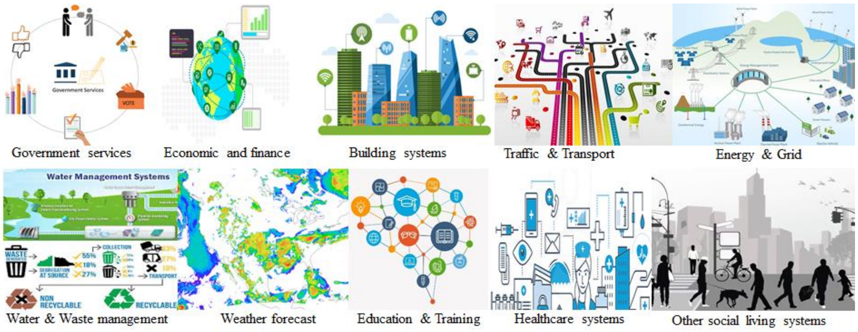


Figure 1. The first stage of smart city focuses on of physical systems

In short, it believed that the essence of smart city will improve life quality and urban sustainability by using information technology as well as developing technology and building physical infrastructure (Figure 1).

Developed countries seeking to change their inherent infrastructure under the bottom-up model local autonomy and interdisciplinary cooperation (Dameri & Rosenthal-Sabroux, 2014). In contrast, the development in Vietnam path is quite different based on the uniqueness of the political system, government, and local government relationships vertically from top to bottom. Vietnam has many opportunities to develop a smart city by dynamic urban population, high internet coverage, and the way of extensive international integration (World Bank, 2016). The country has 63 provinces, including two cities are the economic engines of the country – Ha Noi and Ho Chi Minh city, more than 80 cities and towns in grades I to III, and nearly 650 towns in grades IV and V. 50% of the urban population is concentrated in sixteen cities, economic growth reached 12–15%; these urban kernels contain socio-economic, innovation activities, education, scientific and technological research, production, and commerce (Hieu et al., 2013). Despite being a country with positive economic development, sustainable urban development has been a problem for Vietnam. The issue of development process include obstruction, pollution, and lack of housing in big cities (World Bank, 2016; Hieu et al., 2013). Two megacities, including Hanoi and Ho Chi Minh got many issues in urban administration, erratic projects, chaos expanding, and lack of connectivity in newly peripheral areas (Khoa & Kim, 2019). Meanwhile, medium and small cities lack the resource to shape, leading to an imbalanced urban development, affecting the national development space (World Bank, 2016). Housing prices are inflated, the real estate market is not transparent, the link between the housing gap and low-income people in the urban areas is not stable (UN-Habitat, 2014). Big cities are facing problems with water and air pollution (Hieu, 2015). This situation requires an urgent need to adjust the management system from planning to implementation (Khoa & Kim, 2019). Standing in front of increasing pressure for urban areas, the Vietnam government issued decision No. 950/QD-TTG 2018 on smart city development in Vietnam in a new period (Vietnam Government Portal, 2018).

Till now, Vietnam has nearly launched many projects on smart cities spread over the country. The swift development and spreading of information technology in Vietnam achieve certain achievements including 49 million subscribers mobile broadband and 9.9 million fixed broadband (MIC, 2017). However, the reality shows that the economic potential is limited, slow starting point, the urbanization process is difficult to control, and the experience of urban planning and management still particularly weak especially in medium-sized cities, it is a difficult problem to solve in the process of developing smart cities in Vietnam. Smart city development considered a comprehensive convergence of humans and technology, in this sense; their basic components are the urban setting, ICTs, people, communities, and strategic approach towards one or more of the previous aims. Only a few comprehensive strategies related to the development of smart cities correspond to the big cities in the world. The cause of this issue is; the concept of smart cities is new and has not specifically explored. There are many different views point about what a smart city is and there is a large number of stakeholders who motivated by various interests. Smart cities often seen as marketing tools to promote city images, instead of achieving truly smart. Therefore, many smart city strategies revolve around bringing IT infrastructure into urban environments, often in fragmented ways, lacking specific methods and strategies. The fact that the smart city strategy is oriented to address specific issues of an urban area may be appropriate for one city but may not be appropriate for another. Thus, should a set of principles and guidelines established that a smart city strategy used to improve the opportunities for creating effective smart cities? Although smart cities are considered as the focus of development, however, the strategy for developing smart cities is still mostly abstract and indeterminate

(Tompson, 2017). Moreover, stakeholders are a key element of smart cities as they form such a city through continuous interactions (Balser & McClusky, 2005). The emergence of the smart city concept, which highlights the cooperation potential of all stakeholders - including human, and technologies opening new perspectives and contexts to be better understand how local governments can increase people's participation in public affairs. This makes stakeholders' engagement in smart cities a new area of academic research. Despite the existence of literature on developing smart cities, the model structure on the success of a smart city base on stakeholders' approach has not been widely studied. This is exactly where this thesis comes from; this thesis is interested in how medium-sized cities in Vietnam can take advantage of stakeholder approach in smart city strategies to promote economic and urban development. Which points need to specifically addressed?

1.2 Purpose of the Research

One the one hand, as described, smart city has now become a trend within the realm of sustainable development. It has been interpreted in various ways by the public and private sectors to suit their agenda. In Vietnam, the development of "smart cities" is in the early period and continues to spread all over the country. One the other hand, however, there are significant issues in developing and implementing strategies for smart cities with unstructured information, disorientation, and no "smart", consensus that stakeholder participation is a major challenge for cities to successfully apply and develop smart city. Choosing a "right and winning" strategy to develop smart city needs to be clarified.

Follows the previous observations, this study aims to analyze the important factors for smart city development in the medium-sized cities in Vietnam. Recommended guidance to promote smart city development effectively based on stakeholder engagement at the foundation stage.

To achieve these goals, this study firstly analyzed the important factors that influence by comparing the weights among indicators, thereby having a comprehensive view and a basis for developing a guidance framework. Second, determine the readiness of technological, organizational, and environmental factors from the assessment of stakeholders, namely the governmental and non-governmental sectors. From there, find out the weaknesses and limitations that local authorities need to overcome to establishing smart cities.

This thesis covers all those interested in urban development and urban policymaking, be it research or application level. It can be a reliable basis for strategic policy advice and enhancing urban development in medium-sized cities of Vietnam.

1.3 Contribution of the Research

In a complex and omnidirectional develop smart city ecosystem, forming an overall picture of the entire development process is a challenge. The fact that current knowledge about smart cities is not clearly in scientific literature and reviews. Many studies related to smart cities still focus on technological innovation, energy management, and environmental benefits, etc. On the other hand, there is still lag research on smart cities focusing on development at the foundation stage. The rationale of this thesis focused on delivering original on the theoretical, consider the diversity of factors affecting and seeking their priorities of smart cities development. This thesis will improve the current understanding of smart cities by grasping the foundation factors. The results will allow for the design of comprehensive smart city development guidelines.

Specifically, this thesis aims to:

- Give the body to the theoretical framework of developing smart cities by detecting, assessing, and structuring information through the smart city literature available.
- Build up internal and external factors related to smart cities development that need focused in the early stage.
- Increased stakeholder engagement through involved the applied cognitive survey method. From there, will find out about the weaknesses and complications that cities encounter in developing smart cities. The cognitive approach is reasonable because smart city development is a relatively new concept for most Vietnamese society, and the most useful insights can gain from sample groups.
- Finally, proposes the guidelines developed expected to provide practical insights that can help urban strategists propose smart city development implications to enhance preparation for smart cities transition.

1.4 Research Outline

This study focuses on identifying factors that influence smart city deployments from both experts and stakeholder perspectives and then provides an appropriate suggestion model for local authorities as well as the government aims to build a smart city. The layout of the study shown in figure 2.

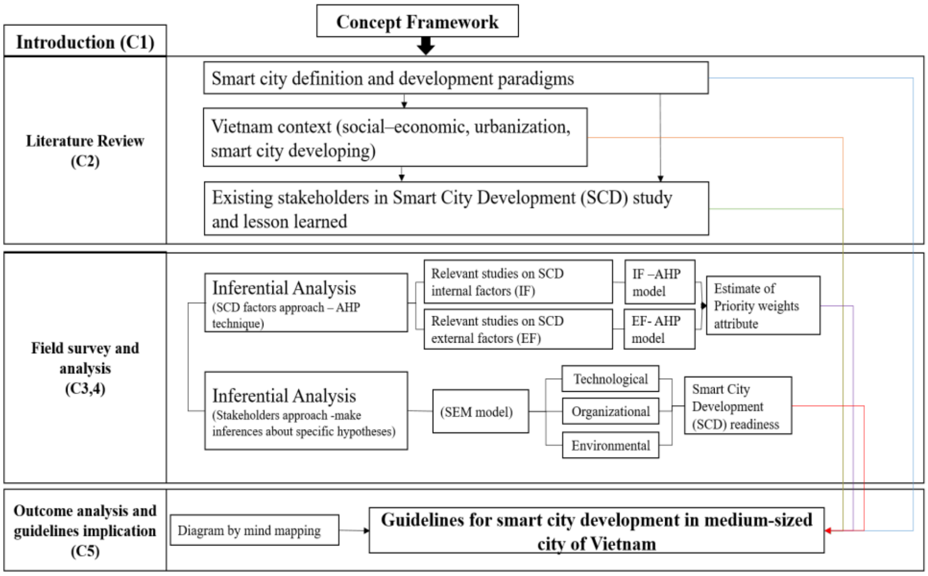


Figure 2. Research outline

The thesis starts with an introduction in Chapter 1 and followed in Chapter 2 by an intensive literature review of interrelated topics: smart city, Vietnam context, local government, and stakeholder approach. The assessment of a smart city covers the main parts of city development in recent centuries, its role, function, and the application of technologies in city development. Smart city reviews also include developments in new trends, which are characters, critiques, challenges, and roadmaps. From the review, it would confirm that there is no exact definition of what is a smart city. The government seeks cooperation with stakeholder, the consideration of stakeholder participation provides insight into why this trend is getting noticed. As with other topics, stakeholder participation varies based on government and technology's attraction and impetus. Chapter 3 presents the justifications of the applied methodology in determining factors in smart city development. The model developed by identifying the attributes of smart city development using existing documents and incorporating a multidimensional approach. We use the Analytic Hierarchy Process (AHP) technique to determine the priorities of smart city determinants. AHP divides the decision-making process into phases and then proceeds to the final decision by showing the subjective judgment of the evaluator through a systematic analysis. This system ranks various alternatives and retrieves them according to the percentage that reflects the weight. Chapter 4 is a study on smart city development readiness by the stakeholder approach based on the TOE model. The TOE framework is an operation theory that explains that three different elements of context influence adoption decisions. Three elements that characterize this model are technological, organizational, and environmental context. Set up hypotheses and creates a suitable hypothesis model through evaluation from stakeholder base on the SEM model. Chapter 5 discusses the empirical findings, the corresponding implications, suggesting guidelines for smart city development further to limitations and recommendations for future study.

Chapter 2. Literature Review

2.1 Smart City

2.1.1 The Fourth Industrial Revolution and Smart City Emergence

Since 2011, the rapid explosion of the fourth industrial revolution has spurred the development of technology towards connecting things (Internet of Things - IoT), using cloud computing, big data analytics tools, and artificial intelligence (Anthopoulos, 2015). Base on digital evolution, the fourth Industrial Revolution allowing "wipe the limit between the physical and biological world". Through a combination of data, computing and connectivity technologies; analytical technology and artificial intelligence; human-machine interaction. Thereby enabling the formation of physical systems in virtual space, changing the way we interact of people with machinery and equipment through the Internet environment (William & Charles, 2014). If in the 2000s, the explosion of social networks created a huge database of people, so far the data generated from intelligent systems including systems of machines and vehicles, cameras, home appliances are becoming invaluable assets. The economic value of leveraging the fourth industrial revolution greatly appreciated PricewaterhouseCoopers (2016) research shows that more than 27% of the pioneers in developing industry trends 4.0 have saved more than 30% in terms of expenses and growth of over 30% in profit. It can say that the appearance of the Fourth Industrial Revolution is extremely positive support to the trend of building smart cities in the world.

Many key technologies of Fourth Industrial Revolution are becoming an effective tool for deploying the construction of smart cities in areas such as transportation, energy, tourism, etc. (MinHwa et al., 2018). There is an increasing diversity of solutions from major solution providers as well as products from the startup community in the fields of health, education, transportation, security, environment, and governance (Saviotti & Pyka, 2004). Entering the 21st century, the world is rapidly changing with the development of science and technology applications. Technological and social change to create breakthroughs in organizing transportation, energy, logistics distribution system, management infrastructure and provide public services (McKirahan and Cheney, 2016). The convergence of changes in technology alter perception, change the institutions and how we create the value of the new era, especially in urban areas - the convergence of elite and bright (Rastogi, 2011). The smart city is a necessity born when technology is ripe, large enough demand and social conditions met. Smart city represents a multidisciplinary theme, frequently affected and driven through thinking about urban development and economic growth (Aslam et al., 2020). Although specific ideas about smart cities are relatively new, their historical origins have been around for quite a long time and are quite complex, drawing ideas from many streams of thought. Looking back 50 years, the concept of smart cities once mentioned in the United States but was not complete (Mora and Deakin, 2019). In fact, behind the idea of smart cities gives a whole narrative of evolution, stretching from the early 20th-century vision of the city of the future. There have been a large number of smart city initiatives, city-funded projects and public-funded public research projects showing increasing interest in the concept of smart cities and the need to address challenges related to urbanization (Ahvenniemi, 2017). The concept of smart cities first introduced in 1994, until 2010, the European Union has supported smart city projects (Jucevicius, 2014). Clearly that, the proliferation of smart city reflected the convergence of many factors, from changing needs to the maturity of technology, institutional maturity, and social foundation (Al-Hader et al., 2009). From the perspective of the market and society, the competition in attracting investment and improving the quality of life is the driving force for both businesses, governments, and people have become smarter. From a technology perspective, the maturity of technology has changed the way of managing production and service provision (Batty et al., 2012). In this context, institutions and managers accept new things, accept the participation and supervision of people, accept changes in the game in order to increase competitiveness (Asplund, 2013).

2.1.2 Smart City Definitions

So far, there is no standardized definition of a smart city but there are many cognitive differences used in international forums (Albino et al., 2015). Although the contexts in cities are different, such as culture, climate, economy, ethnicity and geography, the common goals are consistent with most smart city concepts. By improving economic competitiveness, efficiency in infrastructure services, reducing environmental impact and improving the quality of urban life (Poredoš, 2011). In the previous representative model of smart cities, technological applications such as data analysis, ICT, smart grids and remote sensing deployed as functional core components. By recent summary from the different definitions of smart cities and using the two main characteristics or aspect defined, a comprehensive definition of smart cities illustrated in table 1.

Table 1. Smart city definition and identification

References	Definition	Aspect	
		T	**H**
Giffinger et al., (2007)	Smart City refers to the identification of smart solutions that allow cities to improve the quality of services provided to residents.	■	
Chen, (2010)	Smart cities will utilize the communications and sensors incorporated into the city's infrastructure to optimize activities that support everyday life, thereby improving the quality of life for citizens.	■	
Harrison et al., (2010)	Smart city that connects physical, information technology, social, and business infrastructure to leverage the collective smartness of the city.	■	■
Komninos, (2011)	Smart cities are built on the creation of organizations, citizens, and advanced infrastructure for knowledge management and mass media.	■	■
Nam & Prado (2011)	Smart cities transmit information into its physical infrastructure to improve comfort, increase efficiency, save energy, and identify problems. Also, echelon resources efficiently enable collaboration between entities and domains.	■	■

Thuzar, (2011)	Smart cities improve policies for sustainable urban development where all citizens can live well. Smart cities drive sustainable economies by investing in human, social capital and modern communication infrastructure (transport and information technology); and natural resource management through participatory policies.	■	■
Guan , (2012)	In the challenging conditions that global trends bring, clearly that smart cities are prepared to provide the conditions for a healthy and happy community.		■
Kourtit & Nijkamp (2012)	Smart city is the result of combining knowledge and creativity with the aim of improving the efficiency of economic and social development. As a basis for competition that develops between cities.	■	■
Lombardi et al., (2012)	From the point view of smart city, the application of information technology impacts human capital and social capital as environmental issues.	■	■
ITU, 2014	A sustainable smart city is an innovative city that uses information technology - telecommunications and other means to improve the quality of life, the efficiency of its activities, services, and capacity. competitive, while ensuring the ability to meet the	■	

	needs of the current and future generations in terms of economy, society and environment		
SCC, 2015	Smart cities use information and communication technology to improve their quality of life, work ability, and ensure sustainable development.	■	■
IEEE, 2017	A smart city is a combination of technology, government and society to promote the following characteristics: smart urban, smart economy, smart mobility, smart environment, smart people, smart life and smart administration.	■	■

T – Technology Aspect H – Human Aspect

Looking different definitions, it can see that the concept of smart cities has evolved from purely sophisticated cities for the purpose of economic growth and higher quality of life to invest in human and social development, in addition to technical-oriented infrastructure. By all means, implement natural resource management wisely and including participatory governance are considered mandatory elements to realize the smart city (Castelnovo et al., 2015). Although there are notable contributions in the field of smart city research, it is constrained by the lack of integrated approach and inability to solve contemporary urban issues face-to-face, omitting human factors are issues of concern for the formation of current smart city models (Kim & Steenkamp, 2013).

2.1.3 Smart City Paradigms

Many academics and organizations attempt to conceptualize the smart city with various models and consider its aggregation. This term taken from various perspectives and a certain synthesis is necessary in this regard. The first model class that comes from this aggregation discusses smart city architecture and the corresponding concept of components.

Table 2. Smart city paradigms

Paradigms	Description	References
	Academics	
Smart city components	Smart Economy, Smart Governance, Smart People, Smart Mobility, Smart Living, Smart Environment	Giffinger et al., (2007)
Smart city model	Improve urban living based on data collection, interconnected utilize data.	Hollands (2008)
Smart city model	The overall services in the model include education, transportation, government, etc.	Naphade et al., (2011)
Smart City domains	The model refers mainly to government, economy, society, natural resources, energy, and transportation.	Neirotti et al., (2014)

Framework for smart city analysis	Managing, integrating smart infrastructure, innovating services, enhancing urban flexibility	Lee et al., (2014)
Smart city value chain (SCVC) model	Divided into primary activities and supporting activities on smart system platform.	Liu et al., (2013)
Smart city dimensions	Resource, Transportation, Urban infrastructure, Living, Government, Economy, Coherency.	Anthopoulos (2015)
	Organizations	
Nine Pillar Models	Planning and Management Services Infrastructure Services Human Services	IBM, 2014
Attributes and Core themes	Urban aspects, sustainability with social, economic, governance and environment as the core.	ITU (2014a)
A table of city characteristics where smartness is applied	Environmental Context City History and Characteristics Societal Context City Governance City Subsystems (actors, activities, facilities and buildings, hard infrastructure, soft infrastructure…)	ISO, 2014

There have been several approaches employed to conceptualize and standardize smart cities. The idea is an important mechanism for the identification of smart cities, completed recently by standardizing structures (Table 2). In order to build a smart city development platform. The study used existing smart city conceptualization methods and synthesized them. The review confirms the diversity of factors taken into account and different perspectives that can be made to understand smart cities. The smart city sector has come to a unified model, involving innovation in urban space to enhance six city dimensions (human, economic, government, mobility, living and environment). This is a very broad model to cover and many initiatives in this area.

2.2 Vietnam Smart City Development Context

In Vietnam, according to PwC data analysis, the rate of urbanization growth has increased rapidly from 19.6% (2009) to 36% (2018) and expected 45% (2020). To promote economic and social development, the government has officially encouraged all 63 cities and provinces to build smart cities. Up to now, over 20 provinces / cities have cooperated with technology partners to design and develop the implementation roadmap (MIC, 2017).

Developing Smart city is an increasingly concerning issue in many urban areas around the world. In Vietnam, the interest and promotion of smart city programs and roadmap for urban development create many favorable conditions for the renewal of infrastructure and management structures based on urban thinking smart marketing (Khoa & Kim, 2019). Besides the great opportunities opened up by the development of smart cities, it can help the country develop faster, integrate more easily with international integration, in a direction suitable to the era of information and globalization. There are many potential dangers from the localities spontaneously planning smart urban development, lack of effective coordination with each other (Kumar & Dahiya, 2017). The current most important issue needs to formulate a national strategy for building and developing smart cities. So that future smart cities can develop optimally, harmoniously and in good cooperation with each other towards unified values and together with synergistic effects in all aspects of urban development and national development (Kramers et al., 2014). Over the past years, more than 20 provinces and cities in Vietnam have developed and approved the development of smart urban projects based on models of corporations and information technology enterprises (MIC, 2017). In 2012, Da Nang was the first urban area chosen by IBM Technology Group as one of 33 cities in the world. Da Nang then received funding from a smarter city program with total funding of more than $ 50 million, using the smart center operating solution to ensure the quality of water resources to serve people, providing the best public transport level and minimizes traffic congestion (IBM, 2013). Ho Chi Minh City and Hanoi have also implemented concrete steps on various aspects of smart cities such as experimenting with using cards instead of selling traditional bus tickets. The deployment of wifi city in some places, suggestions on the use of mobile phones to convey traffic information or ideas to digitize the daily activities of some businesses (Leducq & Scarwell, 2018). Hanoi City and Dell Technology Group through Dell Global B.V (Singapore branch) will cooperate in the process of building e-government and smart cities. The architecture of e-government and smart city of Hanoi city built to ensure conformity, consistent with "Vietnam e-government architecture framework", guiding the construction of "e-government architecture". Province "and" Orientation of information and communication technology in building smart cities in Vietnam "issued by the Ministry of Information and Communications (MIC, 2017), aiming to form and develop the knowledge-based economy bringing the capital to participate in smart city forums in the world.

