Framework Proposal of Smart City Development in Developing Country, A Case Study - Vietnam

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Abstract. Smart City has been determined as the key solution for urbanization which is considered as the inevitable trend of urban areas. There are many cities aim for the goals to become Smart City, but mostly failed because of different challenges. There is a desire for Smart City strategy of developing countries which having cities that begin to significantly face with the difficulties of urbanization process. This study offered a revolutionary smart city approach and framework for implementation in developing countries considering Vietnam cities as the case studies. Based on the revision for critical factors and journey of Smart City development of successful smart cities globally, the study proposed groups of solutions and framework for building Smart City effectively towards the sustainability in developing countries.

Keywords: Smart City · Framework · Urbanization · Urban planning · Sustainable development

1 Introduction

Urbanization is currently taking place strongly around the world, in four different directions which are natural population growth mainly in Asia and Africa; rural-to-urban migration; regional reclassification between rural and urban areas [1] and international migration from poorer, politically unstable countries to wealthier countries. The population living in cities currently accounts for nearly 55% of the total population and is forecast to grow to 70% by 2050, accounting for 60% of global GDP [2]. It brings positive impacts to urban life such as economic benefits, social communication, job opportunities, innovation, life utilities including health care, education, entertainment, and transportation [3, 4]. On the other hand, urbanization has negative impacts on the natural environment, public health, and social equity [5].

Urbanization leads to land degradation. It is estimated that 10% of land with agricultural potential gets concreted every year, which reduced crop and pasture productivity,

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poor vegetation, and biodiversity loss, which has the reverse impact of hastening soil erosion and degradation [6, 7]. Ninety-seven percent of the earth's areas has changed significantly due to human impacts on construction, population density, electricity infrastructure, productivities of crops and pastures, and transportation infrastructure, resulting in a biodiversity crisis [8]. Urbanization also has a negative effect on the environment. Industrial exhaust gas, vehicles are the main sources of air pollution. Wastewater from industrial parks, business households, and even from household activities caused surface and ground water pollution and soil pollution [3]. Urbanization contributes to global warming due to the heating of buildings, concrete structures, as well as the use of fossil fuels such as coal, gasoline, and diesel in industrial parks, leading to the greenhouse effect which negatively affects citizens' health, labor productivity, and leisure activities [9]. As cities have expanded in terms of space, both breadth and height, population density have increased, and the infrastructure becomes overburdened, resulting in higher transaction costs and opportunity costs. More especially, urban land capacity for living is shrinking. It was reported that about 25% of Vietnamese people cannot afford housing and 20% of accommodation is inadequate for living [10]. The process of urbanization brings both positive and negative effects to all cities globally in the same trend, just different in the matter of level and the reaction of them.

Considering solving the above urban issues, government and different stakeholders have implemented different ways and aim for different objectives. In fact, scholars have found, applied and developed many city models in urban development. Every type of city like eco-city, livable city, green city, or smart city was established and developed aiming to solve urban problems that citizens have to face and fulfill the demand of the citizens [11]. With the ongoing Industrial Revolution 4.0, Smart City has established as an inevitable trend, highlighted with the transformation of the real world into the digital world through new technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Virtual Reality (VR), social media, cloud computing, mobility, big data [12]. Although the concept of Smart City has only been widely known since 2015 [13]. Smart City was mentioned in the 1990s when the most important factor in developing Smart City was information and communication technology [14].

Nowadays, when researchers looking for the definition of Smart City, there can be many approaches. From an academic point of view, a city is "smart" when the investment is mainly for human resources, society, traditional and modern communication infrastructure and promotes sustainable economic growth and improves quality of life, with wise management of natural resources, through participatory governance [15, 15]. From the government point of view, Smart City is a high-tech-intensive and advanced city that connects people, information, and elements of the city to create more sustainable green cities, competitive trade, innovation, and improves the quality of life with the city's simple management and maintenance system [17]; in Smart City, information technology is combined with infrastructure, architecture, appliances, and even our bodies to solve economic, social, and environmental problems [12]. Therefore, the development strategies of Smart City are various in different cities leading or inspiring by many different organizations. This paper is focusing on generating the framework of Smart City implementation according to the revision of both successful and fail cases.

