

Research on the Development of Smart City in South Korea

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ABSTRACT. South Korea is one of the most urbanized countries in the world. At the same time, South Korea is famous for its advanced ICT. Since 1990s, South Korea started to construct smart cities to solve the urban problems. At first, South Korea developed U-city and evolved it into smart city in those days. At the national level, the central government set three flagship cases to guide the development of Korean smart cities. Meanwhile, the government also promotes the Korean model to the world. Although South Korea has made a lot of progress, there are still some problems, such as too much government led, lack of two-way communication and so on.

KEYWORDS: Korea, Smart city, Pilot project, Export model

1. Introduction

According to the UN report, by 2050 there will be more than 9.5 billion people living in this world, and about 70% of people will live in the cities. Such a massive urbanization will cause many problems, like traffic, housing, energy, air pollution, garbage disposal, and city safety problems. These problems in cities have to be solved smartly, efficiently, and quickly. With the advancements of technology, more and more people want to use new technologies to solve the urban problems. In this process, people's idea changed from the U-city to the smart city. South Korea is a newly developed country, and the cities in South Korea changed very fast. South Korea is also advanced in information and communication technology (ICT), which has helped South Korea become a leading country in smart city construction. South Korea is also the first country to enact a law on the smart city to offer guideline for the development of smart city.

2. The Concept of Smart City

Accompanied by the industrial revolution, the city also changed. The first industrial revolution, which caused mechanization and invents of the railway, generated the industrial cities. After the second industrial revolution and the popularization of the car, caused the city became more and more huge. Under the third industrial revolution, the city became more intelligent, so the system in the city became automated. In this current fourth industrial revolution, a new paradigm, smart city appeared. Although till now, there is no exact conceptual setting and concrete example of smart city worldwide, there is common consensus that smart city should be based on advanced technology to solve the city problems which we are facing nowadays.

There are some people and organization tried to define the concept of smart city. As early as 2000, Hall defines smart city as a vision that makes the urban be the future center which made the city safe, secure, green and efficient. In the smart city, "advanced, integrated materials, sensors, electronics and networks which are interfaced with computerized systems comprised of databases, tracking, and decision-making algorithms." [1] Susanne and Mary argue that becoming a smarter city needs a journey, and it could not be an overnight transformation. The city system like communication, people, business, water, energy and transportation needs to be transformed and applied by the advanced technology to optimize those city systems. [2]

Some organizations also make their definition on the smart cities. IBM defined smart city as "one that makes optimal use of all the interconnected information available today to better understand and control its operations and optimize the use of limited resources." [3] The UK Department for Business, Innovation and Skills consider smart cities as "a process rather than a static outcome, in which increased citizen digital technologies make cities more liveable, resilient and better able to respond to challenges." [4]

In South Korea, the Act on smart city creation and Industry Promotion (abbreviated as Smart City Act) defines smart city as "a sustainable city that provides variety of city services through urban infrastructure constructed with the convergence of ICT and land development technology to improve the competitiveness of the city and the quality of

life.”[5] This is the first definition enacted as law to promote the development of smart city in the world.

To sum up, smart city means a process which driven by the latest digital technology to network the Internet, big data, cloud computing, Internet of Things and other technologies to change the city management and paradigm to make the urban life smarter and more convenient. It's a new thing that no city in the world has completed the process of being smart, but to solve the city problems and make the urban life better, it is really a good vision about the future of city.

3. The Construction of Smart City in South Korea: from U-City to Smart City

The construction of smart city in Korea experience two steps. First is the era of constructing Ubiquitous-city in Korea. The U-city tried to integrate basic infrastructure like transportation and safety system into the city construction. Actually, the start of U-city was after big incidents, like the incident of constructing subway in 1994 and the explosion of city gas pipeline during the subway construction in 1995. After those incidents, Korea built urban information system to manage the electricity, gas, and communication facilities underground. At the same time, the word class IT technology made Korea could design the policy of constructing U-city. According to the data from the Ministry of Land, Infrastructure and Transport, the U-city still constructed till recent years. It was starting with Hwasung Dongtan U-city in 2003, and now, 73 smart cities are developed or under developing.

Although the U-city was still under constructing, the government-led top-down construction and the less consideration of the residents' demand caused the lower perception of public to this new project. Since 2008, some global IT leaders like IBM and Cisco start to produce their smart city strategy. The “smart” in the smart city means it could reflect the user's response timely, so it is user friendly. The design of the U-city and the smart city are based on ICT to improve the citizens' life quality and the city competitiveness. However, there are some differences between them. First, the U-city was promoted by the central government, but the smart city was promoted by the global IT leaders and the local government. Second, the U-city in Korea was accompanied by the large scale construction, like constructing some new towns, but the smart city is applied in the current existing cities. Third, in the city governance, the U-city was one-way communication, but the smart city is a two-way communication, so, the residents' demand could be collect timely. Fourth, the U-city mainly focus on the transportation, security and disaster prevention, but the smart city focuses not only the transportation, security, disaster, but also contain environment, education, communication, administration etc.[6]

Under the current Moon Jae-in Government, presidential committee on the fourth industrial revolution was organized, and smart city sector was under a special sub-committee to resolve urban problems through innovative solution. This sector could coordinates various ministries members in the national level, encourage public participation, prepare and support public-private partnership to foster the construction of smart city.

4. Three Cases of Smart City in South Korea: Busan, Sejong, and Seoul

From 2019, the committee on fourth industrial revolution chose flagship pilot projects to develop Korean smart city and make efforts to spread and upgrade the result to the nationwide.

Busan is the second biggest city of Korea and is well-known for the water. The Eco Delta City (hereafter EDC) in Busan was chosen as one of the flagship case. EDC, was based on Busan Haeundae Prototype Complex which is located Busan Haeundae. At present, the construction of EDC is under those three main focuses, which are “smart life for future, smart links for sharing, and smart place for everyone”. Smart life for the future means make an innovation cluster to deal with the 4th industrial revolution, solving the aging problem and the employment problem etc. Smart link for sharing means construct a green belt or water front so that the citizen living there could get water in five minutes on foot. The smart place for everyone means through constructing smart innovative hub to create new value and provide opportunity to the citizens.[7]

Sejong Smart City was located at Sejong Special Autonomous City, and it plan about 200,000 household with 500,000 populations. The objective of this project is mainly those five aspects. In transport, through providing traffic information service, traffic control, and public bike etc. to gradually reduce total number of car to one-third. In disaster prevention, through monitoring forest fire system, fire prevention system, urban disaster prevention system, and integrated information on floods and storm to reduce the disaster. In crime prevention area, use the intelligent CCTV to prevent the crime. In the area of energy, smart grid and smart water grid was applied to promote the efficiency of energy uses. Other area, like the smart healthcare, citizens involving governance, and education on creative thinking to make the city change to a human-centric and eco-friendly city.[8]

Seoul is the capital city of Korea and has more than 10 million populations. In 2015, the project of “Smart Seoul 2015” has been established to make a sustainable growth. The Seoul smart city projects pursued and achieved various fields to make the city be smarter, such as city governance, transportation, security, environment, welfare and economy.

In the case of city governance the big data may be used as a reference to find the optimal policy for the citizens'. In the case of transformation, the intelligent transportation system which is based on the big data is introduced to provide efficient and convenient transportation. Through this system, the availability of public parking lot will be provided and the late night bus line which was designed by the use of big data is also a good example. In the case of security, the intelligent CCTV will be used to prevent the crimes and the smart disaster response system could manage urban infrastructure through big data. In the case of the environment, "3D-based Virtual Seoul" will be applied and it will evaluate the effect in advance. Besides this the intelligent power metering, solar energy water and sewage management, and water quality management will be provided to protect urban environment and improve the urban life. In the case of welfare, Seoul provides socially disadvantaged people like the elderly or disabled people and women's will be supported by the smart technology. In the case of smart economy, the city government helps to commercialize the products of small and medium sized companies and venture businesses to foster new industries and create jobs.[9]

As cities like those mentioned above in Korea try their way to promote and construct the smart city to solve urban problems and change the city to be a livable place. They try to build big data platform, cloud center or introduce block chain and AI to prepare the coming fourth industrial revolution and apply these advanced technology to the smart city that they are constructing.

5. The Export Korean Model Smart City to the World

Korea not only constructs smart city at home, but also works hard to export its smart city model to the world. In smart city construction, Korea has much strength. First, Korea has the experience of developing various smart cities. From the U-city, to smart city, those consecutive experiences made Korea accumulate abundant knowledge in developing smart cities. Second, Korea has advanced IT technology, which could provide various solutions to the smart cities. Based on the IT technology, Korea could help to construct smart transportation system, smart energy system, and smart environment solution etc. Third, Korea has the ability to export the full package of smart city. Korea could export components of smart city such as technologies or solutions that can improve transport, energy and environment in cities, at the same time, the full-package export where Korea participates in new city development is also possible. Those strengths in the developing of smart cities, made Korea could export its model to the outside world.

In the Middle East, the South Saad Al Abdullah New Town project is one of the cases that Korea constructs smart city in the globe. The size of this project was 64.5 km² and 25,000-40,000 units. The total construction money is about 4 billion dollars. The concept of this project was smart energy, smart environment, smart transportation and smart living. In this project Korea Land and Housing Corporation (hereafter LH) provides service contract management, setting up structure finance for investment. At the same time, the Korean companies provide master plan and detailed design.[10]

In the South Asia, Kalyan Dombivli Smart City project, which was located 30 km east from Mumbai, is under construction. The new smart city will be 2.5 million m², with 15,000 households. The project may be worth 334.8 million dollars. In this project the LH will provide management, doing financing and marketing. Also the Korean company will make master plan and design detailed service.

In South America, Santa Cruz New Town, which was located at 15 km away in the northeast of Santa Cruz city center, is under construction. The total budget for this project is 3 billion dollars to establish a new suburb city for 128,000 units. The role of LH in this project is managing the project, making master plan, doing detailed design, and marketing etc. Korean companies will provide basic and infrastructure planning, like waste treatment, energy facilities, and intelligent transportation system.[11]

Those three cases are the overseas cooperation project specifically promoted by the LH. They develop and spread the Korea model smart city to the Middle East, South Asia, and South America. Besides this there are some private companies like LG CNS, Lotte, Hanwha export their advanced technology, like intelligent transport system, smart trash clean cube to construct smart cities.

6. The Lessons of Smart City from South Korea

In just 70 years, Korea achieved spectacular economic success and has abundant urban development experiences. In 2003, Korea enacts the law on U-city to encourage the development of smart city. From 2005, Korea has applied the ICT to the new town construction. In these days the governments made the committee on the 4th industrial revolution set a subcommittee on smart city to support various cutting-edge solutions from the government level.

The construction of smart city in and abroad achieved some success. At the same time, the construction of Korean model smart city has some problems. First is the strong government centered mechanism. The construction of a smart city needs to public-private cooperation, but the Korean model was usually driven by the states, like the construction fund was raised by the government. So, this model is hard to promote or copy to the other region. Second is the lack

of two way communication. One of the most different points of U-city and smart city is the reflection of citizens' response timely, but till now the construction of smart city in Korea still focuses too much on the High-Edge infrastructure development. In addition, the promotion of smart city in Korea should bring more chance to the people, but till now, those combined effects have not worked sufficiently.

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