On Enhancement Approaches and Current Situation of New Type Smart Cities Construction in Small and Medium-sized Cities

-- A Case Study of "Smart Bengbu City"

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Abstract

Informatization, industrialization and urbanization are considered as the three major trends for the future development of cities, therefore, the construction of new type smart cities is just in line with the requirements of the new era and the future development trends of cities. The article firstly explores the origin of the smart city and the development status of the field at home and abroad. Furthermore, combining with certain hot issues and similarities in research of smart city, the article makes the deeper analysis of the current situations of Smart Bengbu City construction from the following aspects: "0552 project", smart government affairs, smart transportation, smart security, and smart urban training bases. Aiming at the key problems existing in Smart Bengbu City construction, the article holds that approaches to enhancing the construction in this field should be related to the following five layers: clarify the relationship between smart cities and smart governance, focus on the overall layout and precise positioning of the city, improve citizen participation and satisfaction, integrate urban public resources and strengthen regional collaboration, and accelerate the adjustment and upgrade of urban industrial structure optimization.

Keywords

Smart City; "Smart Bengbu City"; Enhancement Approaches.

1. Introduction

The change of the times has spawned transformation in urban development. From traditional towns to modern cities, and from traditional smart cities to new type smart cities, each transformation of the city not only tests city managers, but also tests every city residents. With the advent of the Internet and big data era, cities are endowed with new era connotations and new development requirements. Informatization, industrialization and urbanization have become the three major trends of urban future development. The construction of new type smart cities meets the requirements of the background of the new era and the development trend of modern cities.

Zheng Liming (2011) pointed out that the construction of smart city is not only the inherent demand for governance of urban problems and urban diseases, but also a rare opportunity to take the initiative to achieve leapfrog and innovative urban development [1]. Chen (2011) took "Smart Nanjing City" as the research object, and established the evaluation index system of smart city from four aspects: infrastructure, urban smart industry, urban smart service and urban smart humanities [2]. Ding Kekui (2012) discussed the structure of smart cities in China

from five levels: environmental perception layer, data center layer, business layer, service layer and user [3]. Chen Bo et al. (2013) pointed out that the essence of smart city construction is a comprehensive urban system project, which should highlight planning and design, resource integration, technological innovation and environmental optimization; and should strengthen system planning, overall coordination, intelligent application and institutional innovation [4]. Cui Qinghong (2019) studied the relationship between public willingness to participate in smart city construction and performance based on the theory of planned behavior. The results showed that the public willingness to participate in smart city construction had a positive effect on its participation behavior, and the stronger its participation willingness was, the more it would show the corresponding participation behavior [5]. Yang Juanli (2020) pointed out that COVID-19 was a touchstone, which made a thorough test on the smart city and urban efficiency. Furthermore, combined with the epidemic situation, this paper put forward the shortcomings of the current smart city development and the future development direction [6].

It is a significant research topic how to grasp this favorable opportunity to actively promote the construction of new smart cities, optimize urban governance and services, deepen the development connotation of small and Medium-sized cities, and improve the quality of life of citizens.

2. Origin and Development of Smart Cities

The term "Smart City" originated from the concept of "Internet + Internet of Things=Smart Planet" first proposed by IBM in November 2008 (see figure 1). Internet of things, interconnection and intelligence have been recognized by all countries as the three mainstream trends of social future development. In the following 2010, IBM put forward the vision of "Smart City" whose main view is that the six interconnected service systems of people, government affairs, communication, transportation, water and energy constitute the cities we live in. The core of smart city is to connect, integrate and coordinate the six service systems in the operation of the city with the help of a new generation of information science and technology, so as to realize smooth interconnection, and efficient and intelligent operation of urban resources, accelerate the informatization, industrialization and urbanization of the city, and then optimize the management and service level of the city, improve the quality of life of the citizens, and realize the coordinated, healthy and harmonious development of the city.

