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Binh Duong new city as a smart city in Southern Vietnam

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Abstract

Smart city is a new world's trend in business, technology and architecture. A lot of conditions should be met to build a smart city. Of course, there are different levels and stages in a way to become smart city. Some cities are better prepared to become smart while other are not. Cities in capitals of Northern Europe are likely smart city's role models for other cities in Europe and the world. In Binh Duong province, the

newly formed Binh Duong New City has great conditions to implement 4th Industrial Revolution related technological, social and architectural solutions to serve as a role model for other cities in the country, connecting Southern part and Northern part of the province toward sustainable development. In this article solutions for that purpose and recommendations have been studied.

Keywords: Smart City, Binh Duong Province, Role Model, Sustainable Development.

1. Introduction to Industrial Revolution 4.0

The term "industrial revolution 4.0" or "fourth revolution" has been mentioned for the first time in 2011 at the Hannover fair introducing the Industry 4.0 (in German: Industrie 4.0) program, to promote the automation industry and traditional German mechanical engineering. Industry Expert Group 4.0 presented a series of recommendations for the realization of 4.0 industry to the Federal Government of Germany. Members of this group have been recognized as fathers and motors behind Industry 4.0 [5].

According to Gartner, Industry 4.0 is based on the concept of "Industrie 4.0" in a report submitted to the German government in 2013. "Industrie 4.0" connects embedded systems and intelligent manufacturing facilities to create digital technological convergence between industry, business, functions and processes inside [5].

The first industrial revolution began in United Kingdom, starting from the second half of the 18th century. To date, there has been a unified vision of the three industrial revolutions which have been characterized by revolutionary change of nature of the production process, and this change is created by the breakthrough of science and technology [5]. The first industrial revolution (1.0) used water and steam energy to mechanize production. The second industrial revolution (2.0) took place through the application of electricity to mass production. The third industrial revolution (3.0) uses electronics and information technology to automate production processes. At present, the fourth industrial revolution is emerging from the third revolution that combines all technologies together, blurring the boundaries between the physical world, the digital world (virtual world) and the biological world (the world of life) ".

According to Klaus Schwab, the revolutionary pace of the 4.0 industrial revolution is without a historical precedent. Compared to the previous three industrial revolutions, the 4.0 revolutionary industry is advancing exponentially rather than linearly. Moreover, due to the interdisciplinarity and due to the information and communication technology as a basis, it is currently breaking most of the industrial structures in each country. It anticipates a shift in both the breadth and depth of the entire global production, business and administration system. Table 1 details the contents of these revolutions.

Table 1: Industrial revolutions in the world

Industrial revolution	Timeline	Content
1.0	1820-1870	Transportation. Steam engine (also called internal combustion engine).
2.0	1870-1913	Traditional industries (agriculture, heavy industry, mechanics, chemicals, mining, metallurgy) in developed countries. Electric motors.
3.0	1913-1950	New technologies such as energy, aviation, space, biotechnology, military technology, information technology and communications. Computerization, automation.
4.0	1950-now	Integrate technologies together based on information and communication technologies. -Social Network -AI – Artificial Intelligence, ML – Machine Learning -IoT – Internet of Things -Big Data -3D Printer -VR – Virtual Reality -Cloud and Cognitive Computing -Driveless cars, Drones - Smart robot, factory and city -E-Learning, Telemedicine

Source: [5]

Generally, there are three fundamental principles that assist companies in identifying and validating the perspectives of the Industrial Revolution 4.0:

Interoperability: The ability to communicate and connect machines, devices, sensors and people connects and communicates with one another through a network of people connected to the internet or a network of things connected to the internet.

Transparency: The ability of information systems to create a virtual version of the real world by enriching intelligent digital factory models with sensor data. This requires the aggregation of raw sensor data to higher value context information.

Supporting technology: First, the ability of human support systems to gather and visualize information in a comprehensive and concise manner for making informed decisions and addressing urgent matter. Secondly, the ability of physical-cyberspace systems to support difficult, excessive, or unsafe tasks.

2. The idea of smart city

Smart city, an important element of the Industrial Revolution 4.0 mentioned above, is an urban area that uses different types of electronic data collection 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 concept integrates information and communication technology (ICT), and various physical devices connected to the network (Internet of things) 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. ICT is used to enhance quality, performance and interactivity of urban services, reduce costs and resource consumption and increase contact between citizens and government. Smart city applications are developed to manage urban flows and allow for real-time responses. A smart city may therefore be more prepared to

respond to challenges than one with a simple transactional relationship with its citizens. The term itself remains unclear to its specifics and therefore open to many interpretations. Other terms that have been used for similar concepts include digital city, electronic communities, information city, intelligent city, knowledge-based city, ubiquitous city, wired city.

Major technological, economic and environmental changes have generated interest in smart cities, including climate change, economic restructuring, the move to online retail and entertainment, ageing populations, urban population growth and pressures on public finances. The European Union (EU) has devoted constant efforts to devising a strategy for achieving smart urban growth for its metropolitan city-regions. The EU has developed a range of programs under Europe Digital Agenda. In 2010, it highlighted its focus on strengthening innovation and investment in ICT services for the purpose of improving public services and quality of life. It is estimated that the global market for smart urban services will be \$400 billion per annum by 2020.

Due to the breadth of technologies that have been implemented to build smart city, it is difficult to distill a precise definition of a smart city. Deakin and Al Wear list four factors that contribute to the definition of a smart city:

1. The application of a wide range of electronic and digital technologies to communities and cities
2. The use of ICT to transform life and working environments within the region
3. The embedding of such ICT in government systems
4. The practices that bring ICT and people together to enhance the innovation and knowledge that they offer.

Deakin defines the smart city as one that utilizes ICT to meet the demands of the citizens and that community involvement in the process is necessary for building smart city. A smart city would thus be a city that not only possesses ICT in particular areas, but has also implemented this technology in a manner that positively impacts local community. In order to get a better insight into the idea of smart city, we consider its alternative definitions proposed by other authors and experts. According to Giffinger *et al.* [4], smart city is featured by its regional competitiveness, transport and ICT, economics, natural resources, human and social capital, quality of life, and participation of citizens in the

governance of cities. Caragliu and Nijkamp^[1] understand that a city can be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with wise management of natural and human resources, through participatory action and engagement. Frost & Sullivan^[2] identified eight key aspects that define a smart city: smart governance, smart energy, smart building, smart mobility, smart infrastructure, smart technology, smart healthcare and smart citizen.

It has been suggested that a smart city (also smart community, smart business cluster, smart urban agglomeration or smart region) uses ICT to:

1. Make more efficient use of physical infrastructure (roads, built environment and other physical assets) through artificial intelligence and data analytics to support a strong and healthy economic, social, cultural development.
2. Engage effectively with local people in local governance and decision by use of open innovation processes and e-participation, improving the collective intelligence of the city's institutions through e-governance, with emphasis placed on citizen participation and co-design.
3. Learn, adapt and innovate and thereby respond more effectively and promptly to changing circumstances by improving the intelligence of the city.

Smart cities evolve towards strong integration of all dimensions of human, collective and artificial intelligence within the city. The intelligence of cities resides in the increasingly effective combination of digital telecommunication networks (the nerves), ubiquitously embedded intelligence (the brains), sensors and tags (the sensory organs), and software (the knowledge and cognitive competence).

3. Smart cities in the world

Stockholm (Sweden)

Public-business-academia strong cooperation

Sweden's capital city Stockholm is globally recognized as one of the leading examples of a smart city. The city houses fluid cooperation between the three spheres of public, business, and academic life. This willingness to contribute from all of the key sectors has made the road to becoming a smart city, which started in the mid-1990s, a significantly easier one. The neighboring innovation cluster, Kista Science City, has grown with Stockholm and is now one of the most productive ICT regions in not just Sweden but the whole world, due largely to the collaboration between investors and workers.

Ubiquitous Internet broadband coverage

In 1994 the city-owned company Stokab began developing the all-encompassing and accessible Fiber network that exists today, enabling Stockholm to enjoy full broadband coverage. This was a mutually beneficial decision for many organizations within the city: The citywide access to internet encourages economic activity, business growth, and innovative ideas/start-ups. The network essentially has a hand in everything that goes on in Stockholm as well, gathering data from traffic, energy consumption, water treatment; the list goes on. Stockholm has been constantly ahead of the pack, planning well into the future: the world's first 4G/LTE network was established in the capital in 2009 and the city also received the inaugural European Green

Capital Award a year later in 2010.

Digitalization and go green

Stockholm's green plan, "Vision 2030", is a prime example of the aforementioned forward-thinking mindset, detailing goals and the steps to achieve them by the year 2030. ICT is synonymous with green in the city, with the sector accounting for less than 5% of the Capital's greenhouse gas emissions, and data is constantly being gathered by Stokab network in the hopes of reducing the city's footprint even more so. The City of Stockholm has also been progressively digitizing its services. Now the E-Services, while also reducing paper usage/waste, put the information from traffic monitoring and sensors to use by showing citizens the fastest way to make their commute by car or bicycle.

Start-up and social entrepreneurship

The almost-complete integration of IT into Stockholm's infrastructure has benefited the capital in many ways, the most obvious of these being digital equality for citizens and the massively reduced carbon footprint. Start-ups and tech companies flourish, and the city has made a unique blend of business motivated but still citizen-centric decisions to get to where it is now. The quality of life in Stockholm is one of the highest in the world, and their sustainable metropolis is a role model smart city.

Copenhagen (Denmark)

All-round business-academia-government-society partnership

The smart city Copenhagen is a living laboratory for testing smart technologies to handle the challenges of urbanization and climate change. Unique access to data and efficient public-private sector partnerships attract many multinationals. Copenhagen has become a preferred living lab for testing and developing smart city technologies, owing to easy collaboration with academia, the public sector and industry. Moreover, the Danes are early adopters of new technologies, and Denmark has a long tradition of citizen involvement in urban planning and development.

ICT and clean-tech sustainable solutions implemented along all the sectors

Copenhagen is a smart city front-runner. Here, a multitude of new smart city technologies and solutions are being tested and developed across the ICT, clean-tech, construction and transportation sectors. Copenhagen aims to become the world's first carbon-neutral capital by 2025, and Denmark is determined to become fully independent of fossil fuels by 2050. These ambitious objectives and the strong political focus on sustainable societies in national and local government create motivation for developing smart cities and pave the way for large-scale testing of smart city solutions in real-life urban environments.

Strong digitalization

For decades, the Danish authorities have collected and stored basic data about citizens, businesses and real estate in order to digitize services across administrations and sectors. A new government program provides free access to public data sources in the aim to drive smart city innovation. This availability of high-quality basic data provides a unique starting point for developing smart solutions to meet the challenges of urbanization and climate change, such as traffic congestion and flooding of urban areas.

Easiest place to start-up and to do business

International companies are strongly encouraged to come to

Greater Copenhagen to become part of the region's fast-growing smart city industry. Free of charge, Copenhagen Capacity assists international companies looking for business partners, investment opportunities and test markets for new products and technologies. Copenhagen is a breeding ground for smart city start-ups. Around 250 companies are involved in smart city activities in Copenhagen, and small companies make up two thirds of the smart city industry, offering attractive investment opportunities as well as bridgeheads for collaboration with the public sector in Denmark. Flexible labor market regulation, highly qualified talent, favorable taxation, fast establishment procedures and virtually no corruption make Denmark one of the easiest and most cost-efficient places in Europe to do business.

4. Solutions for smart city in Binh Duong

According to Mr. Tran Thanh Liem, Chairman of Binh Duong People's Committee [8]: "Building smart city is a necessary trend of development. Model for smart city development will give a premise to implement synchronized solutions in development policy, especially for Binh Duong, a region with high economic development, growing population, strongly developing process of urbanization, the planning and building smart city is really an urgent issue". Over 30 years of renewal, Binh Duong has become one of province with highest economic growth and industrial development in Vietnam. In 2011-2015 period, GDP has grown 13% per annum on average, industrial output has grown 15.7% per annum on average. Binh Duong is renowned for its largest industrial zones and FDI attraction. Binh Duong New City is a modern, green and environment friendly city, with totally reformed administrative bureaucracy, with focus on human resource development, community healthcare. Those successes created a strong foundations for Binh Duong to become a truly smart city. According to the assessment of Mr. Peter Porthine, development director of Brainport group [6], "Binh Duong is a newly developed city, however, the communication and telecommunication infrastructure has been perfectly connected. This is a prerequisite for building a smart city. With more than 20 years of experiences, we will make use of what Binh Duong has to support the city to transform toward reducing labor intensive industry, while increasing high-tech industry as well as to support building smart city. With favorable conditions that Binh Duong now has, I am convinced that in the future Binh Duong will move forward quickly and become a smart city"

4.1 Competitive advantages of Binh Duong province

- **Geographical position:** Binh Duong is situated in the South-East of Vietnam, is only 30 km away from Ho Chi Minh City and Bien Hoa (metropolis of Dong Nai province), the largest agglomeration centers in The South of Vietnam. Binh Duong easily connect Ho Chi Minh City with Tay Ninh province and from there straight to Cambodia, with Binh Phuoc province and from there straight to Central Highland regions.
- **Human resources:** Binh Duong has a lot of universities in its area: Thu Dau Mot University, Binh Duong University, Economic and Technology University, Eastern International University, Vietnamese-German University and many affiliations of Universities situated in Ho Chi Minh City.
- **Good urban and administrative management:** urban planning of Binh Duong is well done thanks to the good policy and mechanism for both urban and social development. Simplification of administrative

management in terms of regulations and procedures is magnet to attract foreign investment from Japan, South Korea, Singapore and other economic powerhouses in the world.

4.2 Recommended solutions for Binh Duong to develop smart city

Based on the experiences of aforementioned Nordic countries in Europe, the following propositions and recommendations is put forward for Binh Duong to develop and implement its smart city in the context of the 4th Industrial Revolution:

1. Enhance training and development of highly qualified human resources – take advantages of Vietnamese-German University and Eastern International University to transfer knowledge, education management skills and competencies from abroad for the rest of university within the Binh Duong province.
2. Being selective, develop smart city for Binh Duong New City (BDNC) first, due to the BDNC is newly build with ready to use communication and telecommunication infrastructure and it is prone to technology transfer and implementation as well as urban life and business style change to adopt a new model of industrial society.
3. Develop strong relationship between government, businesses, universities and local community to test and implement smartest ideas and technologies for the sake of advanced smart city.
4. Attract smartest minds in the countries, across the region and around the globe to work and live in BDNC to contribute to its development toward smart city in a knowledge based economy and innovative society.
5. Let the BDNC be a smart bridge that connect the South, well developed part of Binh Duong province (Di An, Thuan An town) with the North, developing part of Binh Duong province (Bau Bang, Ben Cat town) to retain a high balance and sustainability of overall development.

5. Conclusions

Smart city is a necessary trend of all countries around the world. This model of cities will better serve the citizens. For developing countries like Vietnam, the role of smart city is more important than ever, especially in context of deeper integration with the world and current development of the 4th Industrial Revolution. As one of the highly developed provinces in the country, Binh Duong needs to promote its role as strong economic powerhouse in the South, not only to build successfully smart city and guarantee its sustainable development, but also serve as a role model for other provinces in the vicinity first and all over the country later and hopefully for other countries less developed such as Laos, Cambodia and for less developed provinces of stronger economies in the ASEAN.

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