A favorable factor for developing smart cities in Vietnam, is that the percentage of Internet users / total population in Vietnam is quite large, ranked in the top 10 in Asia. Vietnam currently has about 49 million Internet users, reaching 51.5% penetration density. Some urban areas have suitable conditions to apply smart urban models such as Hai Phong, Da Nang, Bac Ninh, Hue, Can Tho, Rach Gia, Da Lat, Phu Quoc, Nha Trang and Quy Nhon (MIC, 2017).

2.3 The foundation of smart city development components

Up to now, there are a number of studies that have proposed issues related to the background of smart city development components. Based on the Vietnam Smart City Index for the period 2025, version 1.0 to determine the fundamental role in smart city development. In this study, were divided into internal and external factors.

2.3.1 Internal Factors

2.3.1.1 Citizen Participation

This factor refers to citizen participation in smart city development initiation. Citizens as main of stakeholder that are considered the key to developing a smart city, they express their desires and seek solutions that benefit themselves; this is also related to the concept of the inhabitants (Kang, 2008). For sustainable smart city development, planning, and implementation of planned smart policies are necessary, but different groups such as citizens and society should participate in the development and implementation of smart policies. Therefore, activating citizen participation and cohesion is essential in strengthening democracy and the effectiveness of city policy (Margerum, 2002). Urban planning in a smart context should expanded and transformed to be different from current urban planning practices. The development of ICT has changed in society and human behavior in various fields. In the process of developing smart cities, it can realize that the expansion of citizen participation in form of bottom-up, the innovation of implementation based on the open platform, and living labs is considered as the new changes in urban planning (Kim & Kim, 2017).

Citizen participation or decision-making by recent citizen participation is considered a major concern both academic research and government practice, with regard to new forms of government relations and citizens enhanced by ICT (Cunha et al., 2013). Smart applications can use to increase citizen participation in a public debate on social needs (Castelnovo et al., 2015). E-governance focused on citizens-considered a new mechanism for the government to increase citizen engagement with political discourse and decision-making (Chatfield & Reddick, 2015). The object of the application base on ICT tools is citizens, so its main purpose is increasing the ability of citizens to participate in governance, including the process of providing public services at different stages such as planning, decision making, implementation and evaluation (Pérez-González & Díaz-Díaz, 2015; Grönlund, 2003).

Citizens who are directly democratic participants in a smart city have several advantages; by participating in the decision-making process, citizens can learn about difficult technical issues and become experts in public-related issues (Irvin & Stansbury, 2004). Moreover, the local authorities are also learning from their citizens about why a policy may not be popular and how to avoid this. Democratic participation gives citizens the opportunity to express their views and apply their views informally. In the context of smart cities, citizens can help prioritize projects to meet budget constraints; citizen participation is also cost-effective because it reduces the chance of litigation or useless investments.

Traditional approaches to innovation in cities include a top-down approach but in the context of smart cities, a new model utilizing citizen input and ideas has emerged from the bottom-up approach (Schaffers et al., 2011). The inclusion of citizens in the planning stage results from the influence of the Helix Quadruple Model that addresses the interaction of the four pillars in the innovation process: university, government, industry and society (Cossetta & Palumbo, 2014). During the initial innovation process, citizens as end-users were limited to passive consumers. However, the advent of new ideas as an important stakeholder has empowered and stimulated innovation for new ideas, this new model has led to new thinking in providing translation public service and general acceptance of the co-creative concept (Lombardi et al., 2012).

2.3.1.2 Administration

Regarding urban policy, the administration of local authorities has a great influence on the success or failure of policies. The administration can implement a city policy that promotes lifelong learning more successfully (Neirotti et al., 2014). The quality of a smart city depends on the specific variables of each country. Among them, governance said to affect a smart city, political level, political risk, and level of corruption. To alleviate the delay in the deployment of smart cities, policymakers in the governance role must find ways to reduce their dependence on the adoption of technology (Washburn et al., 2010).

Local authorities carry out an extended administrative role for the central government and play an important role in the daily lives of citizens. Citizens have direct interaction with local governments including administrative needs or other public services to which they benefit (Pina & Torres, 2001). In order for a city to be influential, the governance process must have a clear understanding in which elected officials must make strong efforts to create a unique living/working environment. A "smart city" modernizes technical and social infrastructure, using integrated methods to coordinate essential and complimentary services. Contingencies needed in the infrastructure removed or reused to make better use of them. Understand the management of access to improved services and processes made more transparent (Szalay, 2019). In today's world, the rapid advancement of technology, the long consideration period often contradicts the rate of change and can lead to increased costs or missed opportunities. On the other hand, the city government is much more agile, and therefore able to act faster and focus on the goals and needs of each community they serve. That said, such commitments are not without their challenges, especially when the scale and cost of a smart infrastructure project considered are significant.

City leaders need to conduct broad community involvement to determine the current and future needs of residents and their businesses.

They also need smart operation practise understanding with the latest technologies to be able to sort through the many options provided by technology companies. At the same time, they should not lose the fact that the goal of smart cities is to achieve a higher quality of life by addressing specific problems. It is towards solutions, not technology (Alonso & Castro, 2016). Before a city can take advantage of advanced technologies, city leaders need to be involved in extensive outreach. Even if an explicit plan would allow multiple services to provide for the same tax dollar, the cost is not the only consideration. The authorities will need to educate not only themselves but also city residents about capital payments and financial profits, increased efficiency and temporary disruptions, technological benefits, and data security, etc. need an open and straightforward dialogue, showing successes but also acknowledging failures and lessons learned.

2.3.1.3 Infrastructure

As ICT becomes more accessible and cheaper, it will change the urban environment by empowering people, by connecting via smartphones and mobile devices, or as part of a succession plan (Ramamurthy & Devadas, 2013). Understanding the basic components of technology solutions and their capabilities is an important step to starting a Smart City project. Many projects have failed in the past because they overlook issues such as proper planning; forecast the general needs of the city; The wrong choice of technology does not keep up with change and becomes obsolete or affects the budget because they are too bulky, high investment costs, low benefits. Regardless of the application, smart city solutions include processes, technologies, and people (Spector, 2014).

From a technology standpoint, it has four basic components. Firstly, connecting infrastructure smart cities require broadband networks to support digital applications for the citizen. Communication infrastructure can be a combination of different data network technologies using the cable, fiber optic, and wireless networks (Wi-Fi, 3G, 4G, or radio), clearly that urban communication infrastructure must be a top priority in the management plan (Matthew et al., 2017).

Secondly: Sensors and connected devices; A city becomes more efficient through infrastructure in buildings, on the street, installed by service providers, then processing these data and turning them into permissible information make decisions that can manage, mitigate risks, or anticipate emerging urban challenges. Aggregating these data requires the installation of sensors and cameras in the city's infrastructure, connecting them to each other and to the data communication network, using data sent in time to support decision-making (Lundqvist & Borgstede, 2008).

Moreover, when data analyzed, it is possible to forecast future possibilities and support the development of new services and public policies. Therefore, the sensor along with the data network is an important foundation in building a smart city (Yu & Xu, 2018). Thirdly: Operation center and integrated control; Integrated Operations and Control Center (IOCC-Integrated Operation and Control Center) is gathered by technological infrastructure and physical infrastructure. Executive staff, representatives of local authorities and service providers, gathered to address issues (Tauberer, 2009).

A Smart City project can start with just one utility or group of utilities, gradually new elements, and utilities can added as the project expands. For example, it could start by solving a traffic problem, fire protection, health, urban lighting, etc. For new projects, need an overall view from the beginning of the integration perspective until the completion of the project. For current projects where an integrated control center expected to add, it is important to focus on the alignment of the various entities and consider integrating utilities into the same physical time or in an interactive structure and real-time interaction.

Finally, communication interface; Once the smart city infrastructure has been deployed to become part of the urban system, a layer of communication system needs to be added, which will act as an interface between management and citizens with different management units of the city. These systems can act as an interactive platform, meaning creating mobile applications that enable citizen data collection and management as well as allow the city to communicate with citizens to send emergency warnings or recommendations (Ibrahim et al., 2016).

Although technology infrastructure is an important element of a smart city, the efficiency of technology infrastructure may be less if the human resources not built. Smart cities are a system that requires individuals to seriously analyze problems spanning multiple areas and provide effective solutions, thus requiring knowledge of many areas. For example, even if a city traffic control system, it would be useless without human resources can operate it. Building human resources is important as well as technological infrastructure. This is why we need to educate people to build a smart city more effectively using advanced technologies.

In smart city development, digital knowledge is an important component that considered a success factor (Hargitti & Hinnant, 2008). This skill is important for the application of support systems, requiring individuals with sufficient knowledge to operate equipment, information systems and get useful information (Callum & Jeffrey, 2014). In addition, these skills allow individuals to develop new programs to address community issues and use existing data to make intelligent decisions and optimize processes (Hagsten & Sabadash, 2017).

2.3.2 External Factors

2.3.2.1 Political Will

To implement a smart city successfully, technology must integrate into a smart system to address a wide range of city needs and goals across the community. To do this, smart city deployments should start with open, interoperable, easily replicable, and scalable platforms, as well as privacy and security measures (Sicari et al., 2015). While technological innovation can be widely observed and agreed upon, policy innovation is more ambiguous (Hartley, 2005). Policy and legal of smart city plays an important role in shaping and changing regional, even global linkages of cities (Bai et al., 2010).

The combination of policies and legal for multiple spatial scales, through organizational activities and across all levels of governance, is vital to innovation in a city (Marceau, 2008). Most metropolitan areas governed by many cities interacting with each other and sharing resources.

Integration is not just for technologies, systems, infrastructure, services, or information, but also for policies and legal. Policy and legal packages, uniquely focused interventions, are essential for successful innovation (Mingardo, 2008; Van Winden, 2008). On the other hand, integration involves coordination between different layers of government, typically central, provincial, city, and international contexts. Creating a comprehensive vision for an urban area can be an important step to achieving greater policy integration (Paskaleva, 2009).

Different visions for a smart city may conflict, but successful modern cities need to incorporate multiple visions (Mingardo, 2008). The mandate for these policies may vary from national jurisdictions to local levels in urban areas (Angelidou, 2014). Successful smart city policies are demand-driven rather than supply-based, which demonstrates the local government's drive for a smart city initiative and its stakeholders. The digital networking application used in the governance process reflects change and increasingly efficient hierarchical structures to better-understood frameworks for the negotiation of many public stakeholders and the private sector operates at different scales through the readiness partnership (Torres et al., 2012). Smart city policy needs balanced with more on the demand side and encouraging diversity, social networking and interdisciplinary innovation. The demand-driven policy can lead to better governance.

2.3.2.2 Stakeholder

In an effort to become a smart city, the challenges that arise may be issues involving a wide range of stakeholders, high levels of interdependence, competitive value, and political complexity society (Nam & Pardo, 2011). Transforming from an un-smart city to a smart city requires the interaction of political and institutional components with technology like the innovation of a smart city, which outlines the importance of stakeholder management in a smart city project (Mayangsari & Novani, 2015). It is important to identify stakeholders in order to plan and implement the stakeholder management process strictly enough because project stakeholders influence the project management process (Olander, 2007).

Stakeholder are a key in initiating smart cities to create a sustainable and livable city (Ielite, 2015). It is important to engage stakeholders to ensure that their activities meet the goals of the smart city project (Angelidou, 2014). Cities are growing, the role of stakeholders directly or indirectly affected by smart cities is also important. If cities based on urban planning as a product of central government-focused development, then smart cities are the product of different combinations of centralized stakeholders. The implementation of smart city projects and building smart city visions can integrate with stakeholders and their close cooperation is indispensable to achieve the ultimate beneficial results (Chourabi et al., 2012).

Stakeholders around the smart city can divided into direct and indirect stakeholders. Residents, city governments, infrastructure managers, and local businesses are direct stakeholders. Citizens are the most direct beneficiaries of smart city services. The government is a key player in building smart cities and providing services to citizens. Local businesses in a smart city can benefit directly from generating new profits by leveraging smart city infrastructure. Indirect stakeholders include smart city application and technology providers, system builders, and infrastructure service providers and operators.

They provide smart city-related technology and infrastructure services in the process of creating value-added products of a smart city (Seunghwan et al., 2018).

2.3.2.3 Technology Era

Today, there are sources that are more creative available in the world than ever before. By using accumulated progress and improvements in ICT over the past decades, smart cities will provide livable scenarios for people with the necessary and simple quality in urban areas (Oh, 2010). Establishing a smart city is more than just improving the old system with technology by adding sensors, remote monitoring, and controlling essential city services. New technologies related to IT will become the mainstay in a comprehensive change in the daily life model (Hall & Hord, 2001). ICTs play an important role in a sustainable smart city because it acts as a platform for collecting and aggregating information and data from this field to help improve understanding of how the city works on consuming resources, services, and lifestyles: Information sharing and ICT support knowledge: Traditionally, due to the inefficiency of information sharing, a city may not be willing to solve a problem even if it is well equipped to the response. With instant and accurate information, cities can better understand the problem and take action before it escalates (Bakıcı et al., 2013). ICT activation prediction: Preparing for stressful factors such as natural disasters requires a significant amount of data dedicated to model research, trend identification, identification of risk areas, and prediction of potential problems. ICTs provide and manage this information more effectively so that the city can improve its readiness and responsiveness.

Integrated ICT support needs ensured to better understand the city's weaknesses and strengths (Schwab, 2016).

As mentioned, ICT infrastructure is like the brain of a smart city, which is the place to make connections and coordinate all activities among the elements. Therefore, the ICT platform must comply with the requirements to avoid the causes of malfunction and limit in cities activities. The urban environment has always stood in close relationship to the technologies of production, transport, and communications. By introducing ICT in urban planning, it can conceptualize as a new type of infrastructure providing for the transport of data and information (Jaewon, 2017). As technologies and their impacts on urban environment change, their relationship calls for new concepts, where the emerging pattern language of electronic connections tie in seamlessly with the language of physical connections.

Over the past century, urban environments have responded to various technological innovations differently. Some technologies with other various factors affected urban design to change its entire landscape; others improved the quality of urban life. ICT, in turn, is bound to affect urban design through the processes of economic development and such changes in land use as redevelopment (Giffinger et al., 2010). Despite the fact that ICT presents an opportunity within the urban environments to improve the quality of life, it poses a challenge to urban planners. The great challenge for urban planning in terms of ICT lies in the capacity of the city to interact, give and receive information among interconnected nodes of different scales and natures like the infrastructure, buildings, public space elements, environmental conditions… (Komninos et al., 2013).

This anticipates fundamental concepts related to the importance of proposing symbiotic systems of organization based on real-time data that can further articulated into responsive systems and metabolic organizations, where small decisions can have a large impact on an urban scale.

2.4 Stakeholder Approach to Smart City Development

The stakeholder approach is becoming an increasingly popular topic in government-related academic research. Their significance reflects the focus on a new trend in promoting new forms of democratic practice and addressing existing political gaps (Olander, 2007). It is important to understand why this new trend takes center stage in many academic and practical fields from political science to public administration, public policy, to scientific dissemination and technology. In an effort to become a smart city, the challenges that arise may be issues related to different stakeholders, levels of interdependence, competitiveness, and social-political complexity association (Nam & Prado, 2011).

Transforming from a non-smart city to a smart city requires the interaction of political and institutional components with technology, which highlights the importance of stakeholders in smart cities (Mayangsari & Novani, 2015). In addition, the involvement of stakeholders in each stage of sustainable smart city development can also recognized. It is important to encourage stakeholders to ensure that their activities meet the smart city development goals (Jones & Newsome, 2015).

According to the model of Jayasena et al., 2019 it is proposed that stakeholders in smart city can divided into two components including direct stakeholders and indirect stakeholders described in figure 3.

In which, subjects including governments, citizen, planners, expert play the role of direct stakeholders. Citizens, planners, experts play a creative role, their knowledge of the city can be considered a valuable document in the initiation of smart city development. They join in to experience urban space and share the viewpoint of inefficiencies or place-based positive and negative views in initiating smart cities (Komninos et al., 2013).

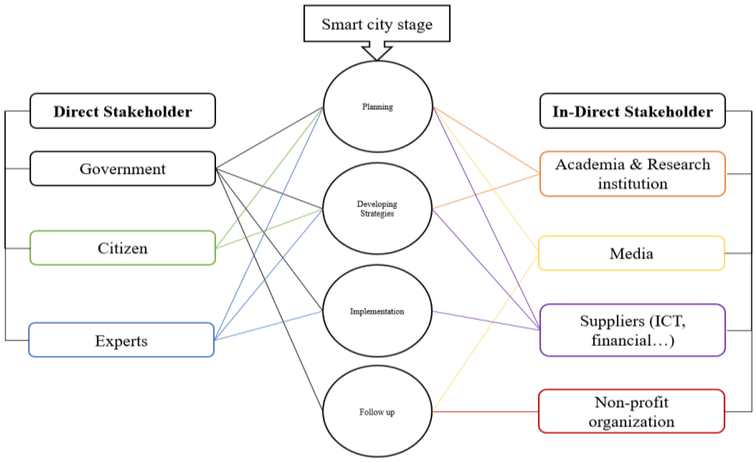


Figure 3. Relation of stakeholder in smart city development

Stakeholder engagement has different meanings for different organizations, it can range from participation in local neighborhoods and community life to structured engagement with public authorities and related decision-making structures (Dupont et al., 2012). Stakeholder engagement requires a perspective that the system supports and builds interaction between public sector agencies, non-profit organizations, business organizations, advocacy groups and the foundation that creates the complex development reality of contemporary society (Innes & Booher, 2004).

In another context of science and technology policy, Powell and Colin (2009) point out that public engagement means citizens should have a say in scientific and technological development because when deployed they will affect to their lives.

Smart cities are a multi-stakeholder ecosystem where their engagement is critical to success. In addition, the other components such as academia and research institutions, energy suppliers, property developers, non-profit organizations, media also contributed significantly to this development process.

Smart cities seen as a lever to push cities around the world to seize the advantage of developing information technology in order to reorganize the city system to adapt to global challenges. The city is a complex system of operating in the economic and social environment; it is difficult to separate each object to study because they are dependent and interconnected. In addition, cities have all shapes, sizes, stages of development, geographical locations, and competitive advantages therefore, the baseline studies of smart cities open up interdisciplinary research needs and capabilities, both providing a deeper understanding of smart cities and creating new models for local authorities and stakeholders to apply to development tasks.

2.5 Existing Stakeholder Study and Lesson Learned

With the first efforts, Nam and Pardo (2011) provided a systematic analysis concept of smart cities. Technology, people and institutions drive these con cepts. According to their aspects, technological factors are key to building smart city because of using ICT can change the life however without proper involvement and willingness to cooperate and between public institutions, citizens and the private sector would not have smart city. Based on institutional factors, they mention that more support from government and governance policies needed. There must be smart governance that allows different stakeholders, especially citizens, in the decision-making process and public social services. E-governance is essential in connecting with citizens, building smart city development initiatives and keeping the management system transparent. Also emphasizing the importance of stakeholders in smart city, Chourabi et al., 2012 identify human and community factors that are important in the sense that smart city initiatives have an impact on the quality of life of citizens and aimed at promoting informed citizens more educated and more involved. Everyone should be involved as much as possible to figure out how to meet their respective needs and desires from smart cities.

Sharing the importance of citizen participation in the development of smart cities, researchers in Europe examined human factors in social environments along with technology and solutions. European cities are developing strategies to become a smart city by adopting an urban approach, allowing high levels of stakeholder participation in co-creation in all both economic and social sectors (Komninos et al., 2013).

Angelelidou, 2014 after exploring the policy difference factors for the development of smart cities concluded that before in making a strategic choice, it is important to review what is available and how to improve it. The city should select priority issues or areas in urgent need of upgrading in which stakeholder engagement can provide valuable insights into the city's current assets and needs.

In Asia a completely new smart city New Songdo whereby Korean researchers focus their research on the technologies of smart cities. They apply functional implementation methods in case studies to establish connections between services, equipment, and technology. The integrated roadmap emphasizes the classification, routing format and data accumulation systems related to the smart devices, technology and services needed for development. Such systems provide a comprehensive and unified view of current and future trends in technology to develop smart cities in Korea (Lee et al., 2016). Also related to smart city services, Lee et al., (2014) proposed a new typing framework to classify smart city services based on stakeholder centric methods instead of a bureaucratic point.

In the context of smart city development in China, An et al. (2014), proposed an innovative model to establish an integrated co-design process, enabling professionals, and citizens to participate engaged in smart city design. Allowing participants to research and evaluate issues, share their ideas, co-create experiments and work towards collaborative solutions to solve problems and deliver results. Fu and Lin (2014) believe that stakeholder participation especially citizens can help smart city planners, designers and managers better understand the planning and improvement of existing urban systems.

In India, Sadoway and Shekhar (2014) conducted research on citizens' priority in smart city governance, their arguments based on the concept of smart citizens stemming from existing concepts. Including civic intelligence, smart community, IT support community, wiser cities and shared cities. Sadoway and Shekhar (2014) stated that the need for stakeholder engagment indeed put citizens, civil organizations as the first to build the next problems in developing smart cities. This approach get more democracy and fairness values, bringing stakeholder's opinions accurately into the local authorities before operating the next steps.

Angelidou (2015) introduces a new approach based on the progress and realization of the urban future and economic innovation.

In particular, the people-centered approach, the empowerment of citizens (knowledgeable, educated and participatory citizens), intellectual capital and creative knowledge; the progress of social capital - social sustainability and digital inclusion should be strongly considered to build and nurture smart cities in the future. Aiming to be a comprehensive and people-centered characteristic of smart cities, Lara et al., (2016) propose a new model of a smart city emphasizing that people are at the center. At the heart of the smart city concept, however, it does not undermine the role of infrastructure, economy and sustainability. The model also emphasizes the development of technologies that are appropriate to local realities and applies governance processes that help build a community associated with cultural values and lifestyle. The new model is an attempt to provide city policymakers with a common and context-free smart city view, clearly explaining what is a smart city in which location stakeholder participation comes first. Such clearer views can improve the current faintness of smart city concepts. In summary, authors point out that the stakeholder approach can enhance democracy, participation, and other technological elements in a new strategic vision for cities. Although there are many strategic options, it is important to choose the correct approach related to the city's culture and ideas. Zubizarreta et al., (2015) believe that the necessary approach is to shift the focus from technology to people.

