

# Developing Smart City: Based on the Assessment of Smart Projects in Medium-Size Cities, Vietnam

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## Abstract

Nowadays, the process of urbanization in Vietnam took place at a relatively high speed compared to the other regions. However, the process of urbanization is also facing many difficulties, almost urban must be concerned with well-managed, urban planning and construction work. when the industrial revolution 4.0 is booming, the successful construction of a smart city model will be able to create a breakthrough solution in solving problems. In recent years, the application of smart mobile devices has been introduced into Vietnam and thrived in many economic sectors, smart technology has crept into the fields of telecommunications, banking, e-commerce, payment and communication. Although majority cities in Vietnam, which not yet capable of developing technology, but still a potential level of understanding and correct orientation on the ICT driven adapted with reference to smart city concept. This study assessed the model of dimension issues on approach, paradigm, and source of capital which play the most important role in building smart city then case study was analyzed through 3 cities' smart projects Bac Ninh, Da Lat, Nha Trang. While Bac Ninh and Nha Trang city has specific directions and strategies based on the city's SWOT assessments, Da Lat city has not yet achieved some basic requirements for conducting construction steps of smart city. This research contributes a perspective to find the adaptive direction for decision-making on smart city developing in medium-size cities of Vietnam.

**Keywords:** Smart city; decision-making; medium-size cities; SWOT; capital .

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## **1. Introduction**

We are living in the convergence of two important phenomenon in human history: The rise of global urbanization and the digital revolution. According to the report of the United Nations, currently 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 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 [20]. Besides the positive aspects, cities are creating about 67% of greenhouse gases and 60-80% of global energy consumption. The process of increasing urbanization creates many pressures on environmental pollution, lack of resources such as clean water, land, space, transport, energy; these are global issues [25]. Population concentration, the urban growth rate has brought for cities and countries some challenges in responding to the increasing demand of the people, start with the basic items such as infrastructure, environment, traffic and respond to natural disasters [4]. While information and communication technology has made great progress in data collection, storage, transmission, calculation with rapid cost reduction, especially the popular trend of equipment smart personal mobile (smartphones, wearables), cloud computing, universal Internet, big data processing and social networks. Clearly, as information technology plays an increasingly important role as a solution to the growing pressure in managing and providing services to the city, minimizing the negative impacts of industries on the living environment [16]. The concept of "smart city" is derived from the idea of building the "smarter planet" (IBM smarter planet), it can be seen that developing a city into smart has become a strong development trend of the era, a revolution in modern urban management in other new form, more intelligent and efficient methods [13]. Many cities in the world have been building a smart city, this is the inevitable trend of the development of human society. Vietnam has 805 cities, including 2 special cities, 17 cities of type I, 25 cities of type II, 44 cities of type III, 84 cities of type IV and 633 of type V, the urbanization rate is estimated at 37% [23]. Although the number of urban areas has increased rapidly, most of them face to the challenges of unsecured urban quality, the technical infrastructure has not kept pace with the urban development, and rapid deterioration leads to the consequences of traffic congestion, lack of water for daily life, flooding of wastewater, rainwater, environmental pollution, lack of resources, mechanisms and policies to cope with the trend of urbanization. Therefore the trend of smart city/urban construction will be inevitable [24]. To promote the construction and developing smart cities, in the framework of APEC cooperation, at the meeting of the Standards and Conformity Assessment Committee (APEC / SOM1 / SCSC1) in February 2017, Vietnam came up with the idea of establishing a common mechanism among APEC members aim to share practical experiences in standardization of solutions and applications to support smart city development. Accordingly, the developed economies experienced in this activity will support information and experience sharing for developing economies in the construction of smart city [2]. Currently, Vietnam has nearly 20 provinces and cities launched projects on smart city, the development of smart city in Vietnam has both advantages and disadvantages. The rapid development and dissemination of information technology in Vietnam by the end of May 2017, fixed broadband Internet subscribers reached 9.9 million, mobile broadband internet reaches 49 million subscribers. However, the limitations of rapid urbanization put pressure on underdeveloped urban infrastructure, low starting points and limitations on economic potential as well as experience in urban development and management are also a weakness of Vietnam in the process of developing smart city [10]. The construction of a smart city is not only in developed countries but also in developing