Since the concept of "Smart City" was put forward, it has been widely recognized by all countries in the world. After that, the implementation of smart city construction in the world has also shown a thriving trend. Among them, Dick of America, Paris of France, Stockholm of Sweden, Copenhagen of Denmark, Galway of Ireland, Barcelona of Spain, Incheon of South Korea and other cities have become model cities in the construction of smart cities. Japan's "i-Japan (smart Japan) strategy 2015" and Singapore's "smart country 2015" plan have become the empirical models of smart city construction, and have already ranked at the forefront of the world in terms of smart city construction. The smart city construction, operation mechanism and mature experience of these cities and countries have provided important reference and enlightenment for other countries and cities in the world.

In China, the concept of smart city construction was put forward in 2009, and then in 2010, Shanghai met the opportunity of the World Expo. The latest information technology was applied in all aspects of the park management, security, service and transportation of the World Expo, and the Shanghai World Expo was successfully built into a model of smart city. Beijing, Shanghai, Nanjing, Hangzhou, Guangzhou, Shenzhen and other cities also successively introduced relevant plans to accelerate the construction of smart cities in 2011. In December 2012, Ministry of Housing and Urban-Rural Development of the People's Republic of China issued the "national smart city pilot temporary management approach", which marked the

formal rise of smart city construction as a national strategy. In January 2013, 90 first pilot cities for smart cities were adopted. Statistics show that, up to August 2018, more than 500 cities in China have clearly put forward the construction of smart cities. It is expected that by 2022, the market size of smart cities in China will exceed CNY 25 trillion [7]. After the exploration in recent years, the research in the field of smart city in China can be divided into three stages: the first stage is the embryonic stage (2009 - 2013), during which the research hotspots of smart city focused on "smart city", "digital city" and "urban informatization"; the second stage is the exploration and development stage (2014-2017), during which, "cloud computing", "Internet of Things", "e-government", "big data" and "new urbanization" became research hotspots in domestic smart cities, and the third stage is the new smart city construction stage(2017 - present).

3. Current Situation of Smart City Construction in Bengbu City

Covering four municipal districts and three counties, Bengbu City (also known as Pearl City), which is an early established prefecture-level city in northern Anhui Province, is also an important comprehensive industrial base and transportation hub in Anhui Province. As one of the first 90 pilot cities of smart cities in China, Bengbu is committed to continuously promoting the deep integration of informatization and urbanization, aiming to build smart city construction as a new engine leading economic transformation, industrial upgrading and urban upgrading [8]. In recent years, Bengbu City has carried out an orderly integration of the city's information resources, focusing on relying on the platform of "0552 Project", intelligent transportation, intelligent security, intelligent government affairs and intelligent city training base to carry out the construction of "Smart Bengbu City", and the expected results have emerged. In the comprehensive influence evaluation system of China's new smart city construction and development, Bengbu gradually rose from the top 30 cities in 2016-2017 to the top 20 cities in 2018-2019, and ranked first in Anhui Province. These achievements are inseparable from the construction of "Smart Bengbu City" in recent years.

3.1. Construction of "0552 Project"

In order to strive to create a "Smart Bengbu City", Bengbu City has established a special public information management office, adhered to the "resource saving, human saving, technology saving" principle, and implemented unified management, coordination, guidance and supervision in the file of the city's public information construction work[9]. In recent years, efforts have been made to promote the informatization construction of big data cloud computing platform, Internet+government services, urban management, traffic travel, public safety and other fields, focusing on the construction of "0552 project". "0552" is the district number of Bengbu City. "0552 Project" means that the construction of "Smart Bengbu City" is contained in this district number. "0" represents zero retention of data sharing and zero distance of serving the people. The first "5" represents five horizontal platforms, namely, public management, public services, public information, public utilities and public emergency response platforms; the second "5" represents the vertical five application levels, namely city, county, street township, community village, grid ; "2" symbolizes two centers, namely big data cloud computing center and operation command and dispatch center, thus forming a complete closed-loop mode, so as to improve the systematic innovation of organs, the three-dimensional governance of urban and rural areas, the fine service of people's livelihood, and the development of industrial integration, which has laid a solid and powerful information foundation for building "Smart Bengbu City".