2 Success Development Factors

According to OECD experts, about 80% of current Smart City projects are not adequate because they just can provide solution for one issue of cities, but not focusing on upgrade the living quality of residents [18]. In fact, cities are ranked in top Smart City lists of many countries around the world proves that building and developing Smart City is a long journey. Reality has proved that every Smart City takes years to accomplish the development. In order to figure out the suitable framework for Smart City implementation, authors have conducted a revision of successful Smart City cases and collected the similarities among them which are believed to be the main factors to contribute to their success.

2.1 Smart City Image

The first common action which can be observed clearly from the best Smart Cities in the world that every period, cities will create a city brand or city image which usually based on cities characteristic or intense problem that needed to be solved, to become the vision for city development, thus government can set up mutual goals for every stakeholder. As the goals and vision are achieved in the set period through effective application of new technologies and strategy, Smart Cities continue to choose a new urban identity, as well as the vision of city authority which support the orientation [19]. It can be clearly observed from the top 10 smartest city development in 2018 which are New York, London, Paris, Tokyo, Reykjavi, Singapore, Seoul, Toronto, Hong Kong and Amsterdam [20].

There are two main methodology which have been applied by numbers of places. Cities with unique characteristics usually take their strengths or features in terms of culture, economy and society as the urban image. Has been well known as the European tourist capital, Paris decided to take its image as "Attractive destination" focusing on green and friendly environment, high-speed Wi-Fi in crowded tourist spots, and densely populated places; solutions for clean energy and renewable energy; public transport and promotion of non-motorized traffic [20]. Somerville in USA, which has the smartest government in the Commonwealth and pioneer in the Smart City development trend, selected "Smart livable community" as urban image. This has clearly reflexed the strengths of Somerville when it was 3 times nominated as All- America city (The award honors communities whose citizens work together to identify and solve common challenges) and one of the 100 Best Communities for Young People. On the other hand, many cities don't own any special characteristic to compete with other region, thus they follow the second methodology that concerning their current urban problems while selecting the city identity. For example, with the slowing down of economic growth after the financial crisis, New York (NYC) decided to build an urban identity as an "Innovative Economic City". All areas are developed solely for the purpose of promoting economic activity for all groups [20]. London, one of the most congested cities in the world, decided to solve this problem by developing a more efficient public transport system. And London takes the development of an efficient public transport system as its urban image [20]. And most importantly, the vision of city authority in this period needs to be very clear, and consistent with city identity. Smart vision also approach target stakeholders in the

city (authorities, businesses, investors, tourists, residents) and will be the key point to mobilize the participation of all sectors, contributing to the success of each project [21].

2.2 Prioritization of Goals

Each stage of Smart City development should focus on the main prioritized objectives according to the selected above city identity, the other aspects of the city will be integrated into the set of action plan when solving the main problems. After all, all urban problems are related to each other and should not be clearly separated in city vision. But with the application of different priority focus, city authority and developers will be able to take advance of their resources effectively and avoid wasting of investment on various issues [22, 23]. In the Smart City development strategy from 2016–2018 of Seoul taking Smart Transportation as the city image [20], authority raised up two problem which are traffic congestion (too much use of personal transport) and environmental pollution (air, waste discharge, lack of electricity) affecting the quality of life for solution. Then the city decide to gain the prioritization for the following objectives: (i) smart mobility, (ii) waste management and smart energy; (iii) smart citizens combined with smart management, (iv) smart public space [20, 24]. In the Smart Environment strategy of Singapore Smart City, its government has separated it into 3 clear phases which are: (i) Aiming to create more green spaces in the city (gardens in the city); (ii) linking the green spaces with each other to create large green areas, occupying the main space in the city (city in the garden); (iii) establishing a friendly living environment with the existing green spaces, so that urban life can be closer to the natural ecosystem (City in nature). With this effort, although Singapore's population density is among the largest in the world, the tree cover density ranks among the highest in the world [20, 25].

