

Smart city model and applying to Hanoi, Vietnam

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Abstract

The background of the urbanization as same as the explosion of the industrial revolution, the development of the smart city is the inevitable trend in many countries on the world. Besides that, other nations are also dealing with the challenges about depleted resources, polluted environment and economic degradation, etc. Thus, strategies, models and solutions for city development are offered to exchange and seek for intelligent, sustainable and appropriate options.

Smart city model

– a creative city, using high technology, communication and other means to manage; urban operation; improve the quality of life; performance and urban services; It also meets the needs of the present as well as the future in terms of economic, social and environmental aspects. Researching and developing these smart, sustainable cities are very important; contributing to stabilizing and developing the economy for the regions; national and regional.

This presentation will introduce the smart urban formation process with ideas and operational models. At the same time, we will introduce a smart city rating system based on the role of urban government and the community; thus, we will find the existing and building of the development orientation. Finally, we will present a case study to applying smart city model in Hanoi capital, Vietnam in the trend of sustainable development in the future.

Key words: Smart city; Sustainable development; Urban planning management; smart environment; smart living; smart mobility; smart government; smart people; smart economy

1. Introduction

The background of the urbanization as same as the explosion of the industrial revolution, the development of the smart city is the inevitable trend in many countries in the world. Besides that, other nations are also dealing with the challenges about of depleted resources, polluted environment and economic degradation, etc. Thus, strategies, models and solutions for city development are offered to exchange and seek for intelligent, sustainable and appropriate options.

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2. Content

2.1. Smart City Definition

What is the Smart City?

Smart city is now regarded as a city with the application of science and technology into the management and coordination of social activities in urban areas.



Figure 1. Smart City Model. Source: Citywork

A smart city is an urban area that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently. This includes data collected from citizens, devices, and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, water supply networks, waste management, law enforcement, information systems, schools, libraries, hospitals, and other community services. The smart city concepts integrates information and communication technology (ICT), and various physical devices connected to the network (the Internet of things or ICT) to optimize the efficiency of city operations and services and connect to citizens. Smart city technology allows city officials to interact directly with both community and city infrastructure and to monitor what is happening in the city and how the city is evolving.

A smart city must include: Smart economy (sustainable development, competitiveness), smart infrastructures (transport, integrated services, public welfare, safe environment education, culture, employment, distribution, etc), intelligent residents, natural resources, intelligent life (quality of life for all

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Figure 2. Smart City Use Cases. Source: <https://www.ameresco.com/customers/state-and-municipal-government/smart-cities/>



Figure 3: Smart City Models in the World. Source: <https://www.ameresco.com/customers/state-and-municipal-government/smart-cities/>

residents) and indispensable Urban management is also smart management.

A smart city is a framework, consisting primarily of Information and Communication Technology (ICT), to develop, deploy and promote sustainable development practices to address the challenges of urbanization and increasing. A large part of this ICT framework are essential smart network of objects and connectors that transmit data using wireless and cloud technologies.

ICT-based cloud applications receive, analyze, and manage data in real-time to help cities, businesses and citizens make better decisions at a time of improving quality of life.

2.2. The essential elements of Smart City

The essential elements that make up the integrated smart urban framework are two-way impact and interplay.

Management Organization: government must be electronic government, using modern information technology.

Technology: Smart

City's key services and infrastructure are managed by intelligent computing.

Residential Communities: Smart City's main residents are modern citizens who are able to participate in monitoring and even coordinating city management.

Economy: Smart economy, is the main driving force to build Smart City,

ICT Infrastructure: affecting the quality of Smart City development,

Natural Environment: The core of Smart City is the application of technology to sustainable development, effective management of natural resources, as well as the fight against environmental change.

Among them, reality has proven that technology is a super-factor that strongly influences on all the other factors.