Cities are pursuing a smart city agenda to address the challenges their cities face, including global competition for investment, and economic development. However, there is still no general definition of smart cities between leading researchers and cities. IT plays an important role in shaping smart cities, it is used in many smart city initiatives implemented by pioneering cities. IT has great potential to help cities address their urban challenges in new collaborative methods and contexts. Current research focuses primarily on the technology and its role and application in the physical infrastructure of the city physical environment. Stakeholder engagement in the development of smart cities is very important. It can be said that Stakeholder in which citizens are appearing as the most important factor of all factors on the journey to success to become smart. There have also been a number of models developed for smart city initiatives and the core dimensions of smart cities and their interactions, but they have not yet fully studied. There is quite empirical research, case studies and evaluation studies of smart city initiatives that cities are applying around the world. Researchers are using data from major cities around the world while medium-sized cities have not analyzed. The number of studies in geographic areas varies widely and cannot correlate with the number of cities called 'smart.'

2.6 Conclusion

The aim of this chapter is to clarify the meaning and to increase a deeper understanding of the smart city. It begins by exploring the impact of the Fourth Industrial Revolution on smart city development, it shows that the foundation of the smart city idea is technology and knowledge, by emphasizing the effect for urban development in recent years. This chapter also presents the definitions of smart cities, the general context in Vietnam as well as the composition of factors in smart city development as they are found in the document and classifies them into groups based on on different approaches. It is essential to begin to understand current perspectives and issues on what smart city development means. This chapter continues to provide an overview of smart city stakeholder, highlighting the role the stakeholder play in the development process. Although stakeholder engagement is widely recognized as one of the key factors in smart city research, the literature on how to understand, solve and capture is hardly developed. Although technology is a key factor, the smart city development process in Vietnam needs to define the foundation in which the evaluation perspectives from special stakeholders especially citizens, experts are important in giving a vision as well as supporting the government in the initial development of smart cities. This is exactly what Chapter 3 and Chapter 4 seeks to achieve.

Chapter 3. Determinant Factors in Smart City Development

So far there have been many discussions and guidelines on the smart city issue. As discussed, when smart city development does not consider the various factors in implementing smart policies, that result in the ineffective provision of quality services to the citizen. In this situation, it is important to consider many factors that affect the smart city and look for priorities in the construction of the desired smart city. Therefore, this part will analyze which factors need to be focused on and examines the internal and external determinants associated with smart cities. The meaning and purpose of the internal and external variables are summarized from the document and additional sources described in the literature review. Its aim to provide a comprehensive perspective for local government in smart city development at the foundation stage.

3.1 Methodology

3.1.1 Model approach

The model developed by identifying the attributes of smart city development using existing documents and incorporating a multidimensional approach. In the research process, we have found that there is more literature focusing on results than on the smart city development process. For a country in the early stages of developing smart cities like Vietnam, drawing out internal and external factors to clarify which determinants will be more important in the construction process of developing smart city is really necessary. The investigation of the factor through the ranking of internal and external determinants in the complex nature of smart city systems and the hyper-connectivity amongst different functions require thinking of systems in a comprehensive scope (Vargas, 1990; Seunghwan, et al., 2018). In this study, we use the Analytic Hierarchy Process (AHP) technique to determine the priorities of smart city development determinants. AHP is a method of decision making that is of importance through pairing between the attributes that make up the hierarchical structure (Saaty, 1982). AHP divides the decision-making process into phases and then proceeds to the final decision by objecting to the subjective judgment of the evaluator through a systematic analysis. This system ranks various alternatives and retrieves them according to the percentage that reflects the weight. AHP allows the calculation of the importance of each option by classifying the importance according to rank, suitable to solve a large number of decisive issues (Seunghwan et al., 2018). In this study, ideas discussed in detail through three steps brainstorming processes (Krishnanand et al., 2013). For the selection of smart city determinants, relevant literature and the smart city index analyzed. Citizen participation, administration, and infrastructure extracted are internal factors among the determinants of smart cities (Washburn et al., 2010; Lee & Lee, 2014; Buck & While, 2017). The study also took political will, stakeholder, and the technology era as important elements of external factors to make smart decisions (Schwab, 2016; Jaewon, 2017). The hierarchical representation of smart city factors depicted in figure 4.

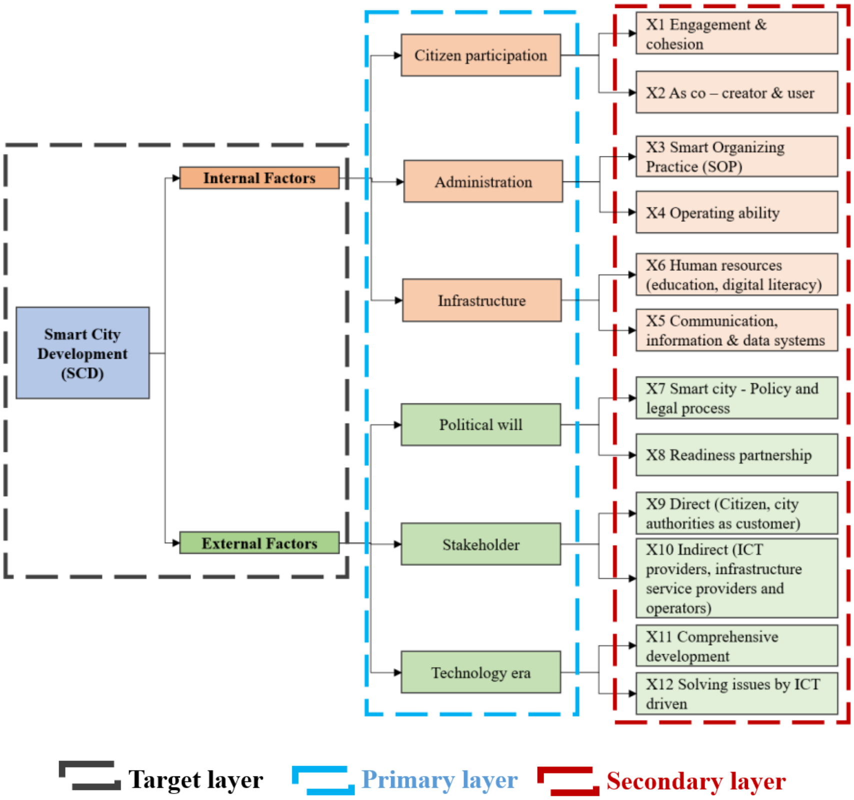


Figure 4. Hierarchical representation of Smart city factors

3.1.2 Analytic Hierarchy Process (AHP) method research

Analytic Hierarchy Process (AHP) is the method used to rank the key components of smart city development factors. The method is intended to quantify the priority of a given population according to an appropriate scale. Decisions are often based on individual perception, emphasizing the importance of the consistency and correlation of alternatives, which have been compared in the complete decision-making (Saaty, 1980). The AHP method aims to find the relationship between the criteria (Figure 5).

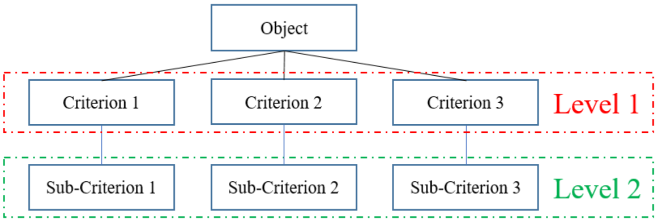


Figure 5. Example of simple hierarchy in AHP

AHP setup steps will illustrated by mathematical model;

If there are n elements, which compared, the comparison results create matrix form A with dimension n x m

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & \dots \dots \dots a_{1n} \\ a_{21} & a_{21} & \dots \dots \dots a_{2n} \\ \dots & \dots & \dots \dots \dots \dots \dots \dots \dots \\ a_{n1} & a_{n1} & \dots \dots \dots a_{nm} \end{bmatrix} \quad \textbf{(1)}$$

The elements of matrix or ratio between, compared criteria expressed by the formula

$$a_{ij} = \frac{w_i}{w_j} \quad \textbf{(2)}$$

Considering the first criteria for reciprocal:

$$a_{ij} = \frac{1}{a_{ji}} \quad \textbf{(3)}$$

Follow step is to obtain a normalized matrix $\mathbf{B} = [b_{ij}]$ as:

$$b_{ij} = \frac{a_{ij}}{\sum_{i-1}^{n} a_{ij}} \quad \textbf{(4)}$$

The calculation of the weights i.e. eigenvector $\mathbf{w} = [w_i]$ form the normalized matrix B performed by calculating the arithmetic mean for each row of the matrixaccording to the formula:

$$w_j = \frac{\sum_{j=1}^{n} b_{ij}}{n} \quad \textbf{(5)}$$

Consistency represents the judgment made by the decision-maker of comparisons. The comparison matrix A is consistent if a_ij a_jk = a_jk for all i, j and k. Is extraordinary for all comparison matrices to be consistent. Thus, given that human opinion is the basis for the forming of these matrices, some "reasonable" degree of inconsistency is expected. A quantitative measurement level for the comparison matrix A should be given to determine whether consistency is reasonable or not. If there is a complete consensus between normalized matrix C and matrix A then the columns will be same– that is

$$\mathbf{C} = \begin{bmatrix} & \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} & \\ & \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} & \\ \vdots & & \vdots & \ddots & & \vdots \\ & \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & \frac{w_n}{w_n} & \end{bmatrix} \quad \textbf{(6)}$$

matrix C is determined by dividing the elements from column $i_{by} w_i$. Thus, have:

$$\mathbf{C} = \begin{bmatrix} & 1 & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} & \\ & \frac{w_2}{w_1} & 1 & \cdots & \frac{w_2}{w_n} & \\ \vdots & & \vdots & & \vdots & \vdots \\ & \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & 1 & \end{bmatrix} \quad \textbf{(7)}$$

The resulting ratio comparisons are depicted in:

$$\mathbf{C} = \begin{bmatrix} & \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} & \\ & \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} & \\ \vdots & & \vdots & \ddots & & \vdots \\ & \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & \frac{w_n}{w_n} & \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_2 \end{bmatrix} = n \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_2 \end{bmatrix} \quad \textbf{(8)}$$

Given that w is the column vector of the relative weights $w_i i = 1,2,\ldots,n$, A is consistent if:

$$\mathrm{A}w = nw \quad \textbf{(9)}$$

For the case where A is not consistent

$$A\overline{w} = \lambda_{max}\overline{w}, \lambda_{max} \geq n \quad \textbf{(10)}$$

In this case, the closer λ_{max} is to n, the more consistent is the comparison matrix A. Based on this observation, AHP computes the consistency ratio as:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}} \qquad \textbf{(11)}$$

CI calculated as:

$$\mathrm{CI} = \frac{\lambda_{max} - n}{\mathrm{n} - 1} \quad \textbf{(12)}$$

RI is Random consistency index of A and its value taken from table 3

Table 3. Random Index (RI) values

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

If CR $\leq$ 0.1 the level of inconsistency is acceptable. Otherwise, the inconsistency is high and decision maker may need to re-estimate the elements a_{ij} of A to realize better consistency. Compute the value of λ_{max} from $A\overline{w} = \lambda_{max}\overline{w}$ by nothing that the ith equation is

$$\sum_{j=1}^{n} a_{ij} \ \overline{w} = \lambda_{max}\overline{w_i}, j = 1,2, \dots, n \qquad \textbf{(13)}$$

Givien $\sum_{j=1}^{n} \overline{w_i}$= 1 get:

$$\sum_{i=1}^{n}(\sum_{j=1}^{n} a_{ij} \ \overline{w}) = \lambda_{max} \sum_{i=1}^{n} \overline{w_i} = \lambda_{max} \qquad \textbf{(14)}$$

This means that the value of λ_{max} can be determined by first computing the column vector $A\overline{w}$ and then summing its elements.

3.1.3 Experts Evaluation Synthesis

The Geometric Mean method used to aggregate individual ratings into a single rating that represents the opinions of the entire group (Saaty, 2008). The averaging method used to calculate triangular fuzzy numbers (l_{ij}, m_{ij}, u_{ij}) from the expert's evaluation using the formula

$$\overline{J_{ij}} = (l_{ij}, m_{ij}, u_{ij});\ l_{ij} \leq m_{ij} \leq u_{ij};\ l_{ij}, m_{ij}, u_{ij} \in \left[\frac{1}{9}, 9\right.$$

$$l_{ij} = \min(B_{ijk})$$

$$m_{ij} = \sqrt[k]{\prod_1^k B_{ijk}}$$

$$u_{ij} = \max(B_{ijk}) \qquad \textbf{(15)}$$

In which, B_{ijk} - Evaluation of the kth expert in the pair comparison between the two factors i and j. If the ratings are heterogeneous then using min and max is not appropriate (Meixner, 2009). Hence, the Geometric Mean method used for both the fuzzy numbers l_{ijk} and u_{ijk} (Meixner, 2009). From there, the evaluation results of experts synthesized according to the formula (Saaty, 1980).

$$l_{ij} = \sqrt[k]{\prod_1^k l_{ijk}}\ ; \qquad m_{ij} = \sqrt[k]{\prod_1^k m_{ijk}}\ ; \qquad u_{ij} = \sqrt[k]{\prod_1^k u_{ijk}} \qquad \textbf{(16)}$$

(l_{ijk}, m_{ijk}, u_{ijk}) - Triangular fuzzy numbers evaluated by the k^{th} expert. k = [1, n].

3.1.4 Data Collection

Questionnaire design for the AHP is one of the most controversial issues among survey researchers because the way respondents are asked questions has a major effect on results. The Moreover, AHP is an optional method, whose options denote the subjectivity of the participant, so it is very complicated to set the exact parameters.

However, by the expert choice process at the time of collection, it is possible to determine whether or not the participants' opinions are pointing to conflicting trends. Thus, the questions can be coordinated so as not to cause participants to raise their perception contradictions. In this way, it is possible to track the Consistency Rate (CR) and evaluate the rate of outliers.

In addition, AHP can applied from one to many members as participants, but to ensure the reliability of the results, the number of participants must be reasonable. Some researchers used a different number of participants, the lowest being five (Peterson, et al., 1994). The number of participants also depends on the size of the potential audience. The selection of respondents for this study included leaders of local departments, experts of urban planning, and experts of ICT are working on smart city field in Da Lat city. Sixteen participants in the judgments used to analyze out of the twenty responses received because four responses rejected due to their high inconsistency.

In this study, participants provided with a research objective, a smart city definition scope, and a briefly description of the variables (internal and external factors described) used in the model so they understood the exact meaning of these attributes before responding questionnaire to record their judgments because of different definitions and interpretations of smart cities can lead to inconsistent results. The questions design shows in Appendix A.

In this study, the SPSS 25 used to analyze the descriptive statistics. In addition, Expert choice 11 and Microsoft Excel used to identify the importance and priority of the derived key factors.

Data collected from 19 December 2019 to 12 January 2020. Their demographic details can found in table 4.

Table 4. Demographics of respondents

Characteristics		No. of samples 16	Percentage (%) 100
Age	21-30	3	18.75
	31-40	8	50
	41-50	3	18.75
	51-60	2	12.50
Working field	Government	5	31.25
	Academic	4	25
	Researcher	7	43.75
Working experiences	Less than 5 years	4	25
	6 – 10 years	6	37.50
	10 – 20 years	4	25
	Over 20 years	2	12.50

The unit and subunit of smart city have organized in the hierarchical structure shown in figure 4, thus categorizing the factors into clusters, which prevent these factors from differing in extreme ways during the pairwise comparison. The goal of ranking these elements per their importance towards smart city implementation is at the hierarchy.

Table 5. Example survey

1: Equal importance, **2**: Equal to moderate importance, **3**: Importance, **4**: Very importance, **5**: Extreme importance										
A	5	④	3	2	1	2	3	4	5	B
Result: A is Very importance than B										
A	5	4	3	2	1	2	3	4	⑤	B
Result: B is Extreme importance than A										
A	5	4	3	2	①	2	3	4	5	B
Result: A and B are Equal importance										

Maintain logical consistency because the two items compared in the survey related to each other. Therefore, consider cooperating to ensure consistency, as in the following example. For example: If A> B and B> C -> A> C

The pairwise comparison questionnaire designed for smart city elements in order to fetch responses from experts. At each level of hierarchy, comparisons in pairs of structural elements are made, in which decision-makers' priorities are represented by the Saaty scale of relative importance. The scale contains levels and subordinates, describing the intensity, with corresponding numerical values in the range from 1 to 5 (Table 5).

3.2 Estimation of Results

3.2.1 Synthesis of Priorities

In this study, the synthesis of experts' evaluation for primary and secondary layers compiled according to the geometric mean method (Table 6, 8). This principle applied to attain the composite priority for the elements, which are the alternatives based on the overall preferences expressed by the decision-makers. The purpose is to attain the composite priority that reflects the overall importance of each alternative. The prioritized ranking of the decision alternatives can derived from the composite priority. In which, expert choice 11 software used to do the de-fuzzy process converts the fuzzy numbers in a pair comparison matrix to real numbers, i.e. converting the fuzzy data into the clear data used to calculate the weights follow the traditional AHP method (Deng, 1999).

The values from the comparison matrix continued to normalize pairwise comparison matrix analysis (Table 7, 9). This process carried out to determine which of the element in a pair is more desirable or preferred compared to the others.

These comparisons positioned into a positive reciprocal or pairwise comparison matrix. The derivation of the priorities from the pair wise comparisons matrix is the main concept of the AHP.

Table 6. Primary layer comparison matrix synthesized

		Citizen Participation	Administration	Infrastructure
Internal factors	Citizen Participation	1	1.3171	1.6158
	Administration	**0.7592**	1	1.8746
	Infrastructure	**0.6189**	**0.5334**	1
		Political will	Stakeholder	Technology era
External factors	Political will	1	1.5871	3.1614
	Stakeholder	**0.6301**	1	2.3097
	Technology era	**0.3163**	**0.4330**	1

Table 7. Primary layer Normalized Paired-wise comparison matrix

					Criteria weights	Weight sum	Standardization value
		Citizen Participation	Administration	Infrastructure			
Internal factors	Citizen Participation	0.4205	0.4621	0.3598	0.4141	1.2525	3.0244
	Administration	0.3193	0.3508	0.4175	0.3625	1.0956	3.0224
	Infrastructure	0.2602	0.1871	0.2227	0.2234	0.6730	3.0133
Total		1.0000	1.0000	1.0000	1.0000		9.0600
		Political will	Stakeholder	Technology era			
External factors	Political will	0.5138	0.5255	0.4885	0.5093	1.5297	3.0037
	Stakeholder	0.3237	0.3311	0.3569	0.3373	1.0126	3.0025
	Technology era	0.1625	0.1434	0.1545	0.1535	0.4606	3.0011
Total		1.0000	1.0000	1.0000	1.0000		9.0073

Table 8. Secondary layer comparison matrix synthesized

		Engagement & cohesion	Co-creator & user	Smart organizing practice	Operating ability	Communication , information & data systems	Human resources
Internal Factors	Engagement& cohesion	1	1.3979	1.2068	2.4641	2.915	1.367
	Co- creator & user	**0.7154**	1	1.4987	2.5909	2.7949	1.4038
	Smart Organizing practice	**0.8286**	**0.6672**	1	2.2822	2.7817	1.3158
	Operating ability	**0.4058**	**0.3860**	**0.4382**	1	2.1185	1.1351
	Communication, information & data systems	**0.3431**	**0.3578**	**0.3595**	**0.4720**	1	1.1472
	Human resources	**0.7315**	**0.7124**	**0.7600**	**0.8810**	**0.8717**	1
		Policy & legal process	Readiness partnership	Direct (Citizen, Authorities)	Indirect (Provider and operators)	Comprehensive development	Solving problem by ICT driven
External Factors	Policy & legal process	1	1.2287	1.5650	2.1351	1.5298	1.4649
	Readiness partnership	**0.8348**	1	1.7954	2.0971	1.5650	1.0073
	Direct (Citizen, Authorities)	**0.8286**	**0.6672**	1	1.4987	1.3722	1.1176
	Indirect (Providers and operators)	**0.2887**	**0.2785**	**0.3047**	1	1.1387	1.2287
	Comprehensive development	**0.7605**	**0.9133**	**0.6749**	**0.8941**	1	1.0181
	Solving problem by ICT driven	**0.7312**	**0.7124**	**0.6189**	**0.6968**	**0.8717**	1

Table 9. Secondary layer Normalized Paired-wise comparison matrix

	Engageme nt& cohesion	Co- creator & user	Smart Organizing practice	Operating ability	Communication, information & data systems	Human resources	Criteria weight	Weight sum	Standardizati on value
Engagement& cohesion	0.2485	0.3092	0.2293	0.2543	0.2335	0.1855	0.2434	1.5140	6.2205
Co- creator & user	0.1778	0.2212	0.2848	0.2674	0.2239	0.1905	0.2276	1.4207	6.2427
Smart Organizing practice	0.2059	0.1476	0.1900	0.2355	0.2229	0.1786	0.1967	1.2260	6.2319
Operating ability	0.1008	0.0854	0.0833	0.1032	0.1697	0.1540	0.1161	0.7191	6.1953
Communication, information & data systems	0.0852	0.0791	0.0683	0.0487	0.0801	0.1557	0.0862	0.5117	5.9363
Human resources	0.1818	0.1576	0.1444	0.0909	0.0698	0.1357	0.1300	0.8476	6.5185
	Policy & legal process	Local authorities readiness partnership	Direct (Citizen, Authorities)	Indirect (Provider and operator)	Comprehensive development	Solving problem by ICT driven	Criteria weight	Weight sum	Standardizati on value
Policy & legal process	0.2349	0.2510	0.2353	0.2535	0.2016	0.2143	0.2318	1.4158	6.0471
Local authorities readiness partnership	0.1912	0.2043	0.2700	0.2490	0.2062	0.1473	0.2113	1.2937	6.0554
Direct (Citizen, Authorities)	0.1501	0.1138	0.1504	0.1779	0.1809	0.1635	0.1561	0.9510	6.0285
Indirect (Provider and operator)	0.1100	0.0974	0.1003	0.1187	0.1500	0.1397	0.1194	0.7654	6.3561
Comprehensive development	0.1535	0.1306	0.1095	0.1043	0.1318	0.1489	0.1298	0.7916	6.1003
Solving problem by ICT driven	0.1603	0.2028	0.1345	0.0966	0.1294	0.1463	0.1450	0.9131	6.2972

3.2.2 The Relative Importance and Priority of Primary Layer

The reliability analysis of AHP techniques can measure interpersonal assessment errors by calculating the consistency ratio (CR) when assessing the relative importance of each evaluation factor. In general, the smaller the CR value, the more appropriate it is. If the CR value is less than 10% (0.1), it can assess that respondents always make binary comparisons (Vargas, 1990). The category-wise priority weights and the overall priority weights of the internal factors determinants with respect to their importance towards the smart city implementation were calculated using excel and expert choice 11. The priority weights for primary layer of the AHP tree given in table 10. The citizen participation important priority towards smart city development is 0.4141 (41.41%), whereas the administration factor has received 0.3625 (36.25%) priority weights. Similarly, infrastructure factor found to have 0.2234 (22.34%) priority weights, respectively. The consistency ratio is 0.017, which is within the acceptable range of less than 0.1.