countries, each city depends on specific needs and suitable conditions way to build a smart model for the local. Building and developing smart city is a process of both working and summarizing experiences so it is necessary to have appropriate focus and conformable steps [11]. The aim of this study to critically analyze through the issues raised of Vietnam's medium-sized cities efforts to implement developing smart city. This paper is structured as follows: first, we will find out the general issues raised to building smart city. Then we will describe the case study follow three dimensions, based on this analysis, we will offer the adaptive direction for decision-making on smart city developing in medium-size cities of Vietnam.

## 2. Assessment model for smart city development issues

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 [16]. A city is considered "smart" when the investment in people and social capital and modern transport infrastructure and information technology systems support sustainable economic development and high quality of life. accompanied by wise management of natural resources, through citizen participation [5]. It can be seen that this is a fairly standard definition, quite ambitious and quite theoretical about smart city. But this is the definition of academia about smart cities. In fact, how are smart city projects initiated and operated? In the face of potentials as well as challenges in building affordable smart cities, there should be a more comprehensive perspective to assess the overall (Figure 1).

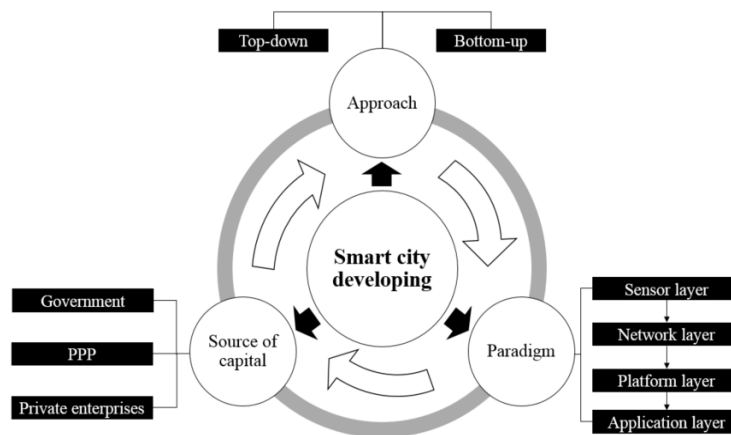


Figure 1: Smart city development issues

Source: By author

### 2.1 Approach issue

Each country and each city has its own development and construction contexts, so no general consensus on building and developing smart city. However, there is a great common that the use of information and communication technology (ICT) helps the city to use its resources more effectively [12]. Basically, two ways of smart city approach including; hard approach (top-down) and soft approach (bottom-up). While the hard approach pays attention to the information technology used with high levels. The operation and decisions of this type of city are supported by technology, using built-in sensors in the infrastructure system and developing

software to handle big data packets [9]; so these are the goals that need to be achieved from the government, a problem to be solved and solutions to implement. For the soft approach, information technology plays only a limited role, the right to access data belongs to the people and allows them to make their own decisions. The soft approach based on platforms such as education, policy, culture, encouragement of entrepreneurship, initiatives, social inclusion, strengthening communication between government and people. Because of its limited role, the information technology system is not necessarily a real-time communication and also cities that heavily invest in "hard approach" often less focus on "soft" areas and vice versa. Till now in Asia countries, smart city projects focus heavily on traffic, while less focusing on initiatives that enhance government, economic and human efficiency. Meanwhile, in Europe projects emphasize the soft side of smart city development [1].

