

Problems and Solutions of Smart Small Cities in China and Japan -View of Yangzhong City and Tsuru City

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Abstract Building smart cities becomes an important strategy to solve the problems of urban development and improve the competitiveness of the cities for better lives and environments. Many smart cities have been launched in developed countries such as Japan. Motivated by sustainable development requirements in global environment, China also started to design and construct smart cities. This paper uses Yangzhong city and Tsuru city as examples to give a review of smart cities in China and Japan. Moreover, some problems and solutions of smart cities are summarized. The aim of this paper is to increase the awareness of the importance of smart city construction, enable the government to provide relevant policy and make optimal resource allocation for city development and environmental protection.

Keywords Smart city, Yangzhong city, Tsuru city, Problems and solutions, City development

1. Introduction

Urban populations around the world continue to rise. In the past three decades, China has seen the largest rural-to-urban human migration in history [1]. According to the latest official United Nations projections, China's urban population is expected to increase from 636 million to 1037 million between 2010 and 2050 [2]. Moreover, this rapid growth is continuing and anticipated to become even faster. The urbanization enhances the growth of the national economy but results in urban environmental and residents' life's changes. There are a number of problems need to be tackled such as overcrowding, congestion, environmental pollution, long-term water shortages, human health problems, citizenship problems for rural-to-urban migrants etc. These problems motivate the cities to become smart to changing industrial structure, increasing more energy-efficient technologies, pollution decreasing for better lives and environments.

Compare with China, Japan has more advanced smart urban planning, management and technology and the smart cities in Japan have brought benefits for the citizens. In Japan, the Ministry of Economy, Trade, and Industry (METI) supports a lot to build the smart cities. METI also invests in Japanese business involvement in smart city projects globally. The smart cities market here, which stood at around ¥1.12 trillion in 2011, is expected to grow to ¥3.8 trillion by 2020 [3]. Many smart projects

have been demonstrated. For example, U.S. and Japanese companies began Smart Grid Project in Hawaii from 211. More over, Nice Japanese Companies launch Japna-U.S. Collaborative Smart Grid Demonstration Project in New Mexico.

In this paper, we will use Yangzhong city in China and Tsuru city in Japan as examples to discuss the smart city problems and solutions.

2. Overview of Smart City development in Yangzhong city.

2.1 Introduction of Yangzhong City

The process of urbanization in China is more complicated and diverse than other countries. With the rapid transformation of China's social economy and rapid urbanization in recent years, the construction of China's smart city has some differences with other countries in the scope of construction, construction mode and focuses [4]. For example, Yangzhong city is a small city in Jiangsu province and it has different construction focus compare with the big cities such as Beijing and Shanghai in China.

Yangzhong is a small city in China, but it has a lot of specialty: ① Strong economy. In 2014, the GDP per capita exceeded 130,000 yuan. The proportion of high-tech products is 75% of the total GDP, ranking first

in Jiangsu Province; ② Beautiful ecological environment (shown as Fig. 1). Yangzhong is known as "National Ecological Civilization Demonstration Area" and is also known as "China Puffer Fish Island". ③ People is rich. The level of urban and rural integration is in the forefront of the country. The per capita savings and per capita income in Yangzhong, list in No. 3 and No. 7, respectively in Jiangsu province.



Fig. 1. Beautiful ecological environment in Yangzhong city

From the industry view, Yangzhong is a highly industrialized city and has a "3 leading industries + X" emerging industrial system (electrical engineering, new energy, equipment manufacturing + other industries).

From the location view, Yangzhong has 54 km deep-water coastline and it is about 204 km far from the sea. The riverbed is stable and unfrozen. It will not be affected by the tide and the typhoon and monsoon, with is suitable for inland port, and suitable for the development of port equipment manufacturing and modern port logistics industry (shown as Fig. 2.).



Fig. 2. View of the port equipment and logistics industry in Yangzhong city

From the view of human resources, Yangzhong is located at the intersection of Shanghai metropolitan area

and Nanjing metropolitan area. It has many comprehensive institutions and vocational schools. These colleges and vocational schools have a wide range of professional facilities. These schools can provide a lot of skilled workers for the industries.

2.2 Comparison of Yangzhong city in China and Tsuru city in Japan

Yangzhong city in China and Tsuru city in Japan are both small size cities. These two cities are both very close to the big city area: Shanghai metropolitan area and Tokyo metropolitan area.

The trend of population and GDP from 2008 and 2015 in Yangzhong is shown as Fig. 3. From this figure, we can see that the GDP is keeping increasing and the population is also increasing except 2015.

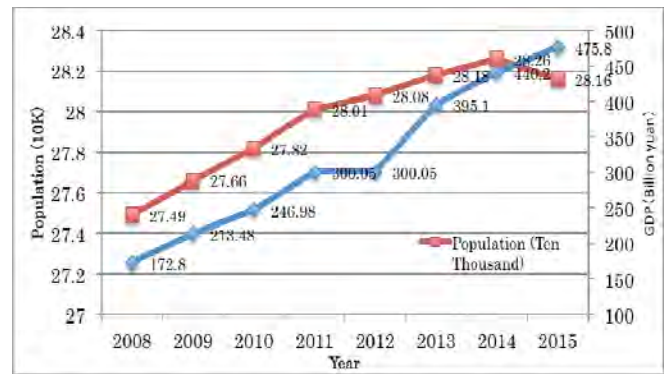


Fig. 3. GDP and Population from 2008 to 2015 in Yangzhong city.

Compare to Yangzhong, the population of Tsuru is around 30 thousand and it started decreasing from 2000. Moreover, the low birthrate and aging population are serious problems in Tsuru and also common problems in Japan. It becomes an important concern when designing the smart cities.

Yangzhong city is an island, which is surrounded by rivers. It has 5 bridges to connect the city and other places. Land transportation and river transportation are both convenient. Tsuru is located in the mountain and has more than 80% forest area. Similar to Yangzhong, Tsuru also has plenty of water resources.

From the view of agriculture field, the agriculture land in Tsuru is less than 2% [5]. The same as Tsuru, Yangzhong almost does not have any agriculture. The economy is almost based on the secondary sector of industry and the tertiary sector of industry.

2.3 Smart city and the energy policy

Nowadays the industry becomes more and more productive by adopting good technology and efficient business models. However, we have to face a lot of challenges, one biggest challenge is Energy. Fig.4 shows that the increase in energy demand is driven by economic growth [6]. In this figure, the blue line indicates that to get the same GDP, China has more energy consumption compare with other countries. To make the air cleaner, and get the sky bluer, we need good energy solutions to decrease the environment pollutions.

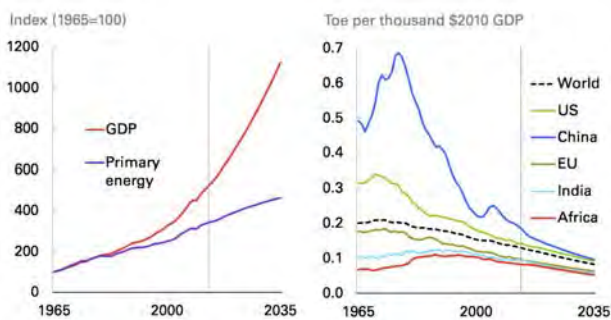


Fig. 4 Increase in energy demand is driven by economic growth

From 2015, Yangzhong city has made “Green Energy Island” as a new target. The key planning is constructing roof photovoltaic power generation, wind power, new energy micro-grid, biomass and other clean energy system; Building clean, low carbon, safe and efficient renewable energy production and consumption patterns; Making very high proportion of renewable energy generation in the near future. From 2016, Rooftop PV can receive 0.72 Yuan/ kWh subsidies from Yangzhong government [7].

In Japan, after the 3.11 earthquake and the accident at Fukushima nuclear power plant, smart cities are seen as a panacea for improving the efficiency of energy consumption. From around 2001, Tsuru citizens were working on revitalizing the region by using micro-hydropower. Tsurumi city has built small hydropower facility, named "Genki-kun", to provide party of the electronic power for the Tsuru City Hall and the Eco House in Tsuru [8]. Moreover, when the City Hall and Eco House are lightly loaded such as in the nighttime and holidays, the extra power is sold to the electric power company.