2.3. Development of the Smart City: Benefits and Challenges

2.3.1. Benefits

Smart city building is the synchronous application of information technology solutions in all areas of socio-economic life based on the six basic characteristics analysed, it brings a lot of the benefits in all fundamental features for the people and authorities:

a. **Economic development:** Smart cities provide the driving force for developing green-oriented economic sectors that will harness the strengths of local industries, ensuring good environmental control, exploitation effectively boosting and pushing the industry with high local gray content towards the knowledge economy. Smart cities will promote the connection of regional and international, encourage innovation and start-ups, that make the local economy more dynamic and innovative, develop industrialization and modernization, tend to develop a strong shift towards service structure and integration.

b. **Providing services to the people:** People living in smart cities in addition to living in a safe environment, not pollution, will also enjoy a full range of quality health services, health care, education, convenient transportation. In addition to the public administrative services provided, people will have



Figure 4. Essential elements of Smart City. Source: <https://doimoisangtao.vn/news/2017/10/9/phn-1-tng-quan-v-th-thng-minh-smart-city>



Figure 5. The Advantages of Smart City. Source: <https://www.bajajelectricals.com/smart-cities/>

access to many other public services such as health, education, insurance, travel. These services are offered equally to all levels of society due to the development of IT and socio-economic infrastructure.

c. Regarding urban planning management: The smart city allows synchronous connections in many areas in an urban space, thus integrating all information on infrastructure, socio-economic of the city. Firstly, this is to provide sufficient information for the planning of urban development in electricity and water infrastructure, transport to socio-economic infrastructure, ensuring a reasonable and scientific planning, this is the problem that don't have its solution. Due to traditional planning methods are lacking of objective information and forecast information. From the well-developed planning work, the issues of safety, transport and health have been developed with a well-balanced plan so that people everywhere have access to services quickly and equality.

d. On urban governance: The smart cities allow the government to operate and monitor infrastructure systems in the most intelligent way through 13 monitors automated management system. Transportation, environment, waste collection, electricity and water are all managed and monitored centrally. The supply monitoring system ensures the city is safer. Providing information

for decision support: smart cities collect a lot of information (past, present, real time, etc) makes longer term forecasts, more comprehensive, more accurate, offer optimal solutions in relatively short time and thereby support decision-making in a more efficient, intelligent way. The last benefits of the smart city are to make people feel happier: better access to services, a safer and cleaner environment, and sustainable economic growth.

2.3.2. Challenges

Smart cities are still existing inevitable disadvantages. Will a city run entirely by information technology become an ideal model for the future? The answer is maybe yes, in a very great way, but it can also be in a very bad way.

We are constantly exposed to and use products related to information technology as well as telecommunications technology, but they are not always smooth. We can't guarantee that a system can be perfect or it has no errors. Bearing in mind that only a small hole collapsed a giant structure. If the smart city scenario is cloned around the world, it is also the kingdom of high-tech crime. Some software viruses can upset your life.

Another proof that security does not mean security, when you are a smart city dweller, you have to get used to the fact that your life is frozen, you can't be sure that all the behavior in Your private

life is not monitored. Do we really feel comfortable with such a life?

Smart life in the city will not only create civilized, self-conscious lifestyles, it will also have a dependency on technology. Life is too easy sometimes not so good, just like having a dental check-up is very difficult for you to adapt to unfavorable environments.

The complexity and high specialization of this model will require residents in the city to adapt to it; currently, only high-income people can access. Smart city dwellers can get used to that lifestyle, but visitors or newcomers will feel a bit overwhelmed. It's not a big deal, but it paved the way for a new, fused image of the world.

One would have to call the "smart urban culture" instead of the old traditional way of living. If the model is replicated unchecked, it is possible that each country and city will be at risk of losing its identity. It is bad if we go around and see that they are exactly the same, which is certainly not the future prospect that people want.

It is very difficult to implement a smart urban project in old cities, such as the capital Hanoi in Vietnam, because it is very time-consuming to recreate a smart urban system. Its resources are many times greater than the construction of a new city. Thus, the complexity of the problem shows that not every place can apply this model. In fact, the model has only been tested

on a modest scale.

The next issue that related to energy, in the distant future, the price of electricity stopped at 0 coins is great, but think a little closer, it is not quite beautiful with everyone. Power markets generally operate on the merit order: they prefer to take electricity from the cheapest supplier, then the second cheapest electricity supplier until enough demand; the price paid to all suppliers is the price from the most expensive source. Because there is no fuel cost, the marginal costs of wind and solar power are low. Therefore, manufacturers have higher costs driven out of the grid, resulting in lower wholesale prices.