The most important internal factor of smart city development that experts appreciate is citizen participation. Citizen participation as mentioned in the literature plays a very important role in the development of smart cities. One fact shows that countries that have developed smart cities are reassessing the direction of sustainable smart city development, which should put citizen participation as the foundation for development (Chatfield & Reddick; Khoa & Kim, 2019).

Table 10. The relative importance and priority of the internal factors

Internal factors	Relative importance	Priority
Citizen Participation	0.4141	1
Administration	0.3625	2
Infrastructure	0.2234	3

λmax = 3.0200 Consistency Index= 0.01 Consistency Ratio= 0.017

On the other hand, depicting that although the development of smart cities in Vietnam is only in the early stages, the focus of attention of experts on human factors and management rather than on technology infrastructure is similar as the study of Seunghwan et al., (2018) suggested that desire to develop citizen participation and legal support in smart city development. According to the analysis of external factors in table 11, political will ranked first with 0.5093 (50.93%), stakeholders ranked second with 0.3373 (33.73%) and the technology era ranked third with 0.1535 (15.35%). Although smart cities have emerged and developed in line with the development of technology era, however, it will delay without timely policies (Mingardo, 2008).

Table 11. The relative importance and priority of the external factors

Internal factors	Relative importance	Priority
Political will	0.5093	1
Stakeholder	0.3373	2
Technology era	0.1535	3

λmax = 3.0024 Consistency Index= 0.001 Consistency Ratio= 0.002

The comparison of judgments between government and non-government (academic and researchers) respondents for internal and external factor attributes shown in figure 6.

There is clearly a consensus between the citizen participation and political will element of experts on both sides. In general, the response distance for ranking attributes is not too different, which shows the high consistency in the research factors mentioned.

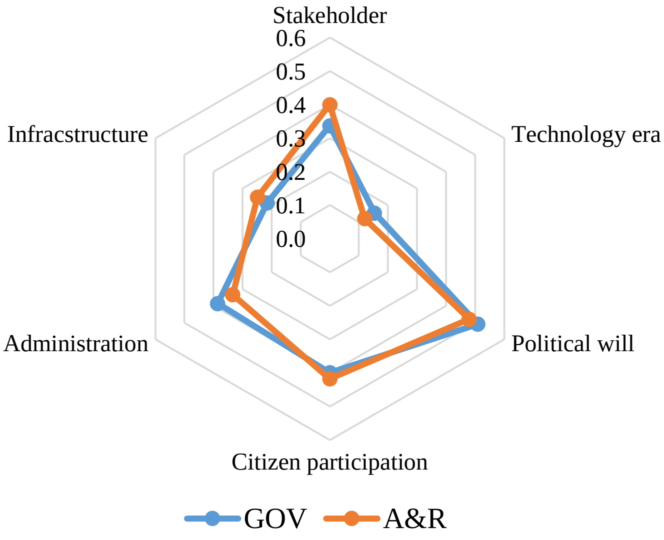


Figure 6. Comparison of judgment from an internal and external factors

Overall, comparing the expert responses from the two sides describes that the results match most attributes. The differences in preferences for the administration, stakeholder and technology era from the government sector could related to management identification during technological change.

3.2.3 The Relative Importance and Priority of Secondary Layer

Results related to the relative importance and priority of details from internal factors shown in table 12.

The details of the subsections should be further refined to reflect the citizen as co-creator and end-user that identify the type of private activity policy in the smart city deployment process. The presence of citizen engagement and cohesion ranked first. Administration includes the ability of local authorities and SOP understanding of the political process in local governance. Finally, the infrastructure items classified into smart technology infrastructure including communication, information and data systems, and human resources for providing smart city services.

Table 12. The relative importance and priority of details from the internal factors

Detail of internal factor	Weight	Priority
Citizens engagement & cohesion	0.243	1
Citizens as co – creator & end user	0.227	2
SOP (Smart organizing practice) understanding	0.196	3
The operating ability of local authorities	0.116	5
Communication, information & data systems	0.086	6
Human resources (education, digital literacy)	0.130	4

$\lambda max = 6.2242$ Consistency Index= 0.04 Consistency Ratio= 0.03

Experts rated the existence of citizens' engagement & cohesion as 0.243, the citizens as co-creator & end-user as 0.227 (22.7%), SOP (Smart organizing practice) understanding as 0.196 (19.6%), human resources (education, digital literacy) as 0.130 (13%), the operating ability of local authorities as 0.116 (11.6%) and communication, information & data systems as 0.086 (8.6%). The high rating for the existence of citizen engagement & cohesion for city building is in line with the significant assessment of citizen participation in the evaluation of the primary layer as the most important internal factor of smart cities.

For details of external results shown that the technology era has changed the pattern of solving existing urban problems and considered one of the key elements of smart cities. In addition, we hope to be able to address existing issues more effectively by integrating various factors into cities as a key driver of new growth. Smart cities have been developing strongly based on integrated technology support, and different smart city development policies have implemented. Depending on the revision or reorganization of the legal system and the cooperation of local governments, smart cities can solve problems quickly and effectively.

While implementing smart city development is viewed as a result of government-led policies, they are not sustainable without stakeholders, which are the main external components of successful city development smart street. Stakeholders of smart cities include local governments, civil groups, businesses, and ICT providers, system integrators.

Table 13. The relative importance and priority of details from the external factors

Detail of external factor	Weight	Priority
Smart city - Policy and legal process	0.231	1
Local authorities readiness partnership	0.211	2
Citizens, city authorities as customers	0.156	3
ICT providers, system integrators	0.119	6
Comprehensive development	0.129	5
Solving issues by ICT driven	0.145	4

λmax = 6.1474 Consistency Index= 0.02 Consistency Ratio= 0.02

As shown in table 13, the experts ranked the smart city - policy and legal process first with 0.231 (23.11%). Local authorities' readiness partnership second with 0.211(21.1%). Citizens, city authorities as customers third with 0.156 (15.6%), solving issues by ICT driven as fourth with 0.145 (14.5%), comprehensive development fifth with 0.129 (12.9%) and finally, ICT providers, system integrators rated sixth with 0.119 (11.9%). From external factors, it shows that legal building and policy issues are the top priority, for the specifics of the Vietnamese political system, they all share a pattern according to the top-down management level. Therefore, it is necessary to have a common legal foundation in order to promote the development process in a sustainable way. To do so, it is necessary to require a great deal of the willingness of local authorities to cooperate or in other words, the local government must have a holistic view putting the connection between the government and the people on the development process.

3.3 Conclusion

As mentioned on the stakeholder approach in smart city development, the role of experts is crucial for the application of the proposed planning framework especially for smart city development. In this regard, experts are seen as agents of change, initiators (Stratigea, 2010).

More specifically, experts have a variety of roles, including persuading public authorities to move from a pure top-down model to a more democratic decision-making model by changing rules and the implications of the institution and engaging stakeholders and the public and convincing stakeholders and the public to contribute their empirical knowledge, perspectives and values to the decision-making process. They need to contribute to help understand the major challenge in more detail and break it down into specific issues. This enables the public authority to gather information, as well as ideas on how it could be handled. The expertise and involvement of city experts from the foundation are critical to the success of smart city development.

In this study, based on the assessment of experts, it can see that, in order to develop a smart city in the context of Vietnam, the processes to encourage citizen participation are very important. The ultimate goal of developing smart cities is to improve the quality of life of people through advanced information technology, or in other words, information technology is only a tool to serve this purpose. Therefore, a rational approach is needed in the development process, it is clear that those who understand the most characteristics and problems of a citizen area, citizen participation is an important factor most and cannot be excluded from policy options in smart city development to solve urban problems.

Citizen participation should ensure based on the support of cooperation between the authorities at all levels, in which the political will accompanied by strong support is an important factor in determining development of the smart city. In addition, the government should develop laws and regulations to minimize the adverse effects of smart city technology adoption while minimizing the excessive regulations that limit the development of new technologies. To do so, the government should act as a pilot, a linker, linking government with stakeholders to propose the right direction for smart city development.

Although this AHP study conducted with an expert group to derive the determinants of smart cities and assess their priority, however, the size and scope of the samples were limited. Therefore, a field survey assesses the readiness to develop smart cities should conduct to increase the validity of the study, as well as the generality of experimental results will be further evaluated in chapter 4.

Chapter 4. Study on the Role of Stakeholder Approach for Sustainable Smart City Development

4.1 Hypotheses Development

4.1.1 Smart City Development Readiness

It recognized that smart city development is a complex process, not only involving the application of an innovation or new technology but also to the government and society applying innovation (Henry, 2003). It is clear that developing a smart city is a major investment in both physical and human resources, so consideration must be given to the objectives of both central and local governments. The application of Smart City involves many risks and uncertainties (Yang et al. 2015). Therefore, this willingness to accept all the risks and uncertainties will greatly influence the decision of the organization that applies the smart city concept (Clark et al., 1995). Razmi et al. (2009) add that the readiness to adopt an innovation will determine the success rate of applying that innovation. As mentioned, due to the high costs and risks of applying smart city development, an assessment of the readiness of the elements is necessary to rationalize an action or decision, thereby bringing devise appropriate guidelines and help organizations effectively manage resources in the development of smart cities (Mutula & van Brakel, 2006). This study proposes a smart city development model that consists of three main components, such as Technological Readiness, Organizational Readiness, and Environmental Readiness. The hypothesis proposed related to this concept is as follows:

H1: Technological Readiness has a significant effect on Smart City Development Readiness.

H2: Organizational Readiness has a significant effect on Smart City Development Readiness.

H3: Environmental Readiness has a significant effect on Smart City Development Readiness.

4.1.2 Technological Readiness

Technology context refers to the application or object of the application of new technology. Many researchers have confirmed the importance of a series of first and second order structures that affect the technological context. Zhu et al. (2003) conceptualized and studied the technology context by identifying and operating technological competence through three structures: IT infrastructure, Internet skills and e-business awareness. In the proposed model of the research, the technological context is refined into three variables: (1) information system; (2) communication system; and, (3) data orchestration. Chourabi et al., 2012 identified effective information systems and new technologies (hardware and software) and interoperability as a factor influencing the intention of acceptance and actual application behavior in new organizational transitions. In addition, organizations depend on their information systems for regular operations, so integrating existing software also contributes positively to connectivity within the city system, thereby quickly solving daily problems (Crnkovic et al., 2005; Jules et al., 2019).

Moreover, in the process of integrating information system, privacy & security system has safety and stability is an extremely important issue. Bartol et al., 2011 argue that resolving security and reliability issues is critical in the wide adoption of information system-related services in the city. According to Zhao and Cheng (2005), the security and reliability issues, related to the city's integrated services, have not been resolved. Recognizing the importance of safety and security, Yague et al. (2005) proposed an access control model for services to address security issues. The presence of high-speed communication systems, including fix-broadband and mobile broadband, is the basis for the development of smart cities as it ensures end-user connectivity and data transfers quickly and reliably (Somani et al., 2010; Toch & Feder, 2016). The choice between these two types of broadband based on device type, quality, and reliability of the communication network. Integrating them into government agencies to develop smart city frameworks requires digitizing processes. Sebastian, 2017 argued that one way to achieve this is to use existing information systems at organizations that incorporate smart city operating systems with modifications appropriate to actual circumstances. Another element that plays a decisive role in the operation of smart city technology systems is data orchestration. In the case of central data storage, all data is stored in a central location and the smart city government has the right to own and decide to share data (Gutiérrez et al., 2018). Miller & Veiga (2010) concludes that the benefits of central data storage to store data and provide interested stakeholders is effective and easy in the management process. It can also help ensure that inconsistent, duplicate data types detected and removed. In addition, allowing free data sharing to allow citizens and businesses to use and support the city's creative development environment (Bernadi & Belizario, 2019). Data sharing between city authorities and stakeholders contribute to the awareness of smart city development (Quyet et al., 2016; Raghavan et al., 2020). Based on the above explanation, this study will use information system, communication system and data orchestration as first-order variables to evaluate Technology Readiness. Thus, we proposed that:

H1a: Information System positively contributes to Technological Readiness

H1b: Communication System positively contributes to Technological Readiness

H1c: Data Orchestration positively contributes to Technological Readiness

4.1.3 Organizational Readiness

Yang et al. (2015) argue that the readiness of an organization in the process of developing a smart city is the preparation of local government including all management elements and the preparation of the resources needed to apply. Human resource factor considered key to smart city operation (Nam & Prado, 2011). One characteristic of human resources is that IT professionals represent the organization's ability and readiness to use new technologies (Lee et al., 2014). Beginning the process of developing a smart city with good preparation for cooperation and consultants, IT scholars will make the adoption process easier. Moreover, the availability of IT professionals will make the intention of developing smart cities higher (Sucahyo et al., 2016). In addition, the ability of local governments to work also needs to meet the requirements of adapting to the development of smart cities. This requires management flexibility to capture new elements coming from smart cities from management levels to local employees in adapting to new changes (Yang et al., 2015). Another factor is the city's educational environment, which opens up the opportunity for a continuous professional learning and implementation process that trains not only future professionals but also a place for future citizens to interact in their smart city. Most cities in Vietnam when embarking on developing smart cities often focus on e-government investment in the first phase (Khoa & Kim, 2019). It is clear that developing a smart city based on the technological context is always a top priority, but it is necessary for local governments to apply improvements to improve management and operation efficiency solid steps based on the overall ICT development plan through which the e-government operation will become more smoothly (Dameri, 2017). Another issue in Organizational readiness is the development method. In common smart city development methods include; the top-down approach and the bottom-up approach. The top-down approach begins with the smart city development master plan considering services within their scope, interaction, potential collaborative organizations, and their participation, following that is the stage of deployment and operation (Amar, 2016; Lee et al., 2013). On the other hand, the bottom-up approach begins with the integration of existing services and the continuous integration of new services as they developed into a smart city platform (Smart City Wien, 2014). Clearly, the city government faces a challenge of choosing a development approach as a top-down approach can receive the support of existing enterprise solutions while a bottom-up approach Up is an appropriate approach to fostering innovation in the local community (Kwon et al., 2016). Another issue in Organizational readiness is the development method.

In common smart city development methods include; the top-down approach and the bottom-up approach. The top-down approach begins with the smart city development master plan considering services within their scope, interaction, potential collaborative organizations, and their participation, following it is the deployment and operation phase (Amar, 2016; Lee et al., 2013). On the other hand, the bottom-up approach begins with the integration of existing services and the continuous integration of new services as they developed into a smart city platform (Smart City Wien, 2014). Clearly, the city government faces a challenge of choosing a development approach as a top-down approach can receive the support of existing enterprise solutions while a bottom-up approach Up is an appropriate approach to fostering innovation in the local community (Hojer & Wangel, 2015). In the element of management and control of smart city services can be implemented based on integrated city control center that manages all services and is responsible for data collection and data provision for stakeholders. The operating center application used by many cities for their smart city deployments (Schreiner, 2016; 79 Lee et al., 2016c; Lee et al., 2014; Kwon et al., 2016). Thus, the following hypotheses are proposed:

H2a: Human Resources positively contributes to Organizational Readiness

H2b: Development Method positively contributes to Organizational Readiness

H2c: Management & Control positively contributes to Organizational Readiness

4.1.4 Environmental Readiness

Environmental readiness defined as how the local government prepares for all external factors; such as economic adaptation, regulatory adaptation, stakeholder engagement, especially citizenship to support and help each other through the city. According to Achaerandio et al. (2012), developing smart cities not only need to pay attention to internal organizational issues but also needs to collaborate with a number of key external factors. The main purpose of the smart city application is to help, facilitate, and ensure the comfort and well-being of everyone's life (Lombardi et al., 2012). The development of a smart city closely linked to the city's economic adaptation process; attracting investment, fair competition business, as well as technological innovation in production, clearly shaped in this process (Caragliu et al., 2011; Anttiroiko et al., 2014). As we know, the application of smart cities involves the implementation of smart technologies. To provide benefits from the application of smart cities, so everyone should know and understand how to use smart technologies, in addition to contributing ideas as well as participating in the city development plan. The street is also very necessary (Emma et al., 2015). The involvement of stakeholders, especially citizens, is one of the external factors that can greatly affect the willingness of local governments to adopt the concept of smart cities (Giffinger et al., 2007). Citizen participation can also affect the success of the smart city application. This is due to the application of smart cities, where all the technologies, processes, and rules for applying the smart city concept will used and evaluated by the people (Degbelo et al., 2016). The absence of stakeholders, especially citizens, will lead to ineffective applications because all technology or equipment investments will not be used by citizens (McNeal et al., 2008). In addition, Angelidou, 2014; Komninos et al., 2013 also emphasize that the adaptive change of policy elements is also important in the adoption of smart cities. Setting a vision to transform smart cities is a very important step for every administration. It has a direct and long-lasting influence on the process of city development, lack of vision that will cause asynchronous development of the disorder (Desouza & Bhagwatwar, 2012). After establishing a vision, it is essential to develop a roadmap and manageable funding strategy. Komninos et al., 2013 emphasize that determining the development roadmap as well as the management of capital invested in smart projects will affect the entire development process of the city, establishing these factors will help keep the city on track, saving time and money, and delivering the desired results (Sánchez-Torres & Miles, 2017). Thus, based on this concept, we proposed that:

H3a: Economic Adaptation positively contributes to Environmental Readiness

H3b: Citizen Participation positively contributes to Environmental Readiness

H3c: Policy Adaptation positively contributes to Environmental Readiness

Based on the aforementioned research hypotheses, we synthesize and propose a general model for intention to develop smart city (Figure 8)

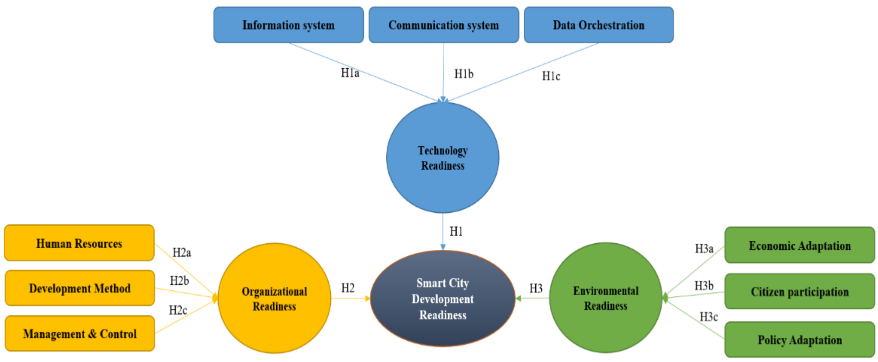


Figure 7. Propose hypotheses model

4.2 Methodology

4.2.1 Model

The model used in this chapter follows the relation of the technological, organizational, and environmental framework (TOE) described in Tornatzky and Fleischer from technological innovation processes (1990). The TOE model in figure 7 shown to be useful in the investigation of a wide range of innovations and contexts.