2.3 Smart Government and Smart Community

The foundation of successful Smart City cases is not the well implementation of information technology platforms, but the initiative to change the mindset and approach of the government regarding of the transparency, willingness to share resources, data, management methods, decision-making for all target groups in society. Residents and other stakeholders (enterprises, agencies, institute, university, etc.) participation for initiatives, smart solutions, decision making will support government in the process of deploying smart economy, smart mobility, smart environment and smart life for smart city development. That is called smart government and smart community [20, 26–28]. For example, Seoul opened a call center called Dasan with the dial number 120. This is the government's phone complaint handling system, directing all inquiries and questions from the residents to one integrated call center, responding to people's daily complaints more quickly and conveniently based on a one-to-one consultation. The system was operating 24/7 and received about 22,000 calls per day in 2016 [20, 29]. Government leading all the cooperation activities with transparent information, objectives and action plan is the highlight strategy of Smart City development in Singapore. This city authority also mobilized all the social resources regarding of public private partnership projects, including the participation of private enterprises, universities, research institutes, residents [30].

The Somerville government vision in urban planning and design is "access – dialogue – decision – implementation" aiming to encourage residents to collaborate them to look at the future of the city, towards a sustainable quality of life. New ideas are tested and determined by gathering input and feedback from the community through the open data platforms Dropbox, which allows uploading and downloading; online survey platforms such as Survey Monkey, Mind Mixer; crowdsourcing social networking platforms like Twitter and Facebook and a network of community connecters - able to reach and chat with anyone in the area [31].

2.4 Integrated Platform

There is an essential requirement of an integrated platform to advance the connection, communicate understanding, mobilize participation, effective cooperation with different stakeholders like authorities, universities, research institutes, organizations, private enterprises, residents in the development process, urban problems solving [19, 32]. Seoul in its period of smart transportation promotion, applied the advance technology including Smart Transportation application, Bus Management System and GPS has reduced the waiting time of public means of transport and encouraged citizens to stop using private vehicles. As result, MRT and Bus users' proportion was about 70% while the percentage of people driving private car was just 30% in 2013 [18, 33]. Smart Nation is an important platform in the Smart City Development journey of Singapore, which include 5 smaller projects: national electronic identification system; smart sensor system across the country; intelligent transportation platform; electronic payment gateway and moments of Life (mobile application that helps the Government deliver the right services quickly to residents) [34]. Regarding the aspect of smart urban planning and management, Somerville government has published an application called ResiSTAT running on the SomerSTAT data system for create connection between government and citizens. The city leaders can supervise all the activities and performances of each department based on the system and have in-time decisions [35].

2.5 Detail Plan for Once at a Time

Last but not least, it is necessary to generate a clear plan with only one or two main goals for each stage as it has been confirmed that a smart city is a journey, not a destination, thus no one can foresee what a Smart City will look like at the end [36, 37]. Seoul is considered one of the leading cities of Smart City development trend when it is continuously in the list of the top 10 smartest cities globally through the assessment of measurement organizations on global Smart Indexes. In fact, Seoul has had a long way to develop Smart City with urban images generated in each stage from urban solving problems or enhancing the satisfaction of citizens. Looking back the journey of Seoul, it can be seen that 2001 marked the first Smart City image as "The world's leading E-government", in 2011–2015 as "Smart Seoul", and 2016–2018 as "Smart Technology in Transportation". From 2019 onwards, Seoul authority has considered this city as the "Data Capital" [38–40].

3 Analysis of Smart City Developments in Viet Nam

In order to generate the suitable solution in the context of developing countries, there must be a revision and analysis of existing cases. Facing the urban challenges, Vietnam cities have huge opportunity when the government has been paying a huge attention on Smart City as the chosen solution along with the industry 4.0 and digital transformation emergence. Since 2015, government of Vietnam and the related departments have released many policies to favor and encourage the development of Smart City, especially the publish of E-government to support Smart Economy, Smart Tourism, Smart Education or Smart Healthcare [41, 42].

In general, many cities in Vietnam have shifted their focus on Smart City Development, even before government encouragement. According to MIC, there are nearly a half of Vietnamese provinces and cities develop services relating to Smart City; 12 out of them have deployed their Smart City management center; 13 provinces and cities have published Smart services which 10 of them have transportation e-service [43]. Looking back along the journey of Smart City development in Vietnam, authors have realized the critical change in the strategy of Vietnamese cities leader's approach.

At the starting point when developing Smart City, most of Vietnamese cities believe that post and telecommunications will be the main foundation, so it can be seen that 30 provinces and cities have signed agreements to develop Smart City or Smart City features with big post and telecommunications companies in Vietnam like VNPT, Viettel. In order to strengthen the services of telecommunication and internet application, cities like Da Nang, Phu Quoc improved their accessibility for internet connection by constructing the free Wi-Fi, smart Wi-Fi system and infrastructure [44, 45].

After a while developing Smart City, city leaders in Vietnam have shifted their focus to technology, thus many localities believe that new technology is a prerequisite for smart city development. The establishment of executive boards in many Vietnamese cities for Smart City Development has usually included technology firms' representatives. Regarding of information technology, Ha Noi, Ho Chi Minh and Binh Duong are the three big cities in Vietnam deployed government and economic e-service with internet platform. The localities believe that the transparency and responsiveness will enhance the connection between authority and other private stake holders and citizens [46–48]. On the other hand, focusing on technology implementation for solving urban problems or infrastructure management, Da Nang and Phu Quoc invested in many projects of transportation, environment management [49, 50]. However, learning from successful cases of Smart City globally, the developed post and telecommunication system as well as technology are just supportive tools in the journey of Smart City development. For successful and effective development, it is necessary to have executive representatives from many different groups in society having experience in the field of Smart City development.

In the following period, Smart City development strategy aims for too many goals and too many development directions, thus many projects do not even account for the characteristics of the city or the urban problems which needed to be solved. There are no prioritization in order of action plan while the participation among related stake holders nearly didn't exist. Despite the success in Smart City technology application. Da Nang authority hasn't really had a prioritized list of issues to be resolved first, but rather spread

out all issues. The objectives are in all different directions while there is limitation in resources. A few solutions have been proposed and implemented, but there has not been an appropriate priority in the context of limited resources. Technology incentives have been mainly focused so solve urban problems according to authority's vision, but not from citizens perspective while the city image is livable city [51].

Learning from the world when Smart City has become the global trend for urban area. Many Vietnamese cities have connected or corporate to be consulted by foreign companies with experience in Smart City development. Most important when they have now generated their own cities images according to their characteristics or prioritized problems. To develop smart city, Binh Duong consulted the experience of implementing the Eindhoven Smart City model (Kingdom of the Netherlands) and set its most important goals is attracting high skill labor force for economic development. City authority signed a memorandum of understanding with Eindhoven city (2015) to cooperate and implement the economic development model based on the cooperative society (state, entrepreneurs, scientists/research institutes/universities) [52]. Da Nang has also promoted its urban image as "Livable Smart City" after referencing many Smart City cases in Barcelona, Valencia, Amdalusia, Yokohama, Keihanna, Kitatyushu, Kashiwa-no-ha Seoul, Songdo, Pangyo, Anyang, Busan, Dongtan, London, Dubai, Singapore [53]. The Smart City project of Can Tho was implemented starting in 2020 with the consultation of the Asian Development Bank (ADB). ADB proposes Can Tho to become a smart and energy-saving city (identified as the city image). The focus of the project is on developing LED lights infrastructure and smart technology for public lighting and buildings [54].

4 Framework Proposal for Smart City Implementation

According to the analysis of previous experience for Smart City development, this paper aims to develop a framework for the implementation of Smart City for cities in developing countries facing the difficulties of urbanization. In fact, there is no one universal formula for all cities. Each city is a separate entity with many different factors to consider, thus the authors only propose a framework of development steps (see Fig. 1).

When the developers begin to study further for specific practice, each step will have to be implemented in detail. It is necessary to go into in-depth analysis and reality of each locality to have a smart city development program most suitable to the context of each locality and most effective.

4.1 Identification of City Image and Government Vision

The first and most important thing is that the government must determine the characteristics or image of the city to build and develop in each stage of the Smart City development strategy. The selection of the city image can be based on the inherent characteristics of the city in terms of culture, economy and society. When determining the characteristics of each locality or city, developers should take in mind that they should consider the unique image or strength of their place in the whole region. However, there will be many cities don't own any specialty, thus authors suggest that developers should identify the most critical issues to generate the solution and keep it as their city's images.

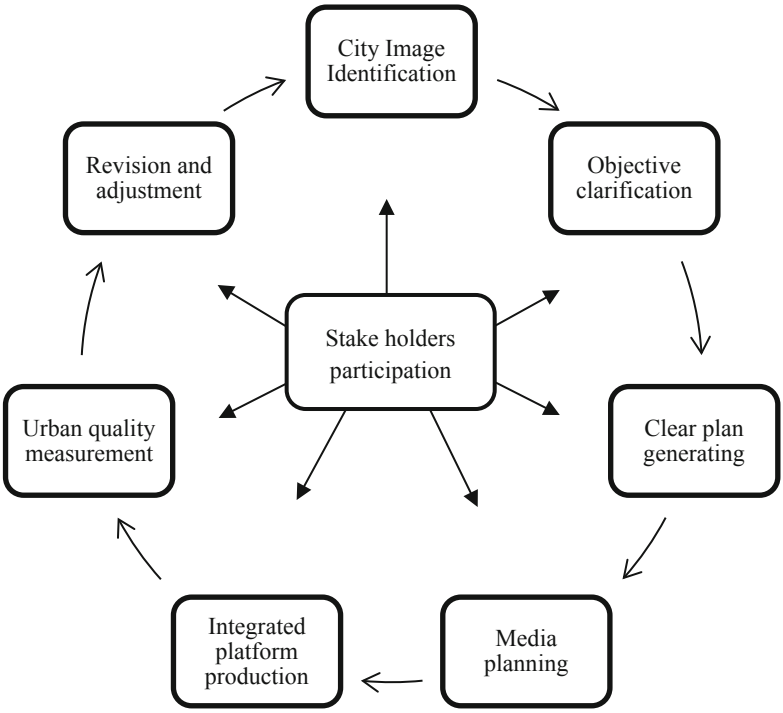

Fig. 1. The proposal framework for Smart City implementation

For instance, 2001 marked the first image of Seoul as "the world's leading e-government", in 2011–2015 was "Smart Seoul", and 2016–2018 was "smart technology in transportation", from 2019 onwards, it has become the "City data" [38–40]. This is a proof that smart city development is a continuous process aimed at solving various urban problems and enhance the quality of life, not just stopping with the destination as a title about smart city. City authority usually use the city image to express their vision and clearly describe their long-term orientation in the future. In particular, a smart vision also needs to show the cohesion of target groups in the city from authorities, businesses, investors, tourists and residents together to achieve the goal which is quality of life.

4.2 Objective Clarification

It is necessary to define clear and specific goals in each development stage corresponding to the selected city image with reasonable resources. However, the important thing is that only 2 to 3 goals should be selected in one stage, thus the implementation is more focused, and solutions are provided effectively.

The chosen objectives should directly connect to the city image made by urban unique characteristic and the prioritized problems. In this stage, developers and city authority must define the potential stake holders, in order to mention them and create a sense of responsibility for them. The other aspects of the city will also be integrated into the set of objectives at the same time to solve other urban problems, more over the

mutual solutions for the mutual problems will give more opportunities for stake holders to find a win-win solution and save the resources.

4.3 Clear Plan Generating

There should be a clear strategy to achieve each objective regarding of methodology, testing, monitoring, solution steps proposal, and how to mobilize human resources must also be given, Stakeholders should also identify their roles and how they will involve in each phase.

Technology is an important factor in planning for Smart City implementation, but in this stage, a detail plan including clear responsibility and action plan for each stakeholder is essentially required.

4.4 Media Planning

This is an important stage to attract the participation of the entire society in the development and implementation of Smart City projects. City branding not only helps city authority to address weaknesses, as well as exploit strengths of the city, but also to increase the competitiveness globally. Moreover, the branding project will spread the information to internal stake holders (local community, local enterprises, university and institute) and external groups (investors, tourists, immigrants), which helps them understand the possible benefits and values of the city's overall strategy, along with guidelines and policies that facilitate and reduce the barriers. The city branding strategy should take place throughout the implementation of smart city projects with messages focused on the City Image. Thus, the efficiency of smart city development will be enormous, and it will be easier to call for capital in all aspects as well as increase the responsibilities of stakeholders. At these integrated platforms (it can be social media, websites, apps, or new technology programs, etc.) businesses, university, research institutes, communities can together propose ideas, test, monitor, plan, manage, feedback. With this integrated platform widely sharing information to every stakeholders, the transparent, the commitment and responsibility, roles and impact of all parties will clearly be observed.

4.5 Integrated Platform Production

The government needs to create an integrated platform where stakeholders can directly interact to each other in different projects in order to achieve mutual objectives. On this integrated platform which can be social sites, websites/apps, new technology programs, etc., businesses, universities, research institutes, communities can propose ideas, test, monitor, plan, manage, and give feedback. With this way, the information will be transparent to all stake holders and the responsibility of all parties will be clearly expressed.

It is necessary to realize that the role of universities and research institutes is not only producing qualified human resource and fulfill the social needs, but also to apply research and assist in solving real urban problems, decision making. They can as well verify the implementation and sustainable development of projects to ensure Smart City development in the right direction and efficiency.

4.6 Urban Quality Measurement

Building smart city is a continuous and long journey, thus a set of indicators is needed to monitor and measure the development process. According to this research, smart city is a developed towards the ultimate goal of quality of life, so the index to evaluate smart cities should focus on the factors that assess the urban living quality.

This paper propose to generate an evaluation on 7 main groups of factors which are the quality of the natural environment, the quality of the physical environment, the quality of the traffic environment, the quality of the social environment, the quality of the economic environment, the quality of the political environment and the quality of the spiritual environment (discussed in detail in Sect. 3). However, the evaluation specific methodology will vary depend on the local condition of different cities.

4.7 Revision and Adjustment

This is the final stage in developing a Smart City towards the quality of urban life. If the process has been done well, city authority just have to inherit and keep developing, otherwise, it needs to be adjusted for the next round of Smart City development.

In conclusion, in order to successfully develop an effective smart city, in addition to implementing the proposed framework, three extremely important complementary factors need to be also considered area (1) the transparency about information and activities of the government, (2) mobilization to create a foundation (mechanisms, policies, regulations) for stakeholders to actively participate in the smart city development process in the future in every stages, (3) it is necessary to have a consultant from local and international universities, research institutes with enough experience and capacity to lead and support the process.

5 Conclusion

From the analysis of urbanization process and its problems globally, it can be realized that every city has its own characteristics in terms of people - culture - natural conditions but the effect of the urbanization process is inevitable. Smart city development is a necessary movement for them to effectively solve internal problems towards sustainability. Although Vietnam is not a pioneering country in Smart City development, thus city leaders should learn from experience of successful smart cities in the world and extract the suitable knowledge for local implementation. Smart city is a journey; thus no one knows what the destination would look like. Therefore, smart cities can be developed with their own characteristics solving their local problems. Reality has proven that the policies and mechanisms proposed by Vietnamese government show the support for Smart City development. However, the previous implementation strategies haven't showed any critical result in satisfying the demand of citizens, which is due to the lack of thorough understanding, subjectivity, unwillingness to be transparent about activities in government representatives and organizations, poor cooperation among stakeholders, lack of strict control. All smart cities in the world have acknowledged that the prerequisite for success to develop smart cities is how people manage, interact and react with

the development instead of just advance technology. Therefore, to effectively deploy the Smart City project in any country, city leaders must have a clear framework from city identity selection to urban quality measurement.

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