If the electricity generation process is continuous, renewable energy is really a big deal for other energy sources. Regarding to essence, renewable energy is not continuous, so it is still necessary to source that energy into the grid. If we shut down conventional power plants, we will not have the necessary supplies at the time of a lack of wind or solar power (due to winds do not blowing and the sun does not shine).

Moreover, as a very small part of the electricity system, renewable energy is subsidized, with only traditional power supplies, wholesale electricity prices will be reasonable so that people can buy. Renewable electricity fixed prices. However, theoretically, more and more renewable energy sources, the lower the price. At times, renewable energy sources can meet the power demand of a region, a country, leading to a loss of traditional energy - or sometimes lead to traditional sources of power. Get paid to be connected to the grid. The more renewable energy in the electricity

system, the more likely it is that this will happen. Therefore, the application of renewable energy development model at the national level is difficult to implement, even affect the energy security.

2.4. Intelligent City Assessment System

Smart cities require a government that can combine six important roles. To be most effective, the city government must deliberately choose the combination of roles through which it addresses the challenges of the city in the most effective way. Each role must be developed at a mature level.

2.4.1. Smart environment

- Reduce energy use
- Environmental impact
- Carbon footprint
- Entail competitive industries
- Planned financial resources
- New concepts
- On the market and near to market solution

Example: Sydney City

The system is capable of gathering information on various environmental parameters such as temperature, humidity, CO₂, CO, NO₂, O₃, SO₂, and air pollution levels.

2.4.2. Smart living

Improve the quality of life of people on food, hygiene and safety

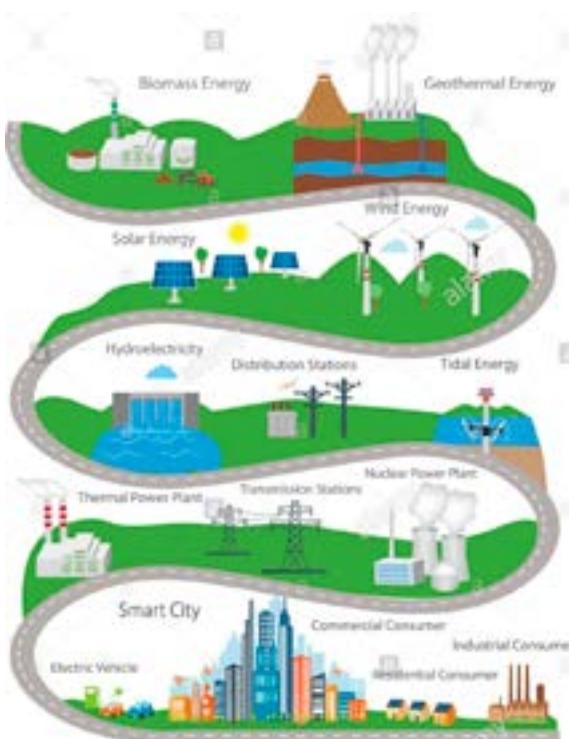


Figure 6: Renewable energies.
Source: <https://www.fotolia.com/id/106026819>

Improve the quality of urban infrastructure

- Strengthen community cohesion
- Security Monitoring
- Community health
- Example: Amsterdam

Today, the world attaches great importance to databases for all industries and jobs. Planning is always a front-runner and development direction for the next areas and with smart urban planning, this issue needs to be paid more attention, so the urban database from at the time of design



Figure 7. Six roles of city government. Source: <https://www.slideshare.net/MSalihKANBER/mskanberdeloittenlpssmartcitiesreport>