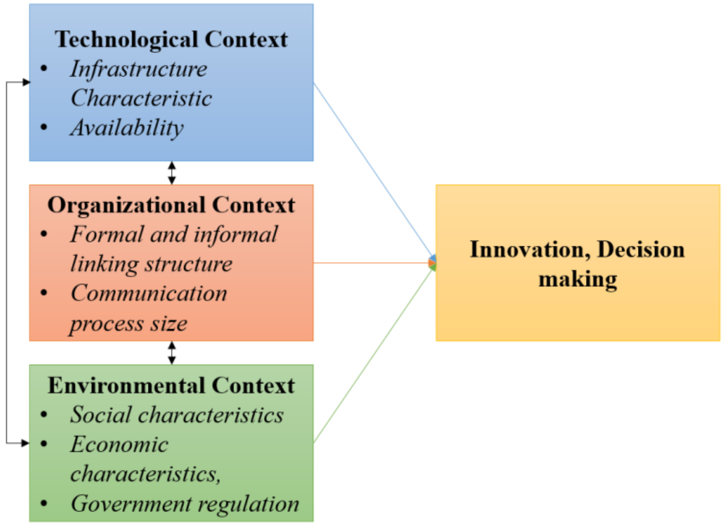


Figure 8. Original Technological – Organizational - Environmental (TOE) model

The TOE framework proposes three key aspects to explore the factors that influence organizational innovation based on the development of technology. Therein the technology context that considers important technologies available both internally and externally can be useful in improving an organization's productivity (Low et al., 2011). The organizational context defined as the resources available to support the adoption of innovation. These criteria include the size and scope of the organization; centralization, formalization, interference and complexity of management perspectives; and the quality and availability of the organization's human resources (Yoon & George, 2013); and environmental contexts related to issues that exist in areas related to economic, social and regulatory aspects. Zhu, Kraemer and Xu (2003) point out that the TOE framework has been proven to be quite effective from previous research, a lot of innovative technology research has been done by applying the TOE research method, including information systems (DePietro et al., 1990), e-commerce (Rowe et al., 2012), web services (Lippert & Govindarajulu, 2006). A lot of empirical studies (Gibbs and Kraemer, 2004; Kuan and Chau, 2001; Zhu and ah Kraemer, 2005) used the TOE framework as a theoretical basis to investigate the organizational acceptance of new technologies. Many authors have used this framework to study various IT application strategies. Although the model is primarily used for applied research or innovation, it does not provide a specific model that describes the factors affecting an organization's adoption decision; It instead provides a classification of applied factors in their respective contexts (Hidayanto et al., 2017). Therefore, the model encourages researchers to take a broader context in which innovation takes place on why it is applied.

This chapter conducted by two stages including: preliminary research and primary research (Table 14)

Table 14. Methodology conducted

Stage	Research model	Method	Technique
1	Preliminary research	Qualitative	In-depth interview, discussion
2	Primary research	Quantitative	Survey by questionnaire

4.2.2 Preliminary Research

The preliminary research phase uses qualitative research methods to discover, supplement, and adjust the observed variables to measure concepts in the model. During this period, we used an in-depth interview with the subjects selected in a convenience sampling way but still reflect the characteristics of the sample set. Subjects selected to participate in qualitative research are experts working or knowledgeable in the field of smart city development including:

Mr. Le Anh Kiet (Head of ICT of Dalat city)

Mr. Nguyen Dinh Thien (Deputy Head of Economic of Dalat city)

Mr. Nguyen Ba Phong (Principal Officer - Department of Science and Technology, Lam Dong province)

Mrs. Nguyen Pham Thu Huong (Lecturers of Dalat University)

The purpose of this phase for testing the clarity of words and the ability to understand the statements as well as the duplication of statements for correction. Participants in the qualitative survey commented and supplemented some necessary statements to measure some components in the proposed model. Most of the comments agree with the content of the qualitative research questionnaire (Table 15)

Table 15. Scale factors of SCDR model

Smart City Development Readiness (SCDR)	Measurement factors	Variables Code	References
Technological Readiness (TR)	**Information system (IS)**		
	New ICT systems	IS1	Chourabi et al., 2012; Parasuraman & Colby, 2015
	Existing system integration	IS2	Crnkovic et al., 2005; Jules et al., 2019
	Privacy & Security system	IS3	Bartol et al., 2011; Elmaghraby, 2013
	Communication system (CS)		
	Fixed-Broadband data transfer rate	CS1	Toch & Feder, 2016; Martin, 2014
	Mobile - Broadband data transfer rate	CS2	Somani et al., 2010; Sebastian, 2017
	Free Wi-Fi public	CS3	Hwang & Choi, 2007; Wien, 2014
	Data Orchestration (DO)		
	Central data provision	DO1	Gutiérrez, 2016; Miller & Veiga, 2010; Gupta &George, 2016
	Open data	DO2	Vaccari et al., 2013; Bernadi & Belizario, 2019
	Data sharing	DO3	Quyet et al., 2016; Raghavan et al., 2019
	Human Resources (HR)		
	IT professionals	HU1	Lee et al., 2014; Sucahyo et al., 2016
	The operating ability	HU2	Yang et al., 2015
	The city's educational environment	HU3	Yang et al. 2015
	Development Method (DM)		

Organizational Readiness (OR)	E-government	DM1	Hazlett & Hill, 2003; Dameri, 2017
	The top-down approach	DM2	Schreiner, 2016; Amar, 2016; Lee et al., 2014
	The bottom-up approach	DM3	Smart City Wien, 2014; Hojer & Wangel, 2015; Kwon et al., 2016
	Management & Control (MC)		
	Integrated smart city control center	MC1	Schreiner, 2016; Lee et al., 2016d; Kwon et al., 2016
	The city enables and performs application	MC2	Marr, 2015; Berntzen et al., 2018; Sanchez et al., 2019
	The city system integration and maintaining	MC3	Lombardi et al., 2012; Baldassarre et al., 2013; Barletta et al., 2019
Environmental Readiness (ER)	**Economic Adaptation (ES)**		
	FDI (Foreign direct investment)	EA1	Wall & Stavropoulos, 2016; Alawadhi et al., 2012; Cocchia, 2014
	The local business environment	EA2	Bessant & Tidd 2007; Anttiroiko et al., 2014; Kumar & Dahiya, 2017
	Technological in business	EA3	Choe & Roberts, 2011; Caragliu & Nijkamp, 2011; Anttiroiko et al., 2013.
	Citizen participation (CP)		
	Rate the performance by citizens	CP1	Siefert, 2003; McNeal et al., 2008; Emma et al., 2015.
	Citizens communication	CP2	Giffinger et al., 2007; McNeal et al., 2008; Fu & Lin, 2014
	Citizens supportive	CP3	Boulos et al., 2015; Degbelo et al., 2016

	Policy Adaptation (PA)		
	E-government efficiency	PA1	Rodríguez Bolivar et al., 2015; Yusuf et al., 2016; Sánchez-Torres & Miles, 2017
	The city government roadmap	PA2	Angelidou, 2014; Komninos et al., 2013.
	Smart city vision	PA3	Doody, 2013; Colau, 2018; De Jong et al., 2019

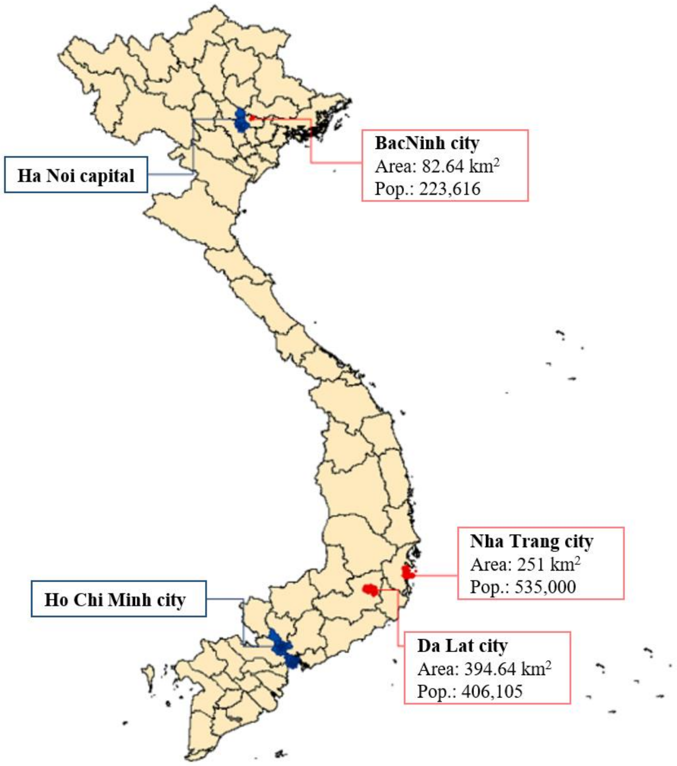
4.2.3 Primary Research

4.2.3.1 Survey Approach

The objective of this study to understand the smart city development readiness of medium cities in Vietnam based on stakeholder evaluation. To meet this goal, the survey has designed to focus on three key areas: stakeholder perceptions, the medium-sized city, and representation of the city case. First, the research applies a method of stakeholder's perception survey. The survey seeks to understand the readiness of smart city development in a given city by examining respondents' opinions from government and non-government sectors, who are knowledgeable about their respective city development contexts and policies. The awareness survey approach is reasonable because smart city development is a relatively new concept for most Vietnamese societies, and the most useful insights can be gained.

Second, the survey targets Vietnam's medium-sized cities (Figure 9) rather than large cities because Vietnam's medium-sized cities are the largest proportion of national urban growth. In addition, Vietnam has two major cities that characterized by political economy; Hanoi is the national capital and Ho Chi Minh City is a long-term economic center, and their special characteristics may be limiting the generality of the survey results.

Thirdly, the characteristics of the three selected cities presented show their representation to Vietnam's medium-sized cities in terms of area, population, year of establishment, and geographic location. In addition, the geographical position of the three cities distributed quite well across the country.



City	Year of establishment	Geographic location	Valid Respondents
Bac Ninh	2006	Red River Delta	84
Da Lat	1920	Central Highland	93
Nha Trang	1977	South Central Coast	79

Figure 9. Summary information for surveyed cities

Currently, these cities are hot spots of the country in the race to develop smart cities. Cities representing each region of Vietnam with specific economic characteristics such as Bac Ninh city is characterized by industrial economy, Nha Trang is characterized by tourism and marine economy, Da Lat is characterized by agricultural and tourism economy, so cities There will be different smart city development directions. In addition, gathering opinions from stakeholders in each city will give an overview of the city development context (technological, organizational and environmental) as well as the issues that the city needs to face in the smart city development readiness process.

4.2.3.2 Survey questionnaire

The survey questionnaire consists of three parts. Part A assesses technology readiness as defined by the smart city development framework presented. Questions organized along three dimensions: (a) information systems (3 questions); (b) communication systems (3 questions); (c) data orchestration (3 questions); Technology readiness (3 questions). Part B investigates the degree of Organizational readiness, including; Human resources (questions); Development method (3 questions); Management & control (3 questions); Organizational readiness (3 questions). Part C solicits opinions about Environmental readiness; Economic adaptation (3 questions); Citizen Participation (3 questions); Policy adaptation (3 questions); Environmental readiness (3 questions). For the final smart city readiness (3 questions). A summary of the survey questionnaire provided in the Appendix. For each question (indicator), an average score above 3.0 implies a positive overall perception, while an average score below 3.0 implies a negative overall perception.

The respondents asked about demographic information in the first part. The source questionnaire of this study written in Vietnamese and translated into English by the author. In order to ensure the accuracy of the targeted questionnaire, a second person translated the targeted questionnaire back to English. Then, the author reviewed and edited to ensure the meaning of the questionnaire. After finishing the questionnaire design, the author conducted a pre-test to complete the questionnaire. The first pilot-test done with five peoples to test online questionnaire errors. Finally, data collected through online questionnaire. Due to the limited resources (financial ability, human capital, geo-location of cities), this questionnaire was distributed and Google survey was chosen as the main channel of online distribution since google's survey is the most popular site in Vietnam using for many research fields (VinaResearch, 2018). The online questionnaire conducted from 5 February to 25 March 2020. The demonstration of the survey questionnaire shows in Appendix B.

4.2.3.3 Data Collecting

The sampling technique in this study was determined using purposive sampling and snowball techniques. First stage selects samples from stakeholders who have a certain knowledgeable in smart city development and understand the context and constraints. Besides, after obtaining sample data using intentional sampling techniques, it is difficult to contact all samples scattered in the three cities. Therefore, the study continues to use snowball-sampling techniques to fix the problem. Snowball sampling is an initial sampling technique with a small amount but then expanded as a snowball. In this study, after collecting data from the samples that can obtained, it is then possible to take new data or samples based on information or suggestions from the first samples. This process will continue until enough sample data collected to represent the study. According to Hair et al., (2006), the general rule for the minimum sample size in confirmatory factor analysis (CFA) and the number of samples suitable for multivariate regression analysis are five times compare to the number of observed variables. Follow to Hair, et al. (2006), the sample size can calculate as follows:

$$n = \sum_{j=1}^{t} kP_j$$

Where

Pj is the number of observed variables of scale jth (j=1 to t).

k is the ratio of the number of observations to observed variables. (5/1).

If n < 50, choose n=50, If n >50, choose n (Hair, et al. 2006).

Therefore, the research' minimum sample size is $n = 5 \times 3 + 5 \times 3 + \ldots + 5 \times 3 = 195$ observations. Since this study focuses on the intention to develop smart city in 3 representative cities, a small sample size might cause selection bias. Therefore, to increase the accuracy of the study, 100 samples for each city selected. After the questionnaire period, 300 samples collected in which there were 44 invalid samples due to the bias of answers. Therefore, 256 samples counted for further data analysis.

4.2.3.4 Distribution of Respondents

In order to reduce the complexity of conducting surveys, the research was carried out, using data of questionnaire surveys with government and non- government in order to implement objectively the goals of this study. 256 / 300 valid respondents from three cities comprised 34% of the government sector and 66% of the non-government sector (Figure 10).

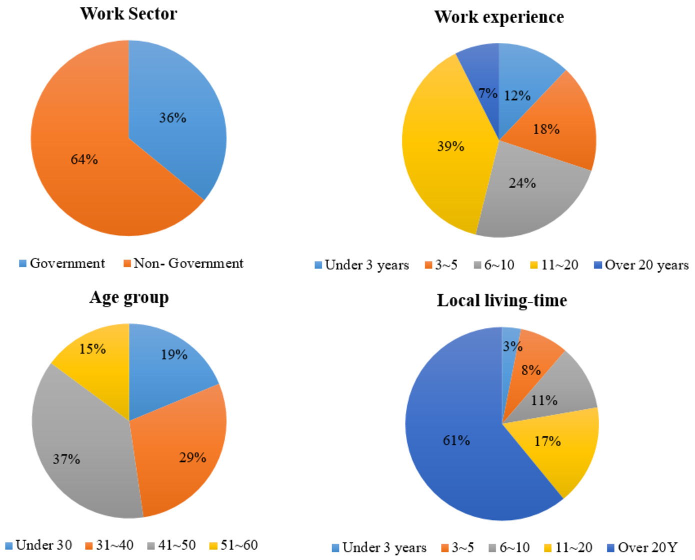


Figure 10. Distribution of respondents

As for the work experience distribution, among 256 respondents, 46% were 11 to over 20 years, 42% were 3 to 10 years and 12% were under 3 years. In terms of age group, those in their thirties or below were 19%, those in their thirties to forties were 29%, those in their forties to fifties reach 37%, and those in their fifties to sixties 15%. In addition, according to figures show that 61% of people thought to living in their city for over 20 years, respectively.

Table 16. Descriptive statistics of key variables

	Variables	N	Min	Max	Mean	Std. Deviation
Information System	IS1	256	2	5	3.70	0.786
	IS2	256	2	5	3.62	0.709
	IS3	256	2	5	3.61	0.765
Communication System	CS1	256	2	5	3.94	0.683
	CS2	256	2	5	3.72	0.734
	CS3	256	2	5	3.70	0.669
Data Orchestration	DO1	256	1	5	4.23	0.804
	DO2	256	1	5	4.00	0.922
	DO3	256	1	5	3.89	1.044
Human Resources	HR1	256	1	5	3.25	0.741
	HR2	256	1	5	3.34	0.707
	HR3	256	2	5	3.37	0.685
Development Method	DM1	256	2	5	3.61	0.710
	DM2	256	2	5	3.54	0.685
	DM3	256	2	5	3.46	0.719
Management & Control	MC1	256	2	5	3.91	0.779
	MC2	256	2	5	3.68	0.770
	MC3	256	1	5	3.70	0.726
Economic Adaptation	EA1	256	1	5	3.59	0.796
	EA2	256	1	5	3.53	0.782
	EA3	256	1	5	3.67	0.869
Citizen Participation	CP1	256	2	5	3.17	0.693
	CP2	256	2	5	3.07	0.806
	CP3	256	1	5	3.20	0.848
Policy Adaptation	PA1	256	1	5	4.03	0.914
	PA2	256	1	5	3.91	0.865
	PA3	256	2	5	3.70	0.782
Technological Readiness	TR1	256	2	5	3.85	0.664
	TR2	256	2	5	3.69	0.693
	TR3	256	2	5	3.56	0.805
Organizational Readiness	OR1	256	1	5	3.60	0.800
	OR2	256	1	5	3.71	0.716
	OR3	256	1	5	3.62	0.818
Environmental Readiness	ER1	256	2	5	3.98	0.811
	ER2	256	2	5	4.05	0.877
	ER3	256	2	5	3.90	0.884
	SCDR1	256	1	5	3.51	0.977

Smart City Development Readiness	SCDR2	256	2	5	4.14	0.783
	SCDR3	256	2	5	3.84	0.858

4.3 Estimation of Results

The research model was analyzed using structural equation model (SEM) with Smart PLS version 3.3.2 and SPSS 25. The data analyzed through two-stage methodology, which the first stage is doing measurement model evaluation and the second stage is structural model evaluation.

4.3.1 Measurement Model

4.3.1.1 Cronbach's Alpha Test

The reliability of a scale indicates the consistency of a measurement tool when it used to measure the same object under the same conditions. The reliability of the scale is assessed through the Cronbach's Alpha coefficient and the correlation between the considered measurement variable and the total remaining variables in the scale (Tho, 2007). The reliability of the scale tested through two indices (Hair et al., 1998). Item-total correlation coefficient is not less than 0.3; Cronbach's Alpha reliability: greater than 0.8 is a good scale, from 0.7 to 0.8 is usable, 0.6 or more is usable in case the concept being measured is new or new to respondents in research context (Nunnally, 1978; Peterson, 1994; Slater, 1995; Trong & Ngoc, 2008).

Table 17. Summary of the Measurement Reliability

Variables	Featured items	T-Correlation	CAt
Information System	IS1	0.575	0.781
	IS2	0.637	
	IS3	0.647	
Communication System	CS1	0.549	0.741
	CS2	0.605	
	CS3	0.555	
Data Orchestration	DO1	0.452	0.710
	DO2	0.616	
	DO3	0.540	
Human Resources	HU1	0.508	0.715
	HU2	0.575	
	HU3	0.520	
Development Method	DM1	0.469	0.707
	DM2	0.560	
	DM3	0.435	
Management & Control	MC1	0.533	0.703
	MC2	0.518	
	MC3	0.508	
Economic Adaptation	EA1	0.632	0.805
	EA2	0.626	
	EA3	0.706	
Citizen Participation	CP1	0.628	0.788
	CP2	0.666	
	CP3	0.588	
Policy Adaptation	PA1	0.692	0.848
	PA2	0.777	
	PA3	0.681	

**** Cronbach's Alpha> 0.6 – T-Correlation > 0.3***

In this study, we chose Cronbach's Alpha coefficient greater than 0.6. The reliability test results by Cronbach's Alpha coefficient presented in table 17. The results showed that the components of Cronbach's Alpha> 0.6 and none variables have correlation less than 0.3. The lowest is the Development Method (0.707) and the highest is the Policy Adaptation (0.848). In addition, the variables are closely related in the same concept of composition, the total correlation coefficients of the variables are greater than 0.3 distribution from 0.435 to 0.777 so all variables are accepted. Therefore, the remaining 27 observed variables continue to be included in the confirmatory factor analysis (CFA).

4.3.1.2 Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) is a quantitative analysis method used to shorten a set of multiple interrelated measurement variables into a smaller set of variables to make them more meaningful but still contain the most informative content of the original set (Hair et al., 1998). The objective of the CFA discovery factor analysis is to determine the number of factors affecting a set of measurement variables and the intensity of the relationship between each factor and each measurement variable. In the study, factor analysis will contribute to a shortened set of multiple measurement variables into a number of factors and each factor represents the majority of the significance of the observed variables in those factors (Tho, 2007). The set of observed variables of the main theoretical concepts in the study will be included in the CFA discovery factor analysis. This analysis used to group observed variables into factors and identify factors according to extracted factors. New factors may differ from the (concept) elements in the theoretical model. Therefore, the theoretical research model and the hypotheses adjusted accordingly according to CFA analysis results.

After the influencing factors tested, Cronbach's Alpha reliability coefficient with 27 variables met, continue to conduct CFA discovery factor analysis. The factor extraction method used is Principal Axis Factoring with Promax rotation. The scale is accepted when $0.5 \leq KMO \leq 1$ (Hair et al., 1998); Sig coefficient. = 0.000 of the Bartlett test indicates that observed variables are statistically significant; The total extracted variance is ≥ 50% (Gerbing and Anderson, 1988) and the factor load factor ≥ 0.5 proves suitable reliability for factor analysis. The CFA analysis results in table 18 with KMO index of 0.706 and Bartlett test value significant for Sig. = 0.000 indicates the observed variables are correlated with respect to the total number of observations. However, the factor loading of the DM3 <0.5 should be removed from the model (Nunnally & Bernstein, 1994). After removal, from the initial 9 factors with 27 observed variables grouped into 09 factors with 26 observed variables extracted at Eigenvalue by 1.043 and cumulative 70.284% ≥ 50%. This means that stop at nine factors with value is 1.043, these 09 factors explain 70.284% of the data variation.

Table 18. Summary of Confirmatory Factor Analysis

	Observed variables	Factor Loading								
		1	2	3	4	5	6	7	8	9
Policy Adaptation	PA2	0.918								
	PA3	0.753								
	PA1	0.730								
Economic Adaptation	EA3		0.842							
	EA2		0.729							
	EA1		0.724							
Citizen participation	CP2			0.838						
	CP1			0.756						
	CP3			0.633						
Information system	IS3				0.807					
	IS2				0.775					
	IS1				0.611					
Communication system	CS2					0.743				
	CS1					0.741				
	CS3					0.605				
Data orchestration	DO2						0.850			
	DO3						0.647			
	DO1						0.532			
Human Resources	HR2							0.720		
	HR3							0.686		
	HR1							0.606		
Management & control	MC3								0.687	
	MC1								0.664	
	MC2								0.632	
Development method	DM1									0.857
	DM2									0.615
	Eigenvalues	4.161	2.860	2.179	1.949	1.710	1.617	1.426	1.329	**1.043**
	Variance Extracted	18.062	12.334	7.735	7.373	6.605	5.806	5.131	4.909	3.939
	Cumulative 70.284%									
	KMO	**0.706**		***p-Value = 0.000***						

Extraction Method: Principal Axis Factoring.
Rotation Method: Promax with Kaiser Normalization.

Technology Readiness, Organizational Readiness, Environmental Readiness considered intermediate variables in the model and Smart city development readiness are unidirectional concept, so conducting the factor analysis, Principal Component Analysis method and Varimax rotation were used (Table 19).

Table 19. The CFA results of concept factors

	Observed variables	Cronbach's Alpha	Factor loading	Cumulative %	KMO
Technological readiness	TR1 TR2 TR3	0.792	0.741 0.923 0.855	71.112	0.585
Organizational readiness	OR1 OR2 OR3	0.833	0.811 0.890 0.896	75.254	0.668
Environmental readiness	ER1 ER2 ER3	0.840	0.868 0.848 0.895	75.828	0.722
Smart city development readiness	SCDR1 SCDR2 SCDR3	0.846	0.899 0.850 0.873	76.506	0.723

** Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.*

The analysis results show that the factor loading of the observed variables in the common unidirectional scale is greater than 0.5. KMO coefficients are respectively 0.585, 0.668, 0.722, 0723 $\geq$ 0.5; p-value of Bartlett test = 0.000 <0.005. The total variance extracted from the scale is 71,112%, 75,254%, 75,828%, 76,506% respectively. Therefore, all variables retained for analysis of the linear structure model of SEM using Smart PLS software.

4.3.2 Structural Model

The method of analyzing the Structural Equation Modeling (SEM) by using Smart PLS software for testing the research model. The model of impact level contains 09 factors: (1) Information System; (2) Communication System; (3) Data Orchestration; (4) Human Resources; (5) Development Method; (6) Management & Control; (7) Economic Adaptation; (8) Citizen Participation; (9) Policy Modification on Technology Readiness, Organizational Readiness, and Environmental Readiness, thus affecting Smart City Development Readiness.

4.3.2.1 Measurement structural

In order to assess the reliability of the scale, the study used the CR reliability factor, the sum of AVE extract (table 20). In particular, the aggregate of Composite Reliability (CR) must be greater than 0.7 and the outer loading factor must be greater than 0.4 (Hair et al., 2014), it is significant for the reliability value. In addition, according to Fornell and Larcker (1981), the average variance extracted (AVE) greater than 0.5 will confirm the reliability and convergence value of the scale. Calculated results of the Composite Reliability and Average Variance Extracted of the component show that the concept scales all meet the reliability and convergence values. In addition, the values of the other fit indices of the SEM, such as standardized root mean square residual (SRMR), measure the model fit. Generally, SRMR values less than 0.08 suggest a good model fit (Henseler et al., 2014). In this study, the result of SRMR is 0.057.

Table 20. Scale Reliability and Convergent Validity

Variables	Composite Reliability (CR)	Average Variance Extracted (AVE)
Information System	0.873	0.697
Communication System	0.853	0.659
Data Orchestration	0.825	0.619
Human Resources	0.838	0.634
Development Method	0.872	0.773
Management & Control	0.834	0.627
Economic Adaptation	0.885	0.719
Citizen Participation	0.872	0.695
Policy Adaptation	0.907	0.766
Technology Readiness	0.880	0.711
Organizational Readiness	0.900	0.750
Environmental Readiness	0.904	0.758
SCD Readiness	0.907	0.765

For further evaluate the suitability of the model the analysis of discrimination been done, the study compares the relationship between the factors and AVE extract variance. The factor loading of each indicator is the largest in the cross-correlation coefficient matrix and statistically significant with p-value 0.000. Thus, the research sample ensures the discrimination of the measurement factors show in Appendix C. To evaluate multicollinearity, we ran a variance inflation factor (VIF) test; the multicollinearity phenomenon test has a value of VIF < 5 (Hair et al., 2014). As a result, with a maximum value of 2.942 indicating that multicollinearity was not critical in this model.

In addition, the coefficient of determination (R^2) measures the proportion of variance in a latent endogenous variable that explained by the other exogenous expressed as an efficient percentage (Chin, 1988a).

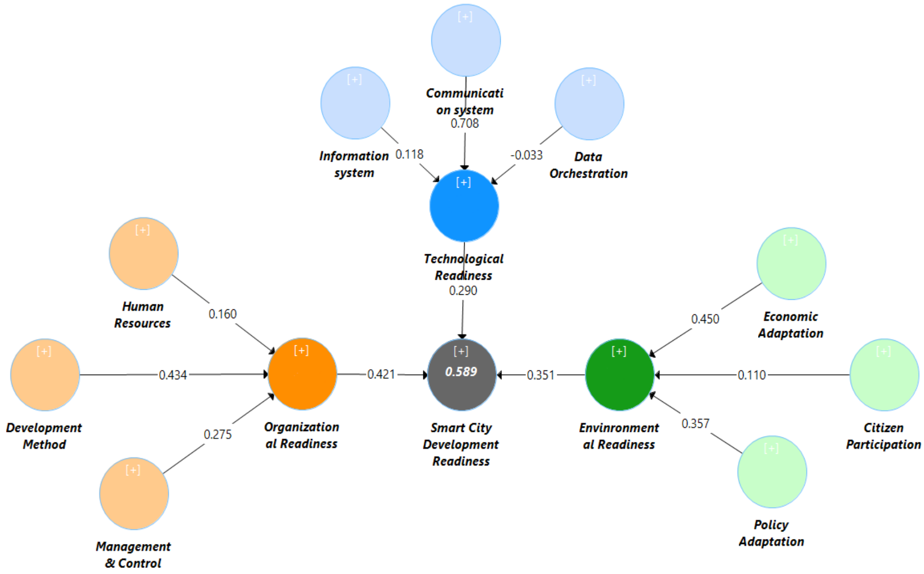


Figure 11. Results of the PLS-SEM linear structure model

R^2 is a measure of the model's predictive accuracy. It represents the amount of variance in the endogenous constructs explained by all of the exogenous constructs linked to it. Usually R^2 ranges between 0 and 1 with higher values indicating higher level of predictive accuracy $R^2 > 0.5$ can be described as a suitable model (Hair et al., 2008). However, R^2 increases when additional predictor construct is included. So use the adjusted R^2 which controls for model complexity when utilizing different model set-ups. In figure 11 show that adjusted R^2 of model about 0.589 is equivalent to 58.9%.

4.3.2.2 Bootstrapping Test

In order to expand the results, the model needs to be tested for reliability by bootstrapping. Bootstrapping estimates the spread, shape and bias of the sampling distribution of the population from which the sample under study is drawn form. The observed samples is treadted as if represents the population. Bootstrap creates a large, pre-specified number of samples and every time sampling happens in bootstrap the same number of case as the original sample will be analysed. n bootstrap > n samples (Hair et al., 2008). In this study used a bootstrapping technique with replicate sample size of 500 observations (n = 500) with an initial sample size of 256 observations (Table 21). Estimates from 500 observations show that the baseline weights are significant for the average weight of bootstrapping since all weights are within the 95% confidence interval. Thus, the estimates in the model can be concluded as reliable.

Table 21. Bootstrapping - confidence interval

	Original Sample (O)	Sample Mean (M)	2.50%	97.50%
Technology Readiness -> SCDR	0.29	0.293	0.203	0.385
Organizational Readiness -> SCDR	0.421	0.415	0.331	0.51
Environmental Readiness -> SCDR	0.351	0.356	0.263	0.441
Information System -> Technology Readiness	0.118	0.119	0.016	0.219
Communication System -> Technology Readiness	0.708	0.707	0.603	0.787
Data Orchestration -> Technology Readiness	-0.033	-0.021	-0.109	0.08
Human Resources -> Organizational Readiness	0.16	0.158	0.042	0.277
Development Method -> Organizational Readiness	0.434	0.435	0.327	0.535
Management & Control -> Organizational Readiness	0.275	0.275	0.176	0.375
Economic Adaptation -> Environmental	0.45	0.444	0.347	0.544

Readiness				
Citizen Participation -> Environmental Readiness	0.11	0.112	0.018	0.197
Policy Adaptation -> Environmental Readiness	0.357	0.363	0.265	0.464

4.3.2.3 Hypothesis Testing

In addtion, bootstrapping is used to evaluate the direct effects of all the hypothesised relationship that are represented by statistical testing of the hypotheses. If t > 1.96 hypothesis is supported. As mentioned, the research has three main hypotheses and nine supporting hypotheses that need to be tested. The results of estimating the relationship between the research concepts show that only 3/3 main factors affecting smart city development readiness at the statistical significance level of 5%. Particularly for the hypothesis H1c - Data Orchestration does not show statistical significance at the 5% level. The hypotheses presented in detail in table 22.

Table 22. Structural Model Hypothesis testing result

Hypothesis	Relationship	Std (β)	T Statistics	P-value	H-Identify
H1	Technology Readiness -> SCDR	0.293	6.117	0.000	Accepted
H2	Organizational Readiness -> SCDR	0.415	8.96	0.000	Accepted
H3	Environmental Readiness -> SCDR	0.356	7.588	0.000	Accepted
H1a	Information System -> Technology Readiness	0.119	2.312	0.021	Accepted
H1b	Communication System -> Technology Readiness	0.707	14.857	0.000	Accepted
H1c	Data Orchestration -> Technology Readiness	-0.021	0.671	0.503	Rejected
H2a	Human Resources -> Organizational Readiness	0.158	2.523	0.012	Accepted
H2b	Development Method -> Organizational Readiness	0.435	7.934	0.000	Accepted
H2c	Management & Control -> Organizational Readiness	0.275	5.419	0.000	Accepted
H3a	Economic Adaptation -> Environmental Readiness	0.444	8.976	0.000	Accepted
H3b	Citizen Participation -> Environmental Readiness	0.112	2.493	0.013	Accepted
H3c	Policy Adaptation -> Environmental Readiness	0.363	7.141	0.000	Accepted

** Impact level 0.02; 0.15 and 0.35 for significant exogenous indicates weak, moderate and strong effects, respectively.*
** T-value≥1,96, the relationship is statistically significant*

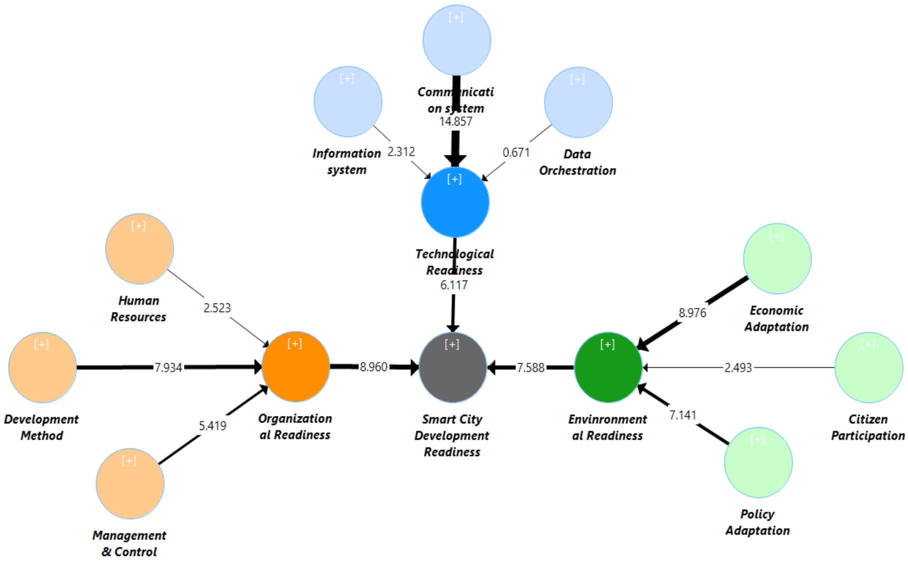


Figure 12. Bootstrapping direct effect results

Based on the analysis result we can conclude that in order to assess smart city readiness three elements should consider, such as Technological Readiness, Organizational Readiness and Environmental Readiness. The SEM estimation results show that Organizational Readiness factor has a positive relationship and strong correlation with Smart City Development Readiness expressed through the β coefficient = 0.415; t-value = 8.960 and this estimate is statistically significant at p = 0.000. Followed by Environmental Readiness (β = 0.356; t-value = 7.588; p = 0.000) and Technological Readiness (β = 0.293; t-value = 6.117; p = 0.000). Three readiness elements have proven to have a significant relationship with smart city development readiness. Thus, H1, H2, and H3 are accepted.

In addition, the analysis result also shows that not all proposed first-order variables can use to evaluate their second-order variable. Firstly, we proposed three first-order variables (information system, communication system, and data orchestration) to evaluate Technological Readiness. However, only two constructs have significant relationship with Technological Readiness, namely information system ($p = 0.02$; $t = 2.312$), communication system ($p = 0.000$; $t = 14.857$), Therefore, those two hypotheses H1a, H1b were accepted. Meanwhile, based on the results of linear structure model (SEM), data orchestration has a negative relationship with technology readiness, this is shown by the impact coefficient $\beta = -0.021$ but the value of t-value = $0.671 < 1.96$ and $p = 0.503 > 0.1$, so it is not statistically significant. Therefore, it is impossible to conclude about the impact of this relationship. Thus, hypotheses H1c rejected.

Secondly, we propose three first order variables and based on analysis result, all of those variables, Human resources ($p = 0.01$; $t = 2.523$), Development method ($p = 0.000$; $t = 7.934$), and Management & Control ($p = 0.00$; $t = 5.419$) have a significant effect on Organizational Readiness. Thus, hypotheses H2a, H2b, and H2c were accepted. Thirdly, based on analysis result, variable of Economic adaptation ($p=0.000$; $t= 8.976$), Citizen Participation ($p = 0.01$; $t = 2.493$) and Policy adaptation ($p = 0.000$; $t = 7.141$) that have significant effect on Environmental Readiness. Thus, hypotheses H3a, H3b and H3b were accepted.

The results show that the most important factor affecting smart city development is organizational readiness. Then followed by environmental readiness and technology readiness. The results of this study are consistent with previous studies from Yang et al. (2015), in which their research results also show that organizational readiness is the most important variable influencing the intention to adopt a complex innovation. The organizational readiness, such as human resources, development methods and adequate managements & controls, will influence application decisions.

4.4 Conclusion

The aim of this chapter for a better understanding the foundation of smart city development readiness in medium-sized cities of Vietnam. The study highlight a number of important factors that cities need to pay attention to in smart city development. Cities need to delve deeper into the existing ICT architecture and implement today's supporting systems and applications as well as create a roadmap to develop the necessary foundation for building a successful model of smart city in the future. These system platforms need to be developed while maintaining the goals and principles of transparency, openness, interoperability and connectivity, security and privacy. Cities, therefore, need to consider an appropriate policy and regulatory framework to support the aforementioned digital framework. Some options the city might consider include: Promulgating regulations and guidance on open standards that need to be applied. Put in place data privacy and use policies to avoid information misuse or legal issues, creating a security framework for data protection. Establish data management, transparency and sharing policies across the city.

Beside trying to build an ICT architecture system or other basic settings, the city cannot ignore the aforementioned policy considerations as these will have a profound effect on the ability to build on the scale of smart city formation. In addition, governments at all levels need to coordinate well with relevant agencies, mass organizations and social organizations, ensuring the autonomy of these organizations in activities of key initiatives, policy review, policy monitoring and evaluation. In addition, in the face of important local and grassroots issues, local authorities and grassroots can also guide citizens to work temporarily to reflect the voice, opinions and recommendations of the people to the government. In addition, governments at all levels need to create favorable environments and conditions to promote well the role and functions of citizens, social organizations, non-profit organizations, and non-governmental organizations in investment management, especially in policy advice, policy criticism, policy assessment, public service delivery, and governance performance evaluation. Existing issues in the highlighted areas will contribute to city leadership and review departments, from which the transition roadmap can be initiated. From there, the city can initiate a transition pathway by conducting detailed feasibility studies along with the identification and corresponding budget allocation.

Chapter 5. Discussion & Conclusion

5.1 Discussion and Implication

5.1.1 Discussion

The world is paying attention to smart cities as an important paraphrase of the fourth industry. Agree with the realization that a smart city is considered as the core solution to promote the sustainable goals that cities aim to do. With the trend of a strong and vibrant developing economy, medium-sized cities in Vietnam are also gradually entering this development path. However, in order to develop a smart city sustainably in this context, cities need to be aware of the position and what their stage on the smart city map. Drawing on lessons learned as well as strengthening cooperation between the government and stakeholders considered an important strategy to be readiness for sustainable smart city development.

5.1.1.1 Determinant factors of Smart city development

By the recent smart city development context, it can say that the role of the citizen in the development of smart cities can be is the key to giving the right direction (Seunghwan et al., 2018; Khoa & Kim, 2019). Citizen participation should be the starting point instead of blindly considering that technology and IT advances will automatically transform and improve the city (King & Cotterill, 2007). Experts suppose that citizen participation is a prerequisite for development orientation. Regarding the relative importance of internal factors, the most important ones are citizen participation (41.41%), administration (36.25%), and infrastructure (22.34%).

In fact, current city issues can address with smart solutions from "smart" citizens through people's awareness, social engagement, learning, training and skills development (Khoa & Kim, 2019).

The challenge so far has been to take concerted actions with the citizens, due to Vietnam's political system as government-centered, so citizen participation is quite vague, the role of citizen participation has not been properly recognized in smart city development. Clearly that, the ultimate goal of smart city that improves the life quality of citizens. The truly smart city should start from the people and use IT to support democratic debates about what kind of city people want to live. The scientific literature recognizes the essential role of citizens in smart cities and argues that the concept of citizen empowerment and democratization of innovation should add to this development process (Schaffers et al., 2011).

The finding of the study supported by Seunghwan et al. (2018) who advocate that citizen participation is the most important factor and cannot exclude from the policy options in smart city development to address various urban issues. Developing smart cities requires advanced levels of information sharing and integration.

In addition, the administration in smart city context has been presented as an emerging model of new public administration (Ruhlandt, 2018). This rapidly changing context requires almost Vietnam cities to soon integrated evaluation studies to find groundbreaking areas to lay the foundations for the long-term development of businesses and society. In detail, it is necessary to develop the administrative capacity to move to an alliance management system and to take advantage of social resources in development.

This requires the initiative of the government in regional connectivity instead of the project. This concerns the connection between the parties in horizontal and vertical relations as well as outside the government.

On the other hand, as ICT becomes more accessible and cheaper, it will change the urban environment by connecting via smartphones and mobile devices. Understanding the basic components of technology solutions and their capabilities is an important step to starting a smart city project. Smart city requires ensuring not only the existence (or development) of broadband networks to support digital applications but also the availability of this connection for all people in the city. Urban infrastructure must be a top priority in the management plan.

Integrated infrastructure with human resource development is considered an important key in smart city shaping. The reality shows that the human resource problem in Vietnam is face on inadequate. Specifically, in the policy of attracting talented people and highly qualified workers has not been defined. Typically, smart urban projects in some big cities such as Ho Chi Minh City and Hanoi are having difficulty finding operators. As an information security expert needs the right income, but the government has no mechanism to reimburse. Meanwhile, a number of qualified people, after being recruited, are assigned to the wrong position, In small and medium cities, it is more difficult to operate and develop smart systems which are transient and discrete (Oanh, 2019). Developing human resources for smart cities requires a long and continuous process, flexibility in policies as well as open mechanisms from the government. Thereby, once again emphasizing the role of smart policy setting in the national context.

Secondly, in the external factors, the respondents expressed the highest preference for the political will 50.93%, which depicts the need for a high concentration of smart city legal process. The complex nature of city systems and their interdependencies requires the existence of experiential knowledge about policy for developing and designing smart city systems and processes in a reasonable way. In essence, the smart construction policy is a comprehensive action program. The development of policies is of great significance, it shows a strategic vision, especially the application of the achievements of Industry 4.0 to make people's lives convenient and more environmentally friendly. Defining policy goals is an important step in the policymaking process.

In parallel with the development of the legal system, the government readiness partnership is extremely important. It leads to organizational, managerial, strategic, technical, and operational benefits for both public and private sectors. It should be emphasized that readiness partnership addresses many challenges such as lack of public sector performance, high cost of public services, limited government budget, no necessary skillset in public sector agencies and there is no incentive to reward performance (Jamali & Olayan, 2004; Sharma, 2007). Readiness partnerships are therefore one of the key measures to increase investment in media infrastructure, in training and learning, in addition to allowing them to increase their solvency every problem in a stable way. In the context of a Smart City, each area/function has its own mission and contributes to the overall development of the city. The ultimate goal of any vision toward smart cities is to achieve sustainable development across all sectors to benefit all stakeholders.

The results of this study show that they are in line with the results of Fernandez-Anez 2016. Suggesting that smart city development t enhances human and social capital wisely using and interacting with natural and economic resources via technology-based solutions and innovation to address public issues and efficiently achieve sustainable development and high quality of life on the basis of a multi-stakeholder, municipally based partnership.

5.1.1.2 Smart City Development Readiness

The study showed that the most significant factor that influences the smart city readiness concept is the readiness of the organization itself. Then, followed by the readiness of environmental and technological. The results are consistent with the prior study from Yang et al. (2015) and Hidayanto (2018), where the results of their study also show that organizational readiness is the most significant variable affecting the intention to adopt a complex innovation.

Regarding the technology readiness framework, the finding show that the problem facing local authorities that need to solved are the information system and data orchestration. Clearly, the research results show that the reality of the information system development in Viet Nam. According to the survey of Vietnam Government Portal 2018, about 700 information systems and databases in ministries, branches, and localities, only 70 systems connected to each other, accounting for 10% The main cause is due to; Lack of legal framework to promote connectivity, lack of connectivity, sharing platform, non-standardized data, and lack of connectivity standards (MIC, 2017).

According to PWC's assessment, at present, all three cities of Da Lat, Nha Trang and

Bac Ninh are promoting development in all 6 areas of smart city, in which e-government is promoted first. However, the ICT adoption of all 3 cities across all sectors is at the basic level, with the average score between level 1 and level 2 of the 4 levels of the current state of technology application. (PWC, 2016).

The common barrier of all three cities is that security and privacy ICT functions are underestimating due to the lack of centralized software protection methods and policy mechanisms related to data security. In addition, due to technical and legal limitations, the management and sharing of data is still limited. Dedicated databases are not technically linked and there is currently no specific legal framework to guide and regulate data sharing between public agencies and service providers (Nga, 2019). The analysis and diagnostics is still limited because information and data collected from different systems are mainly used by some departments for reporting purposes. It is not intended to be used for data analytics to provide insight into system performance or future planning decisions (Tuan, 2018).

Perhaps overlooked, the information system with data orchestration are the brain behind the smart city. Smart cities require diverse information systems, with Big Data capabilities that can respond effectively to dynamic events and emergencies. In order to prevent those problems, the leader of local governments should evaluate some factors before adopting an innovation, especially for a complex innovation like smart city. Urgent requirements must provide solutions as well as specific tasks to overcome the situation of information fragmented, promote the ability to integrate, connect and share digital data among state administrative agencies, creating tools and applications for the steering and administration of local departments.

At the same time, systematically create a technical infrastructure to ensure the implementation of e-government in general and the implementation of important fundamental projects that determine the success of the main development process.

In organizational readiness, results show that human resources and management & control are issues that local authorities need to handle. For developed countries, the demand for IT human resources will be greater because the smart city development characteristics, human resources are the most important factor (Sanchez, 2014). Meanwhile, Vietnam has just opened up and integrated into the country for nearly two decades. IT human resources are still lacking and still have many limitations in quality. According to the statistics of the Vietnam Ministry of Information and Communication 2017, IT human resources in Vietnam are in serious shortage, the recruitment demand in the IT field is about 250,000 labors. In the direction of the national human resource planning to 2020, Vietnam needs 1 million workers in the IT field. However, each year, the country will only train about 60,000 peoples, excluding spontaneous human resources (MIC, 2017). Human resource development, especially in the information technology field is a breakthrough solution that has decisive significance for the development of smart cities. The focus is on recruiting high-quality information technology human resources, combined with additional training and updating new knowledge for existing human resources. The central and local authorities should consider creating a market for social groups to conduct training in the direction of program content innovation, expanding the scale and improving the quality of training technology human resources information that meets market requirements.

Developing forms of training association, improve the quality of the contingent of information technology staff. Focusing on intensive training on skills in the effective application, use and exploitation of the information technology system. In terms of management & control, building the main operating center while innovating and integrating technology is an extremely urgent requirement. The introduction of the city intelligent operating center will provide government leaders with a comprehensive view focus on on-going activities, overall service quality monitoring and management, enabling big data analysis, decision support, organizational plan development, regulations, operating policy for specific situations. Currently, in Da Lat, Nha Trang and Bac Ninh have carried out the operation of the Smart Control Center, this is the first project in the process of developing smart cities. In which, Da Lat city was supported by the construction of VNPT telecommunications group, Nha Trang city was supported by Microsoft group. However, the biggest issue for all three cities is the integration of data systems and management ability. The transition from traditional method to digital data is not stable and lacks specific resources, smart city regulations not clear yet (Anh, 2019). This finding again emphasizes the importance of IT human resources, at the same time highlighting the need to focus on overcoming that cities need to achieve in the development process.

In case of environmental readiness, the issue of the study show that is the of citizen participation and appropriate management policies. According to Binh & Anh, 2019 currently in Vietnam, the government coordinates with citizens and businesses in the process of allocating development resources, in managing and solving common development related issues the city is still superficial.

Local government functions and roles are very important, therefore, the governance of urban government should fully demonstrate democracy, openness, transparency, responsiveness and responsibility. However, the government has not created a favorable environment to promote well the role of businesses and society; respecting and ensuring the realization of citizenship, expanding and enhancing citizen participation. Citizen-centered orientation also requires a renewal of awareness of the effectiveness of smart governance. In fact, not all people in cities have grasp of smart technology and can use the system easily. Although people's knowledge and skills in operating and using computer technology or the Internet are still low, the adoption of the smart city concept can still be successful with the positive behavior of citizens, for example by assisting and actively participating in any of the city's programs. In addition, the limitations on people's knowledge and skills can overcome by providing socialization and training before or after the smart city project implemented.

In addition, defining policy goals is an important step in the policy-making process. Often policy objectives built on the urgency of policy problems in social life, the complexity of policy issues, the opportunity to issue policies and the ability to solve problems by policy. Accordingly, the target of a smart city building policy includes the following contents: improving the quality of life of the people; Lean urban management; effective environmental protection; innovation of economic growth model; improving the quality of public service delivery (Giffinger, 2007). The selection of policy implementation options is an appropriate objective inevitable that will contribute to speeding up the policy to come to life, in order to meet the set objectives.

Central and local governments need to pay attention to options; first, choose to deploy a few separate applications in a few specific areas to ensure stable operation. Then continue to expand, integrate them together. It can choose to deploy in densely populated areas with high urbanization speed. The advantage of this approach is that the efficiency is immediately visible; creating a great incentive to expand deployment to other areas, but its disadvantage is that it will be more difficult to expand and integrate applications, service at a later stage. Second, the option to build to form a solid network infrastructure or a common platform that can deploy all of the above applications before; then select and categorize to see which applications can add to or integrate existing services into this platform. Third, build a trial version (Beta), this method has the advantage that cities that do not have an abundant budget to implement commercial investment can also do it, also pilot projects are often easy to find funding and investment.

The overall findings of this study suggest focusing on all of the organizational, environmental and technological aspects. In which, technology system, policy management and citizen participation in medium-sized cities of Vietnam have to emphasize in order to ensure rapid adoption along with community awareness towards the interoperability of the smart city development.

5.1.2 Implication

As mentioned, the general “smart city” standard has not been widely agreed upon, however, follow the experience of countries that have successfully developed smart cities, especially in medium-sized cities of EU show that Vietnam should inheritance to rely on a six-sector smart framework to design a separate set of national criteria. In this study, it can be seen that each medium-sized city has its own characteristics, in which Da Lat being one of the first localities in Vietnam to implement the smart city is considered as the economic and cultural center of Lam Dong province as well as the Central Highlands region, with diverse economic fields in both agriculture and tourism services. This "smokeless industry" (especially agricultural tourism) has been identified as the economic driving force of the city. Previously, Da Lat was almost isolated from the rest areas due to the inconvenience of infrastructure, especially traffic. The lack of routes connecting to the surrounding areas and the lack of direct international flights inhibited economic development (Trung, 2016). Up to now, the connected traffic system has been invested and upgraded more spaciously, but due to the rapid economic development of tourism in recent years, the city traffic infrastructure is seriously overloaded (Lich, 2019). In addition, Da Lat had 26,182 ha of forest land, including 20,914 ha of protection forest and 5,268 ha of production forest; Forest coverage rate in 2016 reached 47.6% in recent years due to the process of migration as well as high-tech agricultural development, leading to a significant reduction in the forest area. According to statistics, Da Lat currently has a total of 2,800 hectares of greenhouses for growing vegetables and flowers, while the total agricultural area is only 10,000 hectares (Vinh, 2019). Currently, the greenhouses system in Da Lat is paving the way for dead land due to impacts on the ecosystem, soil, and climate change. As a typical city for tourism and agricultural development, the amount of municipal waste per day ranges from 200 to 240 tons per day, but the waste treatment system can only handle 1/4 of the city's waste.

The rest are forced to return to old landfills that have existed for decades for burial. Although the city has built a treatment plant since 2015 until now it has not been completely resolved. In terms of governance, being one of the leading cities in building smart operating centers, but the biggest issue that city face is the data aggregation and synchronization of the management system. In addition, the investment in smart city development depends mainly on the public budget, leading to many problems in the legal stage affecting the disbursement process. Similar to Da Lat city, Nha Trang is the economic center of Khanh Hoa province, contributing more than 2/3 to GDP of the whole province with the main economic sectors of marine tourism and the development of the processing industry. In addition, Nha Trang is one of the cities with the highest urbanization rate in the country, with 90% of the population living in urban areas. Nha Trang city is an attractive tourist destination and the number of tourists is increasing (PwC, 2016). However, the supporting infrastructure, the public transport system, and the coordination center still face many limitations. Moreover, the city is facing a big problem now that its drainage and wastewater treatment system is not fully developed, this is reflected by the low rate of connection between households and wastewater rudimentary drainage infrastructure system (PwC, 2016). Unlike the two cities above, Bac Ninh is located in a favorable geographical position, near Hanoi capital, in the arterial traffic system favorable for economic development of the service industry. Over the past years, Bac Ninh's economy has always grown at a high rate, attracting large enterprises, especially the FDI sector. Although the urban area is experiencing positive changes, but the quality of urban infrastructure is still low, not synchronized, the process of site clearance, focusing on environmental pollution treatment in industrial clusters, craft villages, and residential areas has not been properly handled. Through facts that, developing smart city is the right direction for the local government of three cities. However, to be readiness to develop smart city, cities should proactively choose appropriate investment directions, avoiding stereotyped smart urban which is not feasible. It is necessary to build legal documents, standards and regulations to create a legal corridor for investment and encouragement in fields of city selection. In addition, it is necessary to provide evaluation and measurement criteria on the basis of international standards to monitor and supervise the development.

A portion of literature sees smart city development as the application of intelligence to city management (Boulton et al., 2011). It can quickly infer that sharing and integrating information and knowledge is one of the most critical objectives. To achieve these goals, managerial interoperability across the city's smart services, applications, and organizations are vitally needed (Nam & Prado, 2011). In the smart city ecosystem, services should facilitate based on nature and the needs of citizens (Lee et al., 2013). In order to develop smart city services, the local government must plan cooperation between different division levels, effectively distribute funds, and formulate appropriate rules and regulations for different sectors of the city (Landsbergen & George, 2001). In general, cities need to provide an overall development model, aiming to provide a way and direction to be able to develop a smart city model to maximize consensus and reduce costs.

Determining the best place to start the journey also helps city management adapt how to build and develop according to the model of the smart city in each period. Attracting public support and motivation in the journey, developing milestones, setting up metrics to evaluate performance and enabling scaling of success achieved throughout the process. Therefore, in this study, we propose an adaptive direction to develop smart cities in medium-sized cities in Vietnam;

*** Technological readiness- *identify challenges***

Cities face many challenges in many different areas such as planning, urban transformation, culture, environment, knowledge, urban economics and infrastructure (water, electricity, waste management, housing and sanitation) and e-government services for social infrastructure (health, security and other people's needs). The success of any smart city depends on its level of understanding of current and future challenges, including the current capacity of its divisions to tackle those challenges (Lee et al., 2014). In other words, understanding city limitations and the complexity of projects is critical in the transition to a smart city model. For medium-sized cities like Dalat, Nha Trang, Bac Ninh, the attraction of technology-related projects in smart city development is still modest compared to megacities like Hanoi and Ho Chi Minh City. Therefore, cities need to take a few steps to transform first, one of the essential steps in building the foundation is to identify the most pressing challenges that cities and local citizens need to tackle in while maintaining vision and multidisciplinary cooperation.

While defining physical infrastructure as a complex process, examining the city's technological infrastructure and the parts that provide these services is even more complex (Mattoni et al., 2015). Parameters such as data sensors, connectivity, systems, and equipment need study carefully. Once the challenge of physical infrastructure and the technological backbone to support these infrastructures completed, the city needs to focus more on the institutional capacity to success implement city projects smart (Caprotti & Cowley, 2017). Therefore, the assessment should focus on three main factors: service delivery level and physical infrastructure problems, technological and system challenges, and capacity diagnosis.

*** Organizational readiness - *Common vision***

Each city has its own social and economic characteristics, reflected in its facilities, culture and heritage. Building a future vision must mainly be built on the structure of the city to match and resonate with the strengths of the city, creating a solid support and foundation for the city in the transition process (King & Cotterill, 2007). Once the development team assembled and formed, the city needs to come up with a long-term vision to set goals for this transition. Most cities have a long-term vision of citizenship and a focus on economic and social sustainability (Mulligan & Olsson, 2013). The development team needs to define the strategic vision based on the broader city vision, such as the socio-economic development plan, master plan, regional plan and city aspirations.

*** Organizational readiness - *Specialized divisions***

Designing and directing a common vision of the city requires strong political leadership and a full understanding of the requirements of the community (people, businesses, organizations) to inspire the vision looking at and solving local challenges (Soumaya, 2015). Smart city development needs visionary leaders and capable development teams to realize the city's transformation, and be able to allocate human resources and network partners to realizing the vision of the city. The management team and the development team must be able to build and protect the future vision of the city by linking the efforts of the authorities.

Leadership can assume the role of giving overall strategic direction. However, the city also needs to appoint a team leader for this development team, as it will be mainly responsible for the smart city model phases. Team leaders can be people who know the roles of different authorities and departments in the city as well as the interrelated interactions between the parties. This team should be comprised of representatives from each sector, have sufficient managerial knowledge and skills to make strategic and operational decisions, and are necessary to implement city projects.

*** Organizational readiness -*Development Programs***

Vision and priorities have formulated, as well as after research to assess specific challenges, the city needs to develop programs with project portfolios to find results. The focus should be on project outcomes and objectives rather than specific technical solutions to the challenges (Dupont et al., 2012). Multi-disciplinary and multi-disciplinary programs should develop so that traditional platforms and new projects can deliver optimal results. Cities must determine the right scopes and sizes of the projects because for some projects, citywide success will take time and money. Cities must offer specific multidisciplinary solutions / programs / topics by clearly identifying the costs involved, potential funding sources, the common benefits, the timing of implementation, along with the role of the authorities. Cities also needs to continue to focus on existing projects, and entirely new projects or programs need not be preliminary projects. Ideas to improve and extend positive implementation steps may also be a necessary strategy to apply (Novotný et al., 2014). At this stage, another important task is to identify a more suitable measure to manage the project.

The right metrics depend significantly on a clear understanding of what the city wants to achieve. Measurements should develop with corresponding methods to know if the project will achieve the end goal.

*** Environmental Readiness - *Citizens Participation***

Smart city is constantly shaping and changing strategy, combining with people's perspectives for the maximum benefit of everyone. Most cities have set smart city development goals to improve the comfort level and improve the quality of life of Cities often fail to achieve their smart goals if their citizens, as end users, do not contribute their opinion to the design of smart cities. Failure to collect people's ideas early in the visioning process often leads to delayed consensus and will make it difficult to change behavior at a later stage (Li et al., 2015). One of the key characteristics of smart cities is to encourage and engage people in city life, including participation in decision-making and learning (Weisi & Ping, 2014). More and more cities are encouraging their citizens to participate in different stages of the smart city transition. Citizen participation in decision-making has tested in many cities when groups or entire citizens invited by government agencies to respond to proposed decisions and perspectives on policy and new project (Lee et al., 2014; Khoa & Kim, 2019). Linking people's participation also helps to come up with different solutions, which are priorities that people define, and many cities also host events and contests so people can build and work together create ideas for technology projects and solutions. It should note that engaging people in the city-building process is not about giving them access to city governance but co-creating collective solutions and agreeing to a broad agreement more widely (Allwinkle & Cruickshank, 2011).

With these factors, citizen participation will significantly benefit the smart city paradigm transition by expanding and reaching people through the city. Using technology / communication, through this plan, people will be closer to each other, thereby creating an incentive to change citizens' behavior.

*** Environmental Readiness - *Regulation Reviews***

In the process of smart city development, the city will take advantage of solutions based on an innovative business model and an appropriate legal framework. New policies, regulations and methods need to successfully build a smart city model (Dahiya, 2012). Overlapping between existing policies and new regulations for the implementation of the smart city model will not be enough. Depending on which smart city bots need to address, the city will have to adjust the rules to address data privacy concerns, data security, and encourage data access data opening and sharing. All of this must done in a transparent and responsible manner in order to attract and build trust for users as data will be accessed from all sources, an intelligent and inclusive ecosystem requires standard application and high interoperability (Bulu, 2013). Because sharing and accessing data is critical to the success of smart cities, clear rules and legislative development may be required. To be consistent in smart city development, Da Lat city developers need to adhere to a number of standards such as process, technology, framework and standard compatibility features. Therefore, in order to achieve the unified and objective scale of a smart city, the first important step is to study the standards that will apply. The city should carefully review the list of standards as these metrics provide suggestions for the level of compliance it will need to maintain in order to meet the smart city criteria.

The standards for smart cities can be used to monitor engineering operations, ensure safety, interoperability, cut costs, effectively strategic planning, and manage resources (Wolfram, 2012). In addition, standards can use to evaluate best practices. Standards provide a common language and knowledge base, foster unified solutions, and foster public-private partnerships. Ultimately, the standard is the tool and guide for the city to implement solutions with great potential in the market and gain wide approval from the authorities.

*** Environmental Readiness-** ***Funding and Cooperation***

Admittedly, it is very financially difficult to deploy smart city technology development, especially when budgets are tight. An important step in the smart city modeling effort is to early evaluate all potential funding options and identify funding sources, or combinations that could provide a great financial solution. to bring a project from idea to reality. Donor coordination can extend from public and public agencies to innovative and private finance options. It is important to consider a well-structured business case, identify costs and quantify benefits over the life of the project in the city's procurement plan (Abastante et al., 2017). Parts procurement

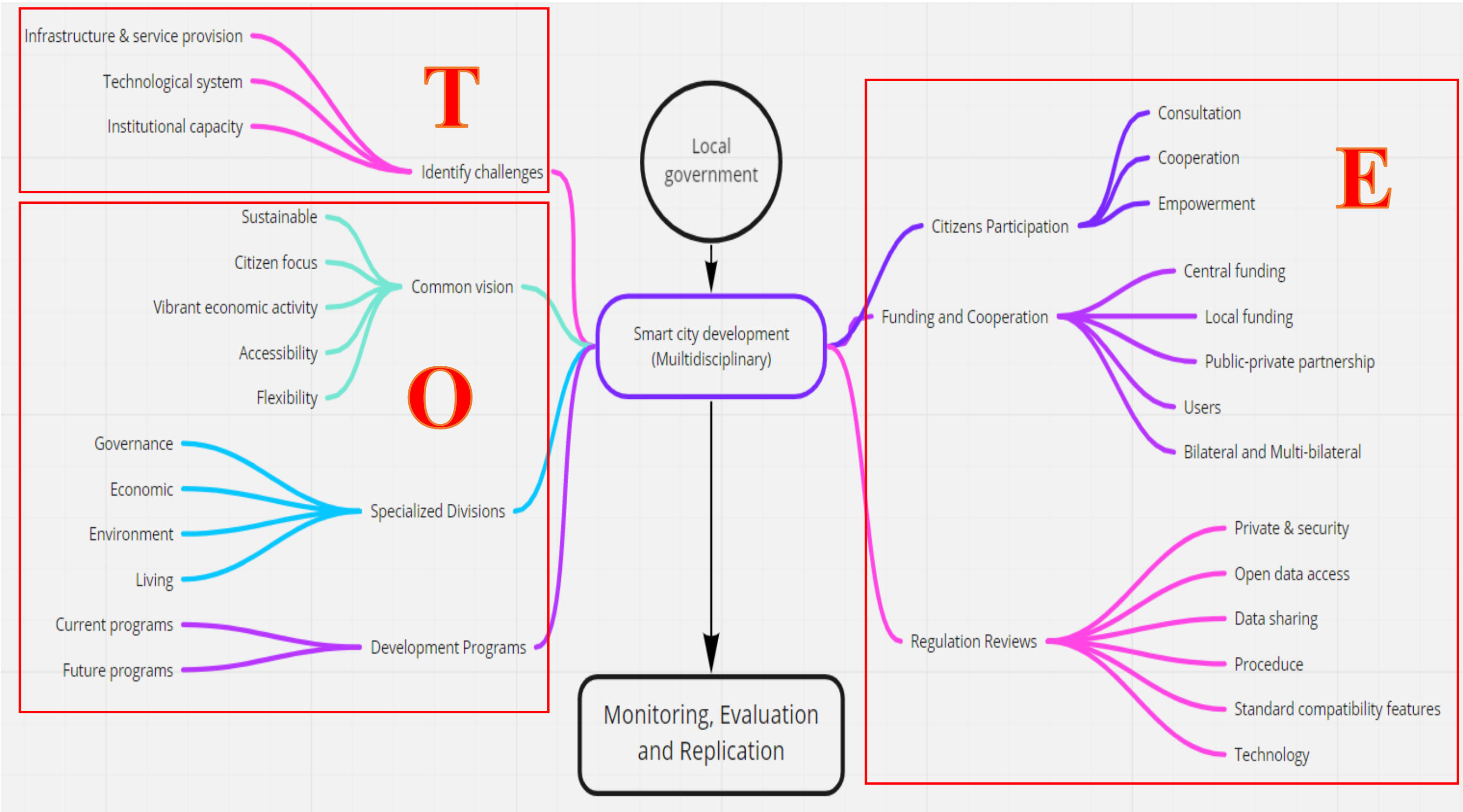


Figure 13. Guideline framework for smart city development.

strategy is also essential to be an integrated strategy to reap economic benefits, eliminate unnecessary costs and enable interaction. Cities may consider possible funding sources. Another important activity when looking at financial and financial resources is finding collaborates (private, academia, organizations, NGOs, technology solution providers), and this partnership is important both technically and from a fundraising perspective. Choosing the right finance for the right to materialize with the right partner is an important factor in the success of smart city development efforts (Lazaroiu & Roscia, 2012). To build smart cities, it is necessary to focus on the short-term success of branding, attracting human resources as well as solutions and investments. Projects that can be completed and quickly retrieved should be a priority. Some early achievements are necessary for any city to embark on a rapid city transition. Initial success will build the trust and motivation needed to accelerate the transition. Initial success can build on the principle of selecting projects with rapid and large returns compared to the amount of capital and time required to invest. With the support of a number of smart city researchers and advisers, a number of areas can select for initial success.