Cities in countries that use more the information technology are likely to develop initiatives in the "soft approach" in the field of government and economy (such as building e-government, e-commerce, promoting entrepreneurship) [9]. Affirmed the importance of information technology and social capital in enabling e-government and e-commerce to be based on transparency and citizen's empowerment. Small and medium-size cities allow the implementation of limited-scale experimental projects - less stagnant, less constrained by existing investment in information technology systems. On the contrary, the big city faces more demand in terms of information technology change, but it is easier to attract information technology investors because of the bigger market. In general, for developing country and medium-size cities in Vietnam in particular, finding an adaptive approach to investing in smart city have to specific calculations in which the SWOT assessment of the city itself is indispensable also, suitable roadmap needs to minimize the risks encountered in the construction and deploying process with big, medium and small projects.

## ***2.2 Paradigm issue***

In fact, there is no common formula or paradigm for smart city development, but every city must be setting specific goals based on the conditions of each area. The biggest shortage now is lacking overall picture, making each application developed by different ways, such as the provider of smart parking solutions and working party on smart land planning but not consolidated on a common infrastructure, leads to more fragmentation. Beginning by the question: "New smart city construction or smartization city availability?" Obviously, the choice of available city smart will help the city choose and solve the most urgent problem, and on the other hand, reduce the burden of having to invest a large amount of money to fully develop set of intelligent systems at the same time. However, building a completely new smart city also has advantages in ensuring cities built and connected more synchronously. The process of structuring of smart City paradigm must be based on a comprehensive and comparative study of the current success stories [3]. Depend on aware, flexible, transformative, synergistic, individual, self-decisive and strategic aspects there have been many models built and developed based on key factors such as smart environment, smart governance, smart mobility, smart living, smart economic, smart human level. However, considering foundation of a smart city divided into four layers (Table 1). The first called sensor layer in the smart city paradigm, collect the information and data that occurs in reality based on sensors. The sensor layer is responsible for interacting with people, tracking information continuously in real time, self-processing the signal in the fastest and most effective way and then sending it to the network's information system center to make processing decisions [26]. The sensor layer includes wireless

sensor buttons, such as RFID tags, RFID readers, cameras, GPS, Qr codes and Qr code readers. While the network layer has to responsible for exchanging and transmitting information, including access network (access network) and transmission network (transmission network) handling and controlling information. The platform layer has many different functions such as coordination, management, calculation, storage, analysis, exploitation and provision of services for users, for specific sectors and fields such as Support platform enterprise support, network management platform, information processing platform, information security platform, support service platform.

**Table 1:** Smart city layers model

Layer	Performance
Sensor layer	Camera, RFID, sensor, smartphone, receiver device signal, signal detector
Network layer	Telecommunication network, internet network, television network, electric network, grid, private network
Platform layer	Service support platform, network management platform, processing platform information, information security platform
Application layer	Smart economic, smart governance, smart living, Smart mobility, smart environment, smart human level

Finally, the application layer contains total technology solutions, including the combination of core technologies with information technology to implement intelligent application services. With the role of the application layer, smart city will impact the economic development and social life of a country through improving the efficiency of the use of infrastructure (energy, transportation...), urban management effectiveness (governance, supervision...), and solving environmental pollution problems that "traditional city" cannot solve. Understand the smart city paradigm will help policy makers fully analyze the advantages, disadvantages, potential and risks will soon find new solutions to develop [18].

### **2.3 Source of capital issue**

In matters related to smart city development, the source of capital is considered an important issue, the demand for capital always huge, even for developed countries. With a developing country like Vietnam there are also no exceptions, even more important. Although, the needs of capital are huge but government budget can only meet a small part, while the private enterprises are hesitant by the high risk of investing themselves in smart city projects [14]. All investments are subject to risks. In the area of smart city development, such as smart infrastructure, new energy, energy saving programs and other smart city investment areas, the level of risk is often too high to attract investment. By identifying the nature of risks of privacy restrictions, the public sector can remove barriers to smart city market participation for private enterprises. As a matter of fact, the model of smart city investment can be divided into 3 types: Government, private enterprises and Public-Private

