From Smart City to Smart Society: China's Journey Towards Essential Urban-Rural Transformation

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Abstract. As an economic superpower in the world, China has always been seeking new ways to enhance living environment and improve life equality of its residents. China has thus made substantial progress in the development of smart city with over 700 pilot projects launched over the last decade. However, these smart city pilot projects mainly cover urban areas in China, excluding nearly 600 million Chinese residents living in rural areas. Consequently, the Chinese government proposed the new concept of smart society in 2017 as the next generation of smart city initiative, with the aim of enhancing living standard of residents in not just urban but also rural areas. In this paper, we elaborate the concept and vision of smart society, and present and discuss a variety of issues concerning the transformation from smart city to smart society in China, including cross-departmental coordination, public awareness and participation, and information security and privacy. We conclude the paper by recommended that China's strategy of smart society development can be considered and potentially adopted by other developing countries with similar contexts and urban-rural issues.

Keywords: Smart city · Smart society · China · Transformation · Urban and rural areas

1 Introduction

When decision makers of a country develop strategies, they must contemplate the state's economic development status, percentage of urban population, ecological environment, culture, historical background, and requirements of residents. For instance, Singapore has a population of 5.54 million and a small land area of 277.6 square miles. Driven by the rapid economic growth and a set of urban issues, Singapore launched its smart nation policy agenda in 2014 which was closely connect to its long-lasting strategic development direction [1, 2]. Moreover, facing an aging society ahead of other countries, Japan put forward the concept of "Society 5.0" to solve the plight of aging society and related social problems [3]. There is another case that the Europe 2020 strategy was proposed, which aims to overcome the structural weaknesses in European economy, decrease unemployment rate, and improve overall competitiveness and productivity [4].

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In contrast to these nations, however, China, as a developing country, has very different economic conditions, spatial distribution of population and urbanization. In recent years, China has had a good performance in economic development but still has an enormous population pressure and a huge gap between rural and urban areas. In China, the urbanization process picked up in the 1980s, compared to that of Europe and America, is far from maturity. Figure 1 shows pattern of China's urban and rural populations, i.e. statistics provided by the United Nations shows that the urbanization of China is probably only about 60%, and the other part is rural population [5]. Besides, according to the National Bureau of Statistics of China, by the end of 2017, there were still about 567 million people living in rural areas [6].

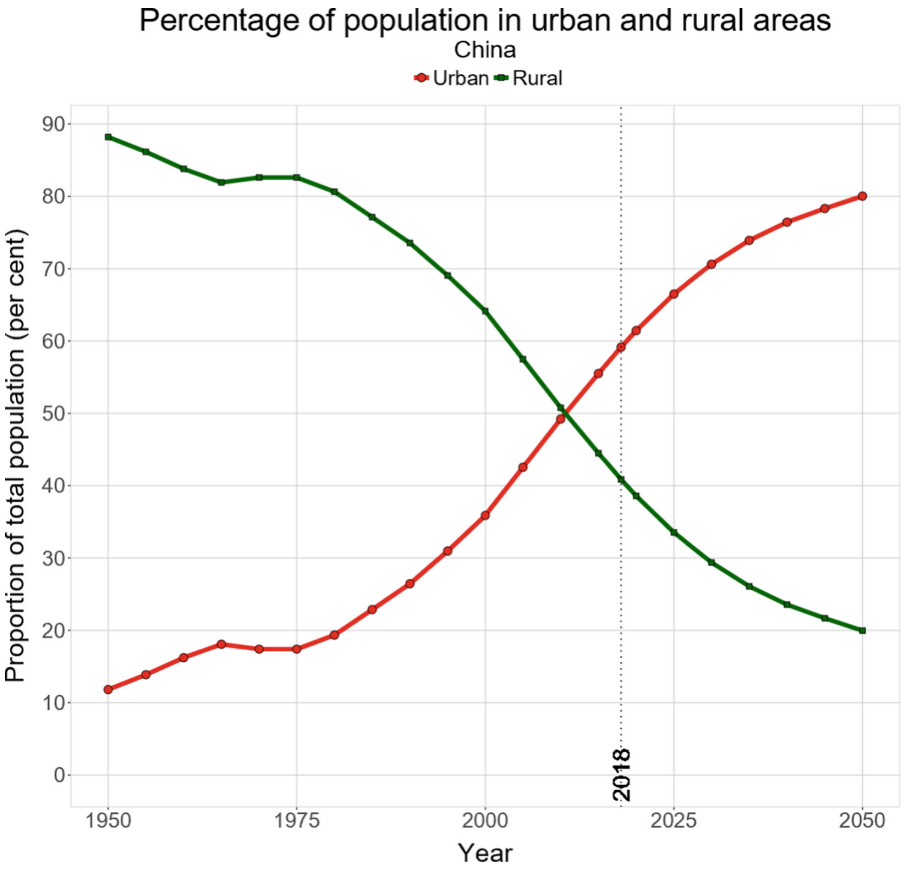

Fig. 1. Urban and rural populations of China Source: United Nations DESA/Population Division

In order to cope with the big gap between rural and urban areas, especially with metropolises, make people's life more conformable and sustainable with special

surroundings, China ought to explore its own path of transformation through the development of smart city and smart society.

The paper is structured as follows. First, the main dimensions of smart city are reviewed, followed by a discussion of current smart city achievements made by China. The most important part specifically introduces the local reason why China proposes the smart society strategy, explains the links between smart city and smart society, discusses associated challenges and anticipates the future of smart society development, with conclusions drawn.

2 Smart City

It is generally considered that cities play a significant role in human social and economic development [7]. The term of smart city was originated from IBM's "smart planet" plan which aimed to cope with the enterprise economy recession in 2008 [8]. As it evolved into the concept of smart city, the smart planet vision is not only emphasized by IBM or the industry, but has also successfully attracted attention from policy makers, scientist and citizens. The strategy of smart city emphasizes the important role of information and communication technologies (such as IoT, sensor network and big data) in developing the urban system [9–11]. Although there is no precise definition of smart city, the notion has become widespread in recent years. It can be accepted that smart city means taking advantage of high technology, especially information and communication technology (ICT) in urban subsystems in order to improve the quality of life as well as to create a sustainable, greener city and competitive commerce [12, 13].

However, the model of smart city is more likely to apt to big cities. When it comes to small- and medium-sized cities, which are likely to lose importance and attention against big metropolitan, they are unable to compete in terms of economic foundation and therefore unable to receive or afford the necessary funds for smart city mission [14, 15]. Moreover, most smart city strategies fail to adapt to the local needs of their residents [16].

3 Smart City in China

Over the last decade, China has launched its smart city initiative as a national strategy and has involved large investments in improving city infrastructure. On one hand, as a developing country, China has learned experience from Singapore, Amsterdam and other countries and cities in the beginning, and has got a good performance. On the other hand, the China Smart City Development and Research Center was established in 2012, which is a cross-sectoral research center specially established to provide policy research and decision-making consultation for smart city development, and provide overall planning, top-level design and implementation plan for local government to carry out smart city construction by the National Information Center. Besides, from central government to local departments, a large number of related documents have been released.

Due to strong political and financial support from the government, a large number of Chinese cities have made substantial progress toward the development of smart city, particularly in provincial and municipal cities. Local governments have invested a lot in technology and infrastructure. For instance, Guiyang, a provincial capital city in southwestern China, has committed to big data innovation project and built a complete big data industrial chain by means of big data transactions which will play a strong supporting role in the construction and development of smart cities. Cities like Shenzhen, Ningbo, Shanghai, and Beijing are guided to build digital city subsystems including smart transportation, smart governance, smart healthcare, and smart grid, and so on. In terms of the number of smart city projects under construction, more than 500 pilot cities have emerged, which have also formed numerous smart city clusters in the Yangtze River Delta and Pearl River Delta [17].

In China, however, population and urban factors are very complex. There are still a large population in rural areas and even a great number of migrant workers inside the city who have been ignored by original smart city endeavors. Furthermore, vulnerable groups should be more concerned about. The growth of smart city cannot be disjointed with the support of the surrounding villages and towns which have a positive feedback process as a mutual promotion [18]. Rather, carrying forward cultural traditions and combining Chinese characteristics, the higher period of smart city should consider the coordinated sustainable development of both urban and rural areas [18].

4 Smart Society in China

4.1 Why Does China Need Smart Society?

Although great progress has been made in pilot projects, there exists two major issues in the development of smart city in China:

- There is still a large proportion of population living in rural areas in China. Even for cities, the outer areas of many Chinese cities still have a rural nature and are pretty much under developed. These rural areas, either in countryside or in outer areas of cities, were not really covered in previous smart city projects, and so could not enjoy the convenience and benefits from smart city infrastructure construction and smart public service systems.
- Smart city development focus on sensor, network and platform layer, as for application layer, far from to satisfaction of the public needs and expectation.

As a result, in 2017, the strategy of smart society was delivered at the 19th National Congress of the Communist Party of China by Xi Jinping, the President of China. It was a key strategy to improve the quality of residents, balance the technology and social development based on its own technological development, smart city construction practice and social reality.

To find a new approach to deal with the issues that cannot be solved by smart city project only, smart society is the best solution.

From a realistic point of view, first of all, in addition to urban areas, there are still a large number of rural areas and economically underdeveloped areas in China.

The disparity between urban, rural and regional development needs to be solved urgently. Secondly, China has entered the age of aging, and is also facing social problems such as resource shortage and environmental pollution [19, 20], which require a more intelligent solution.

From a practical point of view, the Chinese government has made some achievements in promoting the construction of smart cities in recent years. China has the experience and ability to push it forward on a wider scale. From the perspective of science and technology, technology and innovation is the motivation. China's scientific and technological strength has rapidly increased. The development of science and disruptive technology has a sizeable impact on society and other aspects of life [21]. Social life will gradually enter the era of intelligence.

4.2 Smart City and Smart Society

There is still confusion about what a smart society is, where its future will be, and also how it performs in comparison to smart city. Smart society and smart city, both with supportive technologies, such as information and communication technology, disruptive AI, big data and cloud computing, have similarity but are not the same. Strictly speaking, smart society which will bring all-round and systematic changes to China's social development is very different from the term of smart city which initially came from IBM.

The notion of smart city is more concerned with cities and urban areas, focusing on city management system, citizens and business, but, in terms of rural areas, nothing has been done for it. In contrast, human plays an even more central role in smart society, especially the public service of the community. In smart society, residents in metropolis, small towns as well as in rural areas play an important role, which have the access to service of smart health care, education, transport, and economic etc. With the model of the smart society, China strives to narrow the gap between urban and rural areas and pays more attention to the satisfaction of people's needs in the society as a whole.

In essence, smart society is an extension and next generation of smart city development, but there are still fundamental differences between these two concepts. On one hand, the construction of smart city more focus on the application of information and communication advanced technology such as wireless network, IoT (internet of things), sensors, cameras etc. The purpose of smart society is offering smart application and service to satisfy the needs of people' life based on big data, cloud computing and AI. On the other hand, the expression of smart city identifies an urban area that, through the widespread and pervasive use of advanced technologies, is able to address the social and economic needs of citizens in a new way. The smart society which not just refers to a smart city, but includes huge rural areas and residents in small towns, is a real revolution for China. Smart society refers to the use of smart means and tools to promote individual relations more inclusive and harmonious.

From smart city to smart society, there are three key issues needed to be concerned about.

- Focus on the software application based on early hardware (mainly imply ICT infrastructure) investment for the public service in key domains. Smart software applications such as smart parking application, smart healthcare application, smart governance application are able to connect sensors, user, vehicle, hospital, government agencies and so on at any time and in any place. Briefly, quick information should be available through smart phone apps by each individual [22]. One such key of cultivating smart mobility application is to develop the digital platforms. Through collecting, analyzing, processing data on digital platforms, the former investment will be switched into smart service.
- Persist people orientation, pay close attention to people's needs and investigate what factors hinder the smart application for inhabitants and improve public service delivery. In the concept of smart society, people is recognized as a key role and the quality of human's life is a crucial axis for the project. The fundamental purpose of launching smart society project is to benefit all the people of society with the development of science, technology and economy. For the purpose, Chinese government will make every effort to put all people's interests above all else, pay more attention to people's living conditions in society, ensure and improve people's wellbeing, so that all people are able to see that the gains of reform and development benefit in a fair way.

Narrow regional gap, which means rural areas equal with urban should be considered carefully. City is an important part of society, and the construction of smart city is also an important part of smart society. At the same time, rural area is less developed than but as important as city. The notion of smart society will pay more attention to the people living rural areas and the vulnerable groups. To narrow the gap between urban and rural areas and between regions, one of the key strategy is to build a three-dimensional, omni-directional and wide-ranging social information service system by taking cities and villages as the support of the strong and the weak. Poverty-stricken rural areas can rely on smart city construction, use information technology to narrow the development gap, eliminate the digital divide between urban and rural areas, regional digital divide. An effective way is to develop the central dominant city in the direction of the surrounding small cities and villages, to form a group of cities, the representative city cluster of such as Guangdong-Hong Kong-Macao Greater Bay Area, the Beijing-Tianjin-Tangshan city group and so on. Taking advantage of the predominance of central city, to drive the surrounding rural areas as well as small and medium-sized cities, develop smart application across the city and ultimately constitute the entire smart society (as shown in Fig. 2).

Compared with smart city, smart society has a wider scope and wider connotation, which includes not only transportation, government and medical aspects in smart city. The perception system of smart society is composed of sensors in cities, factories, villages, human bodies, automobiles and nature. Technology and innovation is the motivation of smart society. Artificial intelligence system and perception system make the city's sensory nervous system more intelligent and sensitive. Sensors continuously transmit all kinds of information from human society and nature to network space. Big data and artificial intelligence algorithm intelligently process all parts of information of intelligent city. Google cloud, Ali elastic compute service, Tencent cloud, Amazon

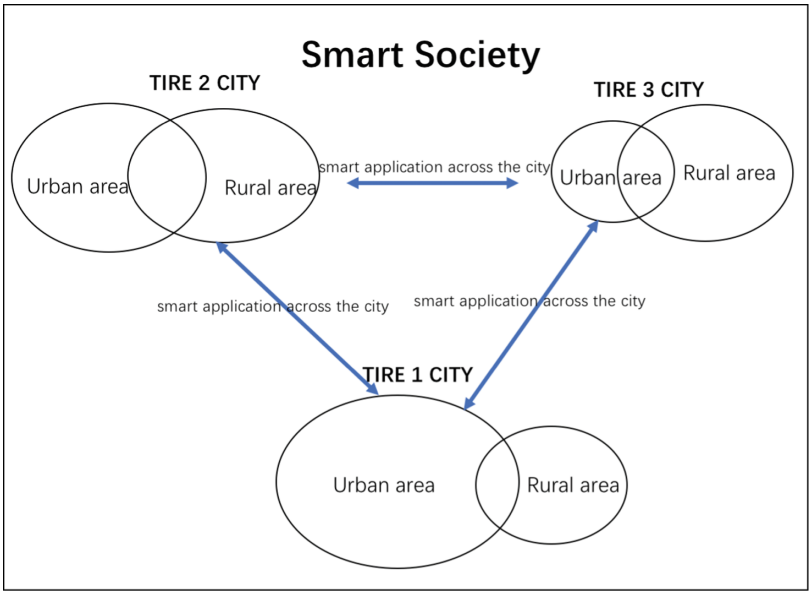

Fig. 2. Concept of smart society

cloud and other companies join in. Big data collected by IoT will be converted into a new type of intelligence by AI and cloud computing and will reach every corner of society. Around people's actual needs of medical treatment, education, social security, employment, pension, transportation and so on, we can make full use of big data and artificial intelligence to realize that everyone can enjoy high-quality services.

4.3 The Challenges of Smart Society

Despite the attractive vision of smart society, China continues to face several significant challenges in the course of smart society. Some challenges exist in the development of smart city, and some appear alongside with the development of smart society. Specifically speaking, the challenges come from administration, social system and ordinary people which should not be ignored.

The most acute challenges lie with cross-departmental and outward partnership and coordination of recourses, closely followed by financial support [23]. The challenge of cross-departmental partnership including the integration of the previous systems is related with interoperability, scalability, infrastructure organization, data privacy and security. Furthermore, the lack of cooperation will impede the construction of unified data platform and also have bad influence on the application of smart service.

The targets of smart society include urban citizens, rural residents, migrant workers in rural areas and so on, which has a certain degree of complexity. Regarding different types of people's social activities, requirements and awareness are different, and they have certain complexity. The awareness and participation of inhabitants is a key factor

for the success in smart city [24] as well as smart society and poor participation will hinder the utilization rate of application [25].

There are huge risks behind the widespread interconnection and high perception of society. China's relevant laws, regulations and management mechanism are still subject to improvement, and so there are gaps and weak links currently. The risks of personal privacy, business secrets and national security have been greatly increased. Data and information security issues have attracted the attention of all sectors of the society. In the case of high data sharing, once personal information is leaked or used improperly, it will bring harm to individuals or society [26]. It is necessary to strengthen legislation, reform the judicial system, formulate and implement laws and regulations to ensure information security, which are more suitable for the development of big data in a smart society.

The weaknesses of smart society should be anticipated and planned for. By doing so, China can both avoid the risks of failure and identify and mitigate them as they emerge. In order to address these challenges, the government will need to encourage greater private-sector participation in the initiative and at the same time ensure the robustness and security of its data servers and platforms.

4.4 The Future of Smart Society

The aim of smart society is to safeguard public interest and maximize value for society as a whole, rather than for individuals or companies [26]. Towards essential urban-rural transformation, individuals in urban and rural areas are able to get access to smart public services anytime and anywhere as the journey of smart society gradually turns from information-oriented to people-oriented and services-oriented and offers ubiquitous smart application.

Smart life comes from data. In the course of smart city construction, there is a big data widely collected, including camera data, activity location, action track, behavior data and so on. The original big data acquisition work is basically completed, and data preparation for interconnection and sharing is provided. These data are deeply developed and applied to effectively stimulate the improvement of public services in smart society. In the future, local government will deeply develop and restore the huge data generated by the daily work, study and life of billions of people, to construct a smart public services system and provide information support for people living in society anytime and anywhere, provide necessary services for people living in society, precisely meet he various needs of society beyond the differences of age, gender, region and language, and provide high quality for the whole society. The elderly, disabled and other vulnerable groups in society can also enjoy a comfortable and convenient life.

Smart technology which is the driving force to promote the emergence of smart society and also have a great effect on society. It encourages all sectors of society to participate actively and make effective use of frontier science and technology so as to form an innovative social form driven by production, life and governance cycle based on intelligence and data. Intelligent driving, 3D printing and intelligent manufacturing extend the movement and mechanical operation, and help the residents and producers of the smart society to complete the operation and construction of the smart society. A higher level of automation has made people have more expectations and leisure time in daily routine.

With an aim to establish information platform on smart public services including healthcare, traffic, public security and education, people's lives will be more conformable and sustainable. Smart hospitals, smart learning, smart government and smart home are the cells and foundation of smart society for individuals. Smart hospitals and telemedicine are developing in depth, so that electronic medical records and health records are popularized, big medical data are constantly gathered and used in depth, high-quality medical resources are freely flowing, appointments for diagnosis and treatment are made, electronic payment settlement reduces waiting time for people to register and pay fees, and the difficult problem of seeing a doctor in remote rural areas is effectively solved. Intelligence of social members and intelligence of technology drive people to be intelligent. The application of face recognition, fingerprint recognition and block chain technology is the embodiment of human being's intelligence.

Smart society also breaks the limitations of space and time, integrates the physical world and virtual space, and encourages the search for the joy and significance of individual social life. IoT is the junction between the material world and the virtual world. Machine and material are interlinked and integrated. Cyberspace is not a simple reflection of the physical world, but will become a new development space of human society.

5 Concluding Remarks

Smart society is not a utopia, and it is coming in China. The goal of building a smart society in China lays emphasis on residents both in urban and rural areas in the country by providing people with the integrated smart applications they need with AI, big data, cloud computing and IoT to improve the quality of life. The realization of smart society from central city to the surrounding small cities and villages, forming a group of cities, ultimately constitutes the entire smart society.

The solution of smart society is along with the state and issues of China which can also help solve social problems such as big gap between urban and rural areas, population aging, shortage of medical resources, environmental pollution and so on.

The journey of urban-rural transformation in China means China have developed its own path, theory and system with the complex national conditions and weak infrastructure, blazed a new trail for other developing countries to achieve urban-rural common development. It offers a new option for other countries such as Brazil, India with a large population and a huge gap between urban and rural development. For such countries, China offers a smart approach to solve the problems in human social development.

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