**** Monitoring, Evaluation and Replication***

When the first stages of success implemented, an important parallel activity will be to set metrics to measure progress toward results and goal setting. Stages should monitor on a regular basis to minimize incurring costs and delays, and to ensure desired quality. The benefits gained from the results performed should disseminated at all levels, not achieving key performance indicators (criteria), and necessary modifications must make. Such surveys also allow city governments to know and find out what solutions are worth investing in future projects. Tracking, evaluating and providing feedback are crucial to smart city learning (Orlowski & Romanowska, 2019). The results achieved through each stage of development together with the transparency and participation of the community will create a great motivation for the picture of the success of the smart city in the future.

5.2 Conclusion

Smart city development is an inevitable trend of countries around the world and Vietnam is no exception. Defining the foundation to develop smart city is an extremely important factor, it affects the sustainable development of the city in particular and the nation in general.

Firstly, the study used a multidimensional approach to internal and external factors to capture experts' choice of components that play a key role in smart city development. The internal components have divided into three different categories considering the level characteristics such as citizen participation, administration, and infrastructure. The selection of experts puts this type of citizen participation to the highest level. As mentioned, although the Vietnam political regime is quite separate from other countries, however in recent decades the Vietnam government is more open-minded, encouraging the development of democracy, this can be seen as a bright spot for the process of smart city development to become smoothly. In fact, smart city technology means improving citizens' existence, technology-based smart cities in the future have little pretension for sustainable prosperity without citizen participation. Citizens' role in evaluating, brainstorming, and collaborating should be closely reviewed by the government before implementing smart city development projects.

Secondly, the study provides valuable insights by identifying external factors that are important for policy decision-making. For Vietnam, especially in medium-sized cities, smart city development is a new concept, so policymakers need to have appropriate plans and strategies in each specific period for the policy to come into practice, correct the goals that are set specifically on political will. The results support policymakers at the foundation stages of smart city development who need to introduce comprehensive policies at the urban level to foster innovation and inclusion. Determining the important factors will enable the use of this data to refine urban processes and develop innovative applications.

Thirdly, the study provides an analysis of stakeholder's assessment in three medium-sized cities including Da Lat, Bac Ninh, and Nha Trang, providing valuable insights into the smart city readiness factors. In which organizational readiness is one of the key aspects that can affect this development, followed by environmental and technological factors. The identification of readiness factors based on the TOE model provides smart city planners and developers a key success factor. It is necessary to build information technology systems, manage and organize data at the same time develop high-quality human resources, improve management capabilities, and increase citizen participation in development steps. At the same time, there are policies tailored to the city's context. In addition, the study has suggested that this smart city development can be the basis for decision-makers to have the right steps and roadmap for smart city development. That, in brief, this study has targeted a very important aspect of smart city development that still little explored in the existing literature, the study could extend to include participants from different geographic areas to explore perspectives between cities, so that results can be generalized and correlated with each local contexts.

5.3 Limitation and Future Work

Data for the hierarchy used in this study collected through in-depth interviews with experts in only one representative city and the factors assessed to be of an overall nature. This could be shortcomings when considering in the context of smart city development with specific characteristics. However, in the context of smart city development in Vietnam, it is necessary to have an overall assessment and orientation. In addition, by using an online survey of individuals claiming to be knowledgeable about the city context and smart city concept. Since the study based on perceptions, the data are only as accurate as per respondents' perceptions. Future researchers may repeat this study to determine the consistency of results. The study targeted only three midsize cities, the results may vary based on the needs of cities or the specifics of a particular brand if the number of cities is increased or the size of the city is changed. These are areas where future research can provide information that is more detailed. Future research may further study these factors using different research methods such as regression analysis. Such a study will be able to provide more details on the influencing relationship between the identified factors and the adoption of sustainable smart city development.

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국문 요약

베트남은 지난 30년 이상의 혁신을 통해 경제적 및 사회적 측면에서 많은 변화와 성과가 있었다. 그러나 이러한 발전에 따라 급속한 도시화가 나타났으며, 많은 지역에서 계획의 과정과 내용에 있어 큰 혼란을 야기하고 있다. 이와 같은 문제는 도시환경 개선을 위하여 계획하는 거버넌스 및 인프라에 압력을 더하고 있다. 다시 말하면, 도시의 발전은 성장속도 뿐만 아니라 모든 측면에서의 조화가 요구되며, 도시의 발전은 스마트 솔루션에 의해 이루어져야 한다. 스마트 시티로의 전환은 전세계적인 트렌드일 뿐만 아니라, 베트남의 많은 도시에서도 확산되고 있다. 스마트 시티에 있어 필수적인 논의, 특히 전통적인 도시 관리 정책의 관점에서 스마트 기술에 대한 논의가 많이 있었다. 하지만, 기술 측면에서 초점을 맞춘 개발 방식은 스마트 시티를 둘러싼 다양한 요소의 수준을 고려하지 않았다는 비판을 받았다. 스마트 시티는 기술적인 요소뿐만 아니라 복잡한 주변 환경을 고려하여야하기 때문에, 정부가 스마트 정책을 적용함에 있어 다양한 요소를 고려하지 않으면 시민들에게 양질의 서비스를 효과적으로 제공할 수 없을 것이다. 물리적 시스템과 사람 간 상호작용을 이끌어내는 공공서비스의 최종사용자로서 이해관계자(Stakeholder)는 정책결정 과정에 있어 아이디어를 제공하고 성공적인 도시 솔루션을 함께 구축하여야 한다. 스마트 시티 개발 과정에서 이해관계자의 역할 정립은 전세계 모든 도시에서 주요 과제로 확인되었다.

모든 과정에서 이해관계자의 참여는 정책결정자가 효과적인 데이터 수집 및 분석과 스마트 시티 개발 과정에서 올바른 의사 결정을 내리는데 도움을 줄 수 있다. 따라서 본 논문은 스마트 시티 개발에 있어 과학적 연구로서 이해관계자 접근을 통해 베트남 중소 도시의 스마트 시티 개발 준비에 있어 통합적인 시사점을 제공하고자 한다. 논문은 우선 스마트 시티 개발 전략과 관련된 선행 연구에 대한 검토와 요인을 추출하였다.

이 과정에서 AHP분석을 통해 요인의 순위를 평가하였다. 분석 결과, 내부 요인 가운데, 시민참여 (0.4141), 행정 , 인프라 (0.2234) 순으로 나타났으며, 외부 요인으로는 정치적 의지 (0.5093), 이해관계자 (0.3373), 기술의 시대 (0.1535) 순으로 나타났다. 또한, 달랏(Da Lat), 냐짱(Nha Trang)과 박닌(Bac Ninh) 등 베트남 3개의 중소도시에서의 설문조사를 실시하여 선형 구조방정식모형(Structural Equation Modeling)을 통해 스마트 시티 개발 준비에 영향을 미치는 요인을 파악하고자 하였다 (adjusted R2=0.589) . 그 결과, 스마트 시티 개발 준비에 영향을 미치는 3개의 주요 요인으로 기술적, 조직적, 환경적 측면으로 나타났으며, 특히 조직 측면에서의 준비는 스마트 시티 개발 준비에 가장 큰 영향을 미친다는 것을 확인하였다 (β coefficient = 0.415; t-value = 8.960; p = 0.000). 마지막으로 초기 단계부터 성공적인 스마트 시티 개발을 위하여 효과적인 전략 지침과 관리 및 운영 원칙에 대한 프레임워크를 제시하였다.

키워드: 스마트 시티, 이해관계자, 도시 개발, 중소도시, AHP분석, TOE 프레임워크, 구조방정식모형

Appendix A: Survey Questionnaire for AHP

I. Personal information

1. Age groups

☐ 21 – 30 ☐ 31 – 40

☐ 41 – 50 ☐ 51 – 60

2. Working fields

☐ Government ☐ Academic ☐ Researcher

3. Working experiences

☐ Less than 5 years ☐ 6 – 10 years

☐ 10 – 20 years ☐ Over 20 years

II. Survey content

This survey intends to prioritize the elements of internal and external factors with respect to their importance towards smart city development initiation. The concept of smart city used in this study employs the use of citizen participation, administration and infrastructure extracted are internal factors among the determinants of smart cities. The study also took political will, stakeholders and technology era as important elements of external factors to make smart decisions. The successful smart city development brings with ensuring efficiency to the urban processes and services.

Based on the scale given from 1-5, select the relative importance of the factor over the other by circling your choice. Please see the example below

Example

1: Equal importance, 2: Equal to moderate importance, 3: Importance, 4: Very importance, 5: Extreme importance										
A	5	④	3	2	1	2	3	4	5	B
Result: A is Very importance than B										
A	5	4	3	2	1	2	3	4	⑤	B
Result: B is Extreme importance than A										
A	5	4	3	2	①	2	3	4	5	B
Result: A and B are Equal importance										

Maintain logical consistency because the two items compared in the survey related to each other. Therefore, consider cooperating to ensure consistency, as in the following example. For example: If A> B and B> C -> A> C

Section A - INTERNAL FACTORS

This section requires your opinion in ranking the elements of the internal factors in terms of their importance towards the success of efficient and sustainable smart city development initiation. In a pairwise comparison, please record your response follow the example.

The objective of this survey is to identify and rank important factors of internal factors based on their importance to development at the early stages of smart cities. The role of internal factors in the deployment of smart cities is important because their goal is to provide interdisciplinary solutions to problems raised by rapid urbanization and integration of Vietnam. The following internal factors ranking will be the basis for the next research of the thesis and may imply policy initiatives and decisions to develop smart cities.

LEVEL 1

What is the more important component of internal factors that contributes smart city development initiation?

Citizen participation	5	4	3	2	1	2	3	4	5	Administration
Citizen participation	5	4	3	2	1	2	3	4	5	Infrastructure
Administration	5	4	3	2	1	2	3	4	5	Infrastructure
1: Equal importance, **2**: Equal to moderate importance, **3**: Importance, **4**: Very importance, **5**: Extreme importance										

LEVEL 2

What is the more important component of internal factors in detail that contributes smart city development initiation?

Citizens engagement & cohesion	5	4	3	2	1	2	3	4	5	Citizens as co – creator & user
Citizens engagement & cohesion	5	4	3	2	1	2	3	4	5	SOP (Smart organizing practice) understanding
Citizens engagement & cohesion	5	4	3	2	1	2	3	4	5	The operating ability of local authorities
Citizens engagement & cohesion	5	4	3	2	1	2	3	4	5	Communication, information & data systems
Citizens engagement & cohesion	5	4	3	2	1	2	3	4	5	Human resources (education, digital literacy)
Citizens as co – creator & user	5	4	3	2	1	2	3	4	5	SOP (Smart organizing practice) understanding
Citizens as co – creator & user	5	4	3	2	1	2	3	4	5	The operating ability of local authorities
Citizens as co – creator & user	5	4	3	2	1	2	3	4	5	Communication, information & data systems
Citizens as co – creator & user	5	4	3	2	1	2	3	4	5	Human resources (education, digital literacy)
SOP (Smart organizing practice) understanding	5	4	3	2	1	2	3	4	5	The operating ability of local authorities

SOP (Smart organizing practice) understanding	5	4	3	2	1	2	3	4	5	Communication, information & data systems
SOP (Smart organizing practice) understanding	5	4	3	2	1	2	3	4	5	Human resources (education, digital literacy)
The operating ability of local authorities	5	4	3	2	1	2	3	4	5	Communication, information & data systems
The operating ability of local authorities	5	4	3	2	1	2	3	4	5	Human resources (education, digital literacy)
Communication, information & data systems	5	4	3	2	1	2	3	4	5	Human resources (education, digital literacy)
1: Equal importance, **2**: Equal to moderate importance, **3**: Importance, **4**: Very importance, **5**: Extreme importance										

Section B - EXTERNAL FACTORS

This section requires your assessment in ranking the elements of the external factors towards the success of efficient smart city development initiation. In a pairwise comparison, please record your response as given in the example before the questions.

The objective of this survey is to identify and rank important factors of external factors based on their importance to development at the early stages of smart cities. Besides the external factors, the following internal factors ranking will be the basis for the next research of the thesis and may imply policy initiatives and decisions to develop smart cities.

LEVEL 1

What is the more important component of external factors that contributes smart city development initiation?

Political will	5	4	3	2	1	2	3	4	5	Stakeholder
Political will	5	4	3	2	1	2	3	4	5	Technology era
Stakeholder	5	4	3	2	1	2	3	4	5	Technology era
1: Equal importance, **2**: Equal to moderate importance, **3**: Importance, **4**: Very importance, **5**: Extreme importance										

LEVEL 2

What is the more important component of external factors in detail that contributes smart city development initiation?

Smart city - Policy and legal process	5	4	3	2	1	2	3	4	5	Local authorities readiness partnership
Smart city - Policy and legal process	5	4	3	2	1	2	3	4	5	Citizens, city authorities as customers
Smart city - Policy and legal process	5	4	3	2	1	2	3	4	5	ICT providers, system integrators
Smart city - Policy and legal process	5	4	3	2	1	2	3	4	5	Comprehensive development
Smart city - Policy and legal process	5	4	3	2	1	2	3	4	5	Solving issues by ICT driven
Local authorities readiness partnership	5	4	3	2	1	2	3	4	5	Citizens, city authorities as customers
Local authorities readiness partnership	5	4	3	2	1	2	3	4	5	ICT providers, system integrators
Local authorities readiness	5	4	3	2	1	2	3	4	5	Comprehensive development

partnership										
Local authorities readiness partnership	5	4	3	2	1	2	3	4	5	Solving issues by ICT driven
Citizens, city authorities as customers	5	4	3	2	1	2	3	4	5	ICT providers, system integrators
Citizens, city authorities as customers	5	4	3	2	1	2	3	4	5	Comprehensive development
Citizens, city authorities as customers	5	4	3	2	1	2	3	4	5	Solving issues by ICT driven
ICT providers, system integrators	5	4	3	2	1	2	3	4	5	Comprehensive development
ICT providers, system integrators	5	4	3	2	1	2	3	4	5	Solving issues by ICT driven
Comprehensive development	5	4	3	2	1	2	3	4	5	Solving issues by ICT driven
1: Equal importance, **2**: Equal to moderate importance, **3**: Importance, **4**: Very importance, **5**: Extreme importance										

Appendix B: Survey Questionnaire for smart city development readiness: Stakeholder approach

I. Personal information

1. Age groups

☐ Under 30 ☐ 31 – 40

☐ 41 – 50 ☐ 51 – 60

2. Working fields

☐ Government ☐ Non-Government

3. Working experiences

☐ Less than 3 years ☐ 3 – 5 years ☐ 6 – 10 years

☐ 11 – 20 years ☐ Over 20 years

4. Local living-time

☐ Less than 3 years ☐ 3 – 5 years ☐ 6 – 10 years

☐ 11 – 20 years ☐ Over 20 years

II. Survey content

No.	If strongly disagree : choose 1 If disagree : choose 2 If neutral : choose 3 If agree : choose 4 If Strongly agree : choose 5	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I. Technological						
1.1 Information systems						
1	The new ICT system has been implemented effectively and stably by	1	2	3	4	5

	the city					
2	Existing software integration has positively contributed to connectivity in the city system	1	2	3	4	5
3	Privacy & security system of the city has safety and stability	1	2	3	4	5
1.2 Communication systems						
4	City's Fix-Broadband connectivity system to be fast and reliable	1	2	3	4	5
5	City's Mobile-Broadband connectivity system to be fast and reliable	1	2	3	4	5
6	Free Wi-Fi public allows to provide an amenity for citizens; enable IoT-based city services	1	2	3	4	5
1.3 Data Orchestration						
7	The city has central data that sharing with stakeholders which brings efficiency to the management processes.	1	2	3	4	5
8	Open data made available to the interested by free of charge and support the innovative development environment in the city	1	2	3	4	5
9	Data sharing among city resources and citizens contribute to the perception of a Smart City.	1	2	3	4	5
1.4 Technological Readiness						
10	The city has information systems that respond to technological readiness	1	2	3	4	5
11	The city has communication systems that respond to technological readiness	1	2	3	4	5
12	The city has data orchestration that respond to technological readiness	1	2	3	4	5
II. Organizational						
2.1 Human resources						
13	The city has IT professionals can organize and ready to apply new technology	1	2	3	4	5
14	The operating ability of local authorities adapt to smart city development.	1	2	3	4	5
15	The city educational environment opens up opportunities for a continuous process of learning and professional implementation	1	2	3	4	5
2.2 Development method						
16	E-government is widely used and has an ICT master plan by the city government	1	2	3	4	5
17	The top-down approach starts with master planning in context of city scope	1	2	3	4	5
18	The bottom-up approach by update existing services and new services	1	2	3	4	5
2.3 Management & control						
19	The city has one integrated smart city control center that manages all the services and bears responsibility.	1	2	3	4	5
20	City enables and performs application domain decision making in the program, establishes practices and maintains.	1	2	3	4	5
21	City support integration of technological layers in the program, and	1	2	3	4	5

	maintains program technological oversight					
2.4 Organizational Readiness						
22	The city has human resources systems that respond to organizational readiness	1	2	3	4	5
23	The city has development method that respond to organizational readiness	1	2	3	4	5
24	The city has management & control that respond to organizational readiness	1	2	3	4	5
III. Environmental						
3.1 Economic adaptation						
25	FDI (Foreign direct investment) has strong presence in the local economy	1	2	3	4	5
26	The local business environment is fair, competitive and strong entrepreneurship	1	2	3	4	5
27	Business have make significant efforts to upgrade production technology	1	2	3	4	5
3.2 Citizen participation						
28	Citizens can use ICT equipment to rate the performance of some department and agencies of local government	1	2	3	4	5
29	Citizens can communicate with local government to expressing opinion, complaining or reporting a violation of city codes	1	2	3	4	5
30	Citizens are supportive of the city open-up policy	1	2	3	4	5
3.3 Policy Adaptation						
31	E-government is widely used by local authorities with adequate information about policy and plan	1	2	3	4	5
32	The city government has launched a manageable funding strategy and roadmap to transform the city in to smart city	1	2	3	4	5
33	The city government has established a vision to transform the city into smart city	1	2	3	4	5
3.4 Environmental Readiness						
34	Economic adaptation of the city that respond to Environmental readiness	1	2	3	4	5
35	Citizen participation of the city that respond to Environmental readiness	1	2	3	4	5
36	Policy adaptation of the city that respond to Environmental readiness	1	2	3	4	5
IV. Smart City Readiness						
37	Technological readiness has a significant effect on smart city readiness	1	2	3	4	5
38	Organizational readiness has a significant effect on smart city readiness	1	2	3	4	5
39	Environmental Readiness has a significant effect on smart city readiness	1	2	3	4	5

Appendix C: Discriminant Validity & Variance inflation factor

Discriminant Validity (Fornell and Larcker Criterion)

	Citizen Participation	Communication system	Data Orchestration	Development Method	Economic Adaptation	Environmental Readiness	Human Resources	Information system	Management & Control	Organizational Readiness	Policy Adaptation	Smart City Development Readiness	Technological Readiness
Citizen Participation	**0.834**												
Communication system	0.059	**0.812**											
Data Orchestration	-0.048	0.169	**0.787**										
Development Method	-0.026	0.129	-0.012	**0.879**									
Economic Adaptation	0.229	0.176	0.033	0.057	**0.848**								
Environmental Readiness	0.315	0.19	-0.079	0.151	0.621	**0.87**							
Human Resources	-0.016	0.083	0.126	0.185	0.155	0.162	**0.796**						
Information system	0.085	0.297	0.103	-0.005	0.098	0.038	0.078	**0.835**					
Management & Control	0.044	0.261	0.122	0.286	0.091	0.118	0.025	0.226	**0.792**				
Organizational Readiness	0.208	0.211	0.053	0.542	0.191	0.238	0.247	0.134	0.403	**0.866**			
Policy Adaptation	0.285	0.135	-0.028	0.108	0.408	0.572	0.122	0.091	0.123	0.205	**0.875**		
Smart City Development Readiness	0.299	0.346	0.046	0.308	0.402	0.527	0.261	0.171	0.273	0.606	0.389	**0.875**	
Technological Readiness	0.168	0.738	0.099	0.193	0.237	0.259	0.103	0.325	0.359	0.351	0.175	0.529	**0.843**

**** The diagonal are Square –root of AVE of the latent variables***

Variance inflation factor

	Observed variables	VIF
Technological Readiness	TR1	1.46
	TR2	2.912
	TR3	2.328
Organizational Readiness	OR1	1.466
	OR2	2.942
	OR3	2.922
Environmental Readiness	ER1	2.103
	ER2	1.805
	ER3	2.148
Smart city Development Readiness	SCDR1	2.249
	SCDR2	1.848
	SCDR3	2.134
Information system	IS1	1.494
	IS2	1.716
	IS3	1.75
Communication system	CS1	1.438
	CS2	1.579
	CS3	1.44
Data Orchestration	DO1	1.28
	DO2	1.615
	DO3	1.47
Human Resources	HR1	1.356
	HR2	1.497
	HR3	1.387
Development Method	DM1	1.425
	DM2	1.425
Management & Control	MC1	1.397
	MC2	1.366
	MC3	1.349
Economic Adaptation	EA1	1.695
	EA2	1.672
	EA3	1.993
Citizen Participation	CP1	1.695
	CP2	1.825
	CP3	1.533
Policy Adaptation	PA1	1.991
	PA2	2.522
	PA3	1.949