3. Problems and Solutions

3.1 Some problems in China

There are some problems in China's smart cities:

- (1) The governments and companies pay too much attention to GDP growth and the environment problems such as air pollution, water pollution are ignored.
- (2) From the current development of the actual development of the city, our understanding of smart city is not consistent: different government departments, different regions of the city have different understanding.
- (3) Poorness of the planning theory.
- (4) Lack of approaches sharing.
- (5) Large cities are developing very fast. However, the instruction of small cities/towns is ignored. Integration of Urban-rural development is required.
- (6) Information network security issues: In the process of building smart city, due to a large number of applications to the Internet of Things (IoT), cloud computing and other technologies, the information network security issues are unclear. We have to be deeply concerned about its potential threat.

3.2 Solutions

To solve the above problems, firstly, we should make an environment protecting attention to reduce the bad impacts on the environment. Recently, the air pollution becomes a severe problem in big cities such as Beijing and Shanghai. Environmental pollution control policies should be made and new technology should be adopted to improve the resource utilization.

Secondly, any smart city construction led by a single department will face many shortcomings. We must establish a comprehensive coordination for different departments to be aware of business content and share resources. Moreover, intelligent city construction involves a wide range of areas, including the management of information and communication industry, urban transport, health care, education, community management services and other fields, a comprehensive coordination mechanism must be established to coordinate different areas in the city.

Furthermore, we should work to narrow the gap between urban and rural areas, and promote their common

prosperity. Balancing and integrating urban and rural development provides the fundamental solution to the above issues.

In the IoT and cloud-computing era, legal and regulatory issues than the traditional Internet era are more complex. In China, there are a of of inadequacy in the construction of Internet laws and regulations. Firstly, information network security issues should be included in the law and the law should be followed. Second is we have to establish and improve the intrusion detection and prevention system to ensure the safe operation of the information network. Also, we have to establish and improve the safety monitoring and emergency response mechanisms and reduce network information threat to our public and enterprise network.

Moreover, actively city data such as Map data, GPS data, taxi/bus/bicycle data, smart phone data, surveillance camera data, environmental weather, water, air pollution state, social activity data (energy consumption, population) etc. can be utilized. Through monitoring, analyzing, integrating and utilizing the city real-time data, various parts of the city's environment can be understood and the harmony between people and the city in all aspects can be achieved. Nowadays, China's central and local governments are actively seeking the better way for construction of smart cities, as well as actively conducting related theoretical research and technology to explore and discover urban data resources [9].

4. Conclusions

The construction of smart city is an effective way of industrialization, informatization and urbanization for the next-generation cities. This paper presented a survey of the development and perspective of the smart cities in China and Japan. As examples, Yangzhong city in China and Tsuru City in Japan are introduced and compared. The problems and solutions are given in this paper. In conclusion, not only for big cities, but also for small cities, the comprehensive coordination should be established to serve the urban residents and rural residents.

Reference

- [1] Gong P, Liang S, Carlton EJ, et al. "Urbanisation and health in China.", *Lancet*. 2012;379(9818):843-852. doi:10.1016/S0140-6736(11)61878-3.
- [2] Yeh A, Xu J, Liu K. China's post-reform urbanization: retrospect, policies and trends. United Nations Population Fund (UNFPA) and the International Institute for Environment and Development (IIED); New York: 2011.
- [3] John Amari, "Will smart cities save Japan", *ACCJ Journal, Energy Metro wise*, July 2016, <https://journal.accj.or.jp/metro-wise/>
- [4] "China's Smart City Standardization White Paper", China Electronic Technology Standardization Institute Jul. 2013 (in Chinese)
- [5] "平成24年度 スマートコミュニティ構想普及支援事業 報告書" (in Japanese), <http://www.city.tsuru.yamanashi.jp/forms/top/top.aspx> (Tsuru City Official website)
- [6] "Energy outlook", BP p.l.c. 2016
- [7] <http://guangfu.bjx.com.cn/news/20160414/724732.shtml>
- [8] "小水力発電の取り組み経緯", 都留市役所地域環境課 (in Japanese), 2015.12.16
- [9] Wang Jingyuan, Li Chao, Xiong Zhang and Shan Zhiguang, "Survey of Data-Centric smart city", *Journal of Computer Research and Development*, DOI: 10.7544?isn1000-1239, 51(2):239-259,2014