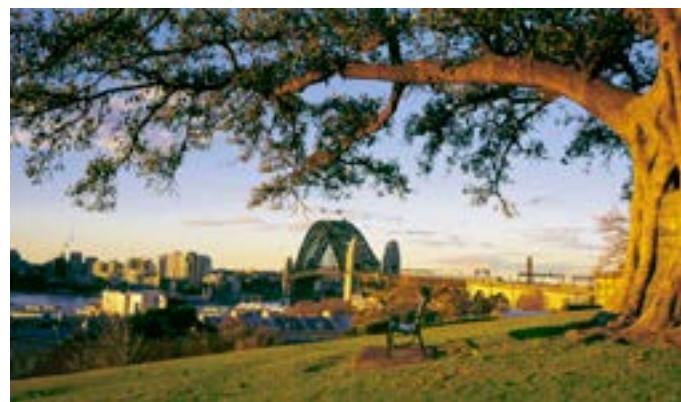


Figure 8. Sydney has a great opportunity to transform itself into a smart city in the coming years.

Source: <https://www.arup.com/perspectives/sydney-a-smart-city>



Figure 9. Amsterdam Smart City is the innovation platform of the Amsterdam Metropolitan Area. Source: <https://www.iamsterdam.com/en/our-network/municipal-government/amsterdam-smart-city>



Figure 10. Creating a safe and pleasant living and operating environment for the completely renovated Amsterdam. Source: <https://amsterdamsmartcity.com/projects/smart-light>

and construction, the project must be digitized and stored for a long time. Applications for urban management on a smart device platform will access and use the database. Especially, building a large database for smart urban development planning noted.

Smart lighting system in the city of Amsterdam: In addition, for the water supply and drainage system, sensor sensors connected to the computer system will provide the user manager with the notes when the system is operating. For example, sensors will alert you when a water pipe is broken and the manager can fix it quickly. Similarly, the sensor will report the risk of flooding and start up rescue systems such as pump-suction, moving evacuation system.

2.4.3. Smart mobility

Recycled energy

Development infrastructure

Management is based on modern technology

Raise people's awareness

Example: Copenhagen

Vehicles will be electrically powered and fully self propelled. The traffic equipment will communicate with the control centre communicate with each other through the technology platform. In addition, the means of transport in the knowledge economy is also shared, minimizing transportation, saving energy.

Electricity generates electricity and is used primarily by solar and wind power. The fossil fuel generated by the combustion will be completely replaced by clean energy. In addition, the equipment used for the electrical system will be studied so that fuel consumption is minimized. Homes and buildings will use solar panels to cover the energy used by homes and buildings.

2.4.4. Smart Government

Clearly disclose specific information

Always update new text information

Create efficient data storage facilities

Example: China

China officially connected to the Internet from April 1994. Since then, the Internet has exploded and become an indispensable part of people's daily lives.

China has implemented the "Government Online" project jointly implemented by China Telecom and the Economic Information Center under the National Economic and Trade Commission. The overall goal of the project is to build a highly effective government that all citizens have access to available resources and facilitation of administrative work. The specific objectives of the project are as follows:

Move the functions of the government to the network including administrative management

Provide government documents, create online information store

Provide daily information on government activities

Implement online management



Figure 11. The smart city Copenhagen is a living laboratory for testing smart technologies to handle the challenges of urbanisation and climate change. Source: <http://www.copcap.com/set-up-a-business/key-sectors/smart-city>

activities (public services) using databases (database) and exchange electronic documents to increase management efficiency

Deploying online commerce generates electricity and is used primarily by solar and wind power. The fossil fuel generated by the combustion will be completely replaced by clean energy. In addition, the equipment used for the electrical system will be studied so that fuel consumption is minimized. Homes and buildings will use solar panels to cover the energy used by homes and buildings.

2.4.5. Smart people

Improve facilities such as schools and libraries

Create a platform for sustainable education

Combining theory and practice to create high educational effectiveness

Example: Melbourne

Melbourne is famous for its long-standing architecture and is home to many of Australia's most prestigious universities. Two of the Go8 schools are Melbourne University and Monash University. Other universities include: Deakin University, La Trobe University, Victoria University, Svvinburne University, RMIT University and Ballarat University are all located here.

These universities are internationally recognized with the best rank and have excellent reputation. It offers world-class education on a vibrant campus with a large international student community from 50 countries. Studying at one of the Melbourne universities, students are supported by excellent teachers from world-class campuses.

2.4.6. Smart economy

Applying modern technology in commercial transactions

Improve product quality

Trade exchange

Example: New York

New York is a global hub for international trading and trading, also one of the world's three "economic hub" centers along with London and Tokyo. The city is a major financial hub, insurance, real estate and the arts in the United States.

Major companies have their headquarters in New York City, of which 43 are listed in the Fortune 500. New York is also a special place in US cities because of the large number of foreign companies. One in ten private sector jobs in the city is with a foreign company.

The production sector is large in number, but there is a downward trend in employment. Apparel, chemistry, metal products, food processing, and home appliances are some of the key products. Food processing industry is the most sustainable sector in the city, valued at \$ 5 billion, employing more than 19,000 New Yorkers. Chocolate is New York's leading export product with \$ 234 million export annually.

2.5. Applying the Smart City in Hanoi

2.5.1. The reason of choosing Hanoi

Currently, Vietnam has 903 urbans including Hanoi and Ho Chi Minh City are the first rank cities. Therefore, the ability to apply smart urban model for megacities of Vietnam such as Hanoi, Ho Chi Minh City, Da Nang, etc focus on the development of infrastructure elements and high-tech applications that can help the city solve many of the current existence of society.

Hanoi is one of the cities with great potential for growth: young urban population, high Internet coverage, fast growing middle class and widespread

international integration. It will be very attractive investment of large corporations.

The urban development status of Hanoi shows that the city has to solve many problems such as traffic, waste, environment, etc. Thus, we need to apply, learn smart urban model from developed countries in the world to improve the quality of urban life.

2.5.2. Proposing and directing Hanoi towards Smart City

a. Hanoi Smart Environment

* Target:

Intelligent Environmental Management System: Waste, Air, Water

Intelligent energy management system: grid electricity, renewable electricity, etc

Intelligent building management system: building standards for buildings in the city

* Actions:

Prioritize heavy use of solar power for public works, agencies, companies, and encourage people to use it. Towards the whole use of solar energy:

Emission monitoring solution

Meteorological monitoring solution

Automatic surface water quality monitoring solution

Groundwater quality monitoring solution automatically

b. Hanoi Smart Living

* Target:

Meet all the needs of people in daily life through technology

Increased connectivity between people

Intelligent application management in all aspects of life (consumer goods,



Figure 12. Applying model technologies

Source: <http://www.chinaperformancegroup.com/2013/01/the-trend-of-developing-a-smart-city-in-china/>



Figure 14. New York City is a leader when it comes to smart city technology

Source: <https://www.techrepublic.com/article/how-new-york-city-plans-to-become-a-smart-city-leader/>

services, public, health, education, etc)

Personalize security monitoring, increase response time before failure

Intelligent life includes solutions to improve the quality of life of people in terms of consumption (food hygiene and safety, etc), lifestyle (community attachment, multi cultural life, etc), security (surveillance, emergency detection, robbery prevention, etc) and health.

* Actions:

Deeply integrate high-tech applications into every aspect of everyday life: Use the internet as a foundation, build a diverse information network for individuals and communities. Continuously update the information related to consumption or health that is helping the parties shorten the processing time and complete the supply and treatment activities.

Ensure security by prompt surveillance and recovery: Installation of multiple street surveillance cameras along with a criminal identification



Figure 13. Melbourne on smart city and human cities. Source: <https://www.australiandesignreview.com/architecture/scott-adam-smart-human-cities/>

system, rapid response measures, no need for direct contact from people such as

traditional systems

Application of smart urban facilities: Road signs, intelligent signage, operating under human identity, saving on lighting costs, operation and maintenance

Increasing connectivity between people: To build comfortable and reasonable public spaces, to create places of play and live exchange between people

c. Hanoi Smart Mobility

* Target:

Uniform traffic information system

Intelligent technical infrastructure

The public transport network

Safe and convenient for city residents

Limiting emissions from vehicles

Traffic management information

Smart travel includes solutions to build and develop a secure, green and clean transport, transportation system,

cost savings and reduced emissions.