3.2. Intelligent Transportation

As an important part of building "Smart Bengbu City", the intelligent construction of the transportation industry in Bengbu has made great progress in recent years. It has achieved remarkable results in six aspects, namely, the intelligent public transportation, the digitalization of traffic law enforcement, the dynamic supervision and service informatization of road transportation, the highway informatization, the informatization of road passenger transportation and the informatization of dynamic governance. The development of smart transportation has accelerated the upgrading of the traditional transportation industry into the modern service industry, to promote the quality and efficiency of comprehensive transportation, green transportation and safe transportation, and improve the management level of the industry [10].

Intelligent transportation system applies advanced information technology, data communication and transmission technology, electronic sensing technology, control technology and computer technology to traffic management, which is a real-time, accurate and efficient integrated transportation management system. In recent years, the level of urban traffic information has made great progress, which basically meets the needs of economic and social development in Bengbu, and lays the foundation for consolidating the status of central city in northern Anhui.

Public transport information platform includes bus intelligent scheduling system, bus information management system, bus APP, bus video monitoring system, road electronic station card system, station safety management system, fingerprint patrol system, and city card system. For example, the city card system can play the roles in public transport, taxi service, small consumption and other areas of punch-card and Internet recharge functions, which helps users complete online recharge without leaving home, makes daily travel convenient, and brings passengers more safe, convenient, high-quality payment experience.

Since the public operation system of traffic law enforcement information platform has been running, the innovation of "zero discretion" of traffic administrative penalty amplitude has been realized, and the "fair, just and open" traffic administrative law enforcement environment has been created, which fundamentally curbs the occurrence of irregular law enforcement and uncivilized law enforcement. Thus, the goal of "zero complaints, zero reconsideration and zero response" of traffic administrative law enforcement has been fulfilled in the city for many years, and civilized and efficient law enforcement has been promoted.

The road transportation information service platform covers 96333 road transportation service hotline, taxi GPS command and dispatch system, two passengers and one danger monitoring system, and transportation management information system. Bengbu 96333 hotline (12328 now) system monthly receives 4,500 telephones, with annual telephone reception 50,000 pieces, and the public concerns about road transport services are effectively solved. Aiming at 2,606 taxis in the city, the taxi GPS command and dispatching system realizes the real-time positioning supervision, query the historical driving trajectory, statistics of vehicle mileage and other regulatory functions. At the same time, information such as lost property recruitment and text messages can be sent to the taxi. Transportation management information system realizes the comprehensive, real-time, and dynamic supervision of 54 passenger stations, 1,025 liner passenger vehicles, 128 tourist buses and 48,852 operating cargo vehicles in the city.

Highway information platform ensures the smooth flow of highway and bridges. The Municipal Transportation Bureau has established the safety guarantee systems for Jiefang Road Bridge, Chaoyang Road Huaihe River Highway Bridge and G104 Huaihe River Bridge, and monitored the traffic conditions of deck vehicles and shipping vessels under the bridge, to timely detect and deal with sudden accidents on the deck and under the bridge, and ensure smooth traffic.

Dynamic vehicle overloading governance interconnection platform has been established. Through the installation of dynamic weighing, video surveillance, LED display and other equipment, and application of vehicle capture recognition, information processing analysis, language alarm and other technologies, the annual inspection of vehicles reaches more than 1.5 million times, thus, all the vehicles should endure the inspection, which effectively combats illegal acts such as vehicle overloading.

The road passenger transport information platform has realized the functions of real-time positioning of passenger vehicles, route query, video view inside the vehicle, and online ticket sales, which greatly improves the passenger service level of Bengbu Auto Transport Group and greatly improves the safe operation environment of road passenger vehicles. Vehicle GPS positioning system can detect and stop illegal behaviors such as speeding and cross-line operation in time by recording and analyzing the driving status of operating vehicles.