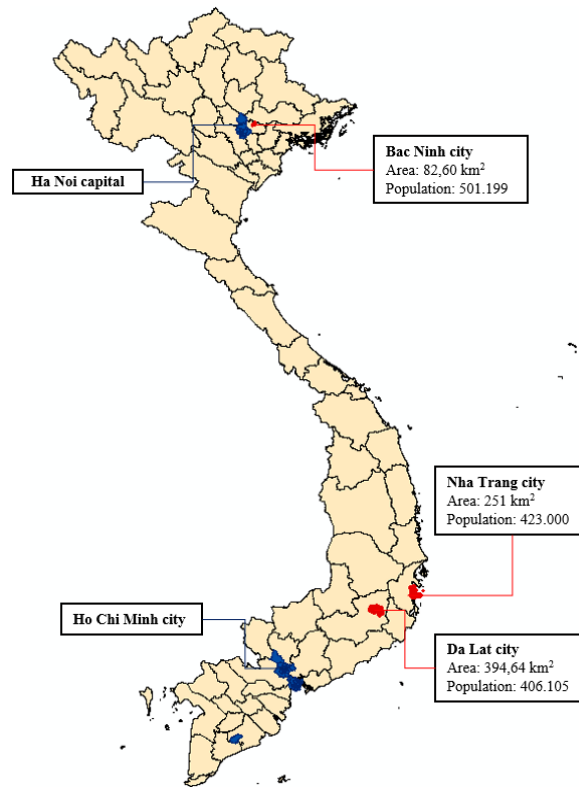
Partnership (PPP). The use of capital from government budget is not an optimal choice for smart city development as mentioned above, while the interest of the business community in building smart cities is increasing in which PPP element is considered more effective. The PPP model understood as cooperation and relationship between public and private organizations, sharing the risks, costs and benefits. This model can be divided into the following types: Government investment model, private operation; Government model of partial investment, private investment and operation; Build - Operation - Transfer (BOT); Build-Transfer (BT) model; Build - Ownership - Operation (BOO) and Build- Transfer - Operation (BTO) [24]. The source of capital for smart city is an important issue especially for developing country because in the process of optimizing urban infrastructure systems through information technology and internet applications, although smart systems are always aimed to bring socio-economic benefits, but not all projects are profitable. Moreover, the profitability of the projects is not always enough to cover construction costs and smart city operation [21]. Meanwhile, smart projects are considered as risk-averse projects and often require large investment capital that cities cannot pay for their own local budget. Cities can adopt a variety of ways to find funding for smart city projects, through loaning or through smart project revenues to pay for building and operating smart cities [17]. Either way, the question for cities that want to be "smart" is: what revenue source to offset and pay for the cost of building a smart city?

### **3. Case study**

#### ***3.1 Bac Ninh city***

Bac Ninh has a favorable location and has developed into an industrialized province with a high proportion of industry and construction; By fast urbanization rate, with the orientation of becoming the satellite city of the Hanoi capital, in the future, urban planning and management is an important issue. The city has been socio-economic development planning, information technology industry planning and other sectors to meet the province's development requirements (Figure 2). Policies to promote industrial development, focusing on policies to attract high-tech industry development also, orientations to promote the application and development of information technology [22]. Through the project "Building the smart city model of Bac Ninh province period of 2017-2022 vision to 2030" the city SWOT analyzed, Bac Ninh has face on the challenges: lack of urban infrastructure due to rapid urbanization, weight loss by rural and urban income, executive management, especially ineffective urban management. However, based on the information technology application strategy to promote the Socio-Economic Development of the Province, Bac Ninh has the full opportunity to achieve its breakthrough development goals within 5 to 10 years and the roadmap to be implemented, by step properly, in accordance with the potential and reality of the city [14].

Discussing the issue of source capital, according to the roadmap of Bac Ninh with 39 projects and most of the capital is called from the government and local authorities. Derived from the socio-economic development planning and sectoral plans to ensure that it closely follows the strategic objectives as well as the ability of the province to mobilize capital, in addition to the geographical and economic characteristics as well as national security, out of a total of 39 projects Bac Ninh focusing on two-thirds of the main projects on e-government development and security (Table 2).



**Figure 2:** Location of Research Area

**Source:** By author

For Bac Ninh City, the selection of key projects is the consensus resolution derived from the actual needs of the city to ensure the province's strategic development objectives and pilot the formation of a smart city model to create a breakthrough in the new phase.

### 3.2 Da Lat city

Da Lat city is located in the middle of the mountains and forests of central highland, the most attractive resource by cold climate and landscape, there are almost no mineral resources to form an industrial zone (Figure 2). While the factors that constitute the industrial service such as health, education and finance are not synchronized [8]. The construction of a smart city is an opportunity for Da Lat to widely apply modern science and technology to the fields of social life in order to solve both immediate and long-term problems and seize opportunities breaking up socio-economic development, in line with the orientation of building Da Lat with modern, in fact convenient and sustainable standards. Information technology application and other means to improve the quality of life, improve the performance of the government, promote socio-economic development comprehensively and sustainably, improve capacity Competitiveness with the goal "Building Da Lat to become a smart city period of 2018 - 2025".

In this project, the local authorities introduced 7 access criteria to build a smart city, the content is a general and mainstream approach based on the direction and supervision of the government [19]. More important is the local

authorities has not yet released the SWOT analysis which has an important role in strategic tool to identify and affirm smart city developing [6]. From the general model of smart city development, the local authorities offer four pillars of governance, living, environment and economy. However, the concern that there is not yet specific consultation of an organization or a specialized unit in the field of smart city development mainly based on available resources from the local apparatus. Starting from 2018, Da Lat city launched a plan to deploy 59 projects related mainly based on local budgets as well as support from the government (Table 2), mostly focused on developing in smart government, agricultural economy, transport and tourism services are completely considered as appropriate in the current period, but the policy for smart city investment still not clear, small and fragile, also discrete urban planning can make the city misleading in smart city developing.

### **3.3 *Nha Trang city***

Nha Trang city is located in the South Central Coast of Vietnam. The city has many favorable factors for socio-economic development, especially economy, maritime services and tourism with the highest urbanization rate in the country, 90% of the population living in urban areas. By 2020, Nha Trang will be among the 15 most populous cities of the country with 444,170 peoples (Figure 2). Nha Trang is one of the first cities to start building smart city in Vietnam, especially from the construction foundation of the project, which was attended by PwC in providing consultancy services for evaluation city development according to the smart city model [7]. According to PwC most of the city's departments are not really in sync and excited to use technology to monitor their assets or to get timely information about the network of service providers for databases and networks. Existing grid is still not connected. Second, there is a lack of clear legal guidelines for information sharing between government services and units, which limits the ability to use and analyze data in decision-making at the city level. Finally, lacks a comprehensive ICT development plan in which the needs and structure of the departments need to be focused, leading to departments lacking coherence when using different software applications [15]. The starting point for Nha Trang will be to build a clear vision, expressing strategic ambitions based on the city's unique characteristics take advantage of the wisdom of the whole society, by learning the best practices of other cities. Developing a clear vision and internal management capacity allows Nha Trang to prioritize, invest and strategically manage needed for the long-term sustainability of the city. PwC offers an assessment of the willingness to transform into a smart city model for Nha Trang including 4 phase of reaction phase, basic development, advanced development and active phase (smart city). According to the four-phase roadmap described, Nha Trang city is currently in phase two - the basic development, this is a very positive result for Nha Trang because cities and countries often take many years to achieve their goals and vision of smart city [7]. In 2017, the city signed a cooperation agreement with Microsoft Vietnam on a pilot project to build Nha Trang under a smart city model. Accordingly, priority to 2020, tourism, urban planning, education, urban safety and e-government will be focused on development. The pilot project is expected to develop into two stages, Microsoft will support the city to conduct surveys and planning; provide advice on technology solutions and partner options for project development. The cooperation between the two sides will be implemented from 2020 according to six areas: infrastructure development; IT application in the provincial e-government; Application of IT in tourism and planning; Applying IT in education, health, transportation, agriculture, e-commerce and industry; training and developing IT human resources; solutions for information security network and intellectual property issues. In terms of capital, admittedly, when the budget is limited it is



a difficulty for the implementation of smart city technology construction, in response to 22 projects that the city prioritizes the development of centralized funding from the government and local authorities, in addition to calling for public-private partnerships, loans and bonds, multilateral bilateral financing is also very well-regarded by the city (Table 2).

**Table 2:** Roadmap and number of smart city projects of 3 cities

City		Bac Ninh	Da Lat	Nha Trang
		Roadmap of invest		
		2017-2022	2018-2025	2014-2022
Smart factors	Investment sector	Projects have been approved and implementing		
Smart Governance	E-Government	11	14	10
Smart Mobility	Transportation	3	9	7
Smart Economic	Agriculture economy	3	15	-
	Health care	4	6	1
Smart Living	Culture and tourism	5	9	4
	Public safety	10	2	-
Smart Environment	Improving the environment	3	4	-

Through the project identify and reinforce vision priorities for the development of Nha Trang City, based on the views of current social objectives and orientations on identifying smart topics to development priorities, Nha Trang city is perfectly suited to pursue a future smart city model by the policies and programs of the government of Vietnam to encourage sustainable urban development.

#### 4. Conclusion

Smart cities apply technology and take advantage of existing infrastructure investments to provide a better quality of life for people, create a positive investment environment for businesses, optimize work resource use and transparency of government, these systems work together to provide intelligent and practical information for decision-makers. In a complex and omnidirectional develop smart city ecosystem, forming an overall picture of the entire development process is a challenge. It can be seen that the common point in the projects of smart city development plans of Bac Ninh, Nha Trang and Da Lat are all towards the development of e-government and economic but the infrastructure for information technology is limited, forecasting, planning is inadequate, the database does not focus on the difficulties encountered during the implementation of the scheme smart city development. In order to deploy smart cities still a lot to do one of the important things is good infrastructure development. *The second is how to manage that infrastructure intelligently. All of this is in addition to infrastructure development, developing services to manage cities in the smartest way. Agencies and businesses also have many solutions to support cities to implement.* Bac Ninh, Nha Trang and Da Lat have chosen according to their priority or potential, so they must depend on the characteristics of city themselves, but each

city needs to have creativity and necessary to consider and have a general strategy with specific development routes. On that basis, each city selects its own priority development objectives based on the problems and practical conditions facing each locality. The important thing, smart urban is not a matter of branding for cities but an effective application of information technology to solve existing problems to improve the quality of life of people in urban areas as well as contribute to increasing the effectiveness of urban management. In this research, key information and data reflect the accuracy of the results at the time of the study, however, due to the information management of the government is relatively difficult, some data about the project as well as specific limitations of cities need to be further exploited by working specific to local authorities. The selection of research that only focuses on 3 cities can expand further research by other potential cities in Vietnam that have been developing smart city.

## **5. Recommendation**

- Develop legal documents, standards and regulations to create a legal corridor for investment and promotion of smart city development.
- Set the measurement criteria based on international standards to monitor and assess the development of smart city.
- Build key areas that can be smart development and implementation guidance. On that basis, urban areas have the right to actively choose appropriate investment directions, avoiding the smart urban model which is not feasible.
- Build urban spatial databases and related mechanisms such as the level of updating, maintaining, sharing, security, applications, factors determining the city's intelligence ...

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