* Actions:

Intelligent parking system: Use smartphone to find parking lot, payment via bank account. Convenient and transparent for the users.

Traffic information system: Provides information on road conditions and traffic conditions for highways users through electronic traffic signs, radio stations (FM) or on mobile information networks and the Internet.

Signaling system for traffic control: Use electronic traffic signs to flexibly control the speed limit of lanes and lane signals; close or open the reversible lane, section of the highway.

Magnetic card system for public transportation: Convenient in management as well as convenient for people using public transport in the city.

Car traffic management system: Collect, analyse, report and store statistics on data describing the status and performance of the road system; Detect bottlenecks or traffic incidents to automatically alert the operator.

Traffic camera system: Assist the operator to visualize the distance traffic on the large screen or screen

at the traffic management center; Provides video traffic visualization for organizations and the public as specified by the competent authority.

Traffic management center: Carry out the task of gathering, processing and storing centralized data; Provides user interaction to implement traffic management, administration and traffic control at the RTDM Centers or the Regional Centers for Regional Operational Management.

Event management system: Assist the operator to monitor traffic events taking place on the road, and provide automated tools that aggregate data from vehicle tracking systems, vehicle load monitoring systems, and information systems. Weather information provides data for automatically alerting operators to traffic safety events.

d. Hanoi Smart Governance

* Target:

Provide personalized services in a way that makes people feel special

Be active listening to people with the goal of continuous improvement

Reflect the views of people and the experience of the people and promote their participation in a comprehensive way

Simplify administrative procedures based on smart applications

* Actions:

Make contact and interact with people through smart applications: Introducing smartphone applications, enabling people to communicate, interact directly with government, to quickly reflect urban issues.

Acquire and consult people in visual and modern forms: Take and use some of the exciting forms currently in use in the world, such as Community PlanIt. Where people's input is used as a scoring method in the game, ending with a face-to-face meeting.

e. Hanoi Smart Citizen

* Target:

Highly qualified support

Lifelong learning support

Create a venue for cultural events and community events

Push the spirit of openness

Support a high quality lifestyle

Good housing, good schools, safe, dynamic and comfortable

Smart people include human development solutions that not only improve education and training

but also promote creativity and innovation as well as enhance interaction and exchange towards an open society of information.

* Actions:

Integrate high technology into education: Improve educational levels with technology, and increase interaction among students

Increase access to employment: Extensive search and job exchange applications, professional support

Increased connectivity with knowledge: Free internet access, upgraded public electronic library system, easy connection with each citizen

g. Hanoi Smart Economy

* Target:

Smart banking system

Limit the use of cash

Economic sharing

E-commerce development

* Actions:

Developing e-commerce is the impetus for the economy. Combined with shared economic models, it will connect directly to buyers and sellers through the internet, making it easier for both buyers and sellers to reduce costs.

Economy restricts the use of cash.

Providing services and payment points by card or using an electronic wallet.

Applying information technology to banks in order to create online banks with online services 24/7 and contributing to economic development.

Unification of e-commerce: Developing a Vietnamese e-commerce site next to big sites like amazon, lazada, etc.

Consistency between banking systems: Banks now participate in a local ATM card union called Napas. With this alliance, the user can deal with all ATMs and card terminals. POS in the whole territory of Vietnam.

Promote services that come with shared economic models.

3. Conclusion

- For Hanoi to become a smart city, there are many challenges for the government and the people.

- But this is a trend of the world, as technology is growing and helping people in all aspects of life.

- First of all, it is necessary to build human resources in information technology and an infrastructure to meet each stage of smart city development.

- Hanoi can solve every problem to move towards a smart city:

+ Stage 1: Focus on human resources and infrastructure.

+ Stage 2: Deploying items from the administrative agencies (such as e-government, e-hospital, e-school...) in order to meet the demand and help people familiarize themselves with them. with the new model.

+ Stage 3: Deploying environmental items and utilities such as intelligent transportation.

Besides that, Hanoi also need to care about smart transport system, information and communication technology system, building smart health system, building smart education system, smart urban light system, smart environment system, smart travel system, smart houses./.

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