3.3. Intelligent Security

Bengbu City attaches great importance to the prevention and control of social security, and takes it as the leading part in the construction of "Smart Bengbu City". Accurate positioning of social security prevention and control information construction goals is being conducted to achieve six protection networks control throughout the city: cloud data platform, public security integrated combat platform, video resource sharing platform, Internet integrated management platform, and Internet of Things security control platform [8]. The construction of these six social security prevention and control platforms should be synchronized with the planning and integration of "Smart Bengbu City".

The public security synthetic combat platform has opened the internal information resource sharing channels of public security, and has solved many cases, playing an important basic role in urban security.

Video resource sharing platform accesses to more video channels, and the city's video surveillance resources integration networking has been launched. City, county and district video patrol control platforms have achieved 24 hours "probe station" and "mouse patrol", and basically formed human and vehicle trajectory capture control as well as seamless connection.

The Internet integrated management platform is to build a "network social prevention and control network". Based on the full control of network exports of the three major telecom operators, the Internet integrated management platform has fulfilled the network security foundation strengthening, Internet node detection and control, mobile network WIFI and other big data gathering, and network space purification.

The Internet of Things security management and control platform adopts a market-oriented operation mode. Under the support of Internet of Things sensing and data processing technology, the accurate prevention and control of theft of "three cars" (bicycles; motorcycles; electrical bicycles) is carried out through the construction of 3,700 Internet of Things detection base stations in the city.

3.4. Smart Government

In terms of smart government construction, in order to save resources, reduce duplication of construction, and truly implement the "Internet+government service", Bengbu Municipal People's Government vigorously coordinates various departments to share information resources, allocates advantageous resource conditions for scheduling, and makes every effort to build the operation platform of government power list. The operation platform of government power list abandons the backward process of traditional paper declaration and manual examination and approval relying on departments, instead, the platform fully links county, township and village levels, realizes cross-level transfer and sequential processing of declared matters within the system, eliminates the interference of multiple applications of

applicants, greatly simplifies the processing link, and provides more convenience for grassroots people[9]. Up to 2018, Bengbu power list operation platform has been included in 24 units and 375 office projects to complete the data warehousing and integration of various departments in three counties of a city. At the same time, the efficient application of big data has achieved the goal of "one window acceptance, one station completion, and managing for whole city" for the city's government service matters. Basic public service matters can be processed online, and the goal of replacing citizens with data has been basically realized.

Among them, the public service portal platform ("Bengbu Family" for short), hosted by Bengbu Municipal People's Government and provided technical support and guarantee by iFLYTEK CO.LTD., is the key convenience service portal platform established in Bengbu City. Based on the city cloud data center, "Bengbu family" is committed to making convenient and efficient government affairs, convenience and public service accessible to ordinary people in Bengbu City by leveraging data resources such as service-related platforms. Residents can handle public service matters easily and achieve nearly 50 transactions online, only by means of login to the "Bengbu Family" network or using mobile phone-related applications. The declaration and handling of matters can be realized without leaving the household, and the inconvenience caused by the time consumed and the queuing waiting can be greatly avoided [8]. At the same time, the platform also covers many areas of people's livelihood, such as hospital inquiries, appointment registration; payment of water, electricity and gas; bus route inquiry; social security, public accumulation funds, traffic violations and other information query; restaurant, hotel, tourism and other information query, which fully embodies the "open, fast, sharing, and convenient" features. Citizens truly realize the convenience brought by the "Internet+ New Life" model and share the results brought by the construction of "Smart Bengbu City".

3.5. Smart City Training Base

The training base of Bengbu Smart City is a supporting project for the construction of "Smart Bengbu City". The training base has been constructed in the Science and Technology Park of Bengbu Economic Development Zone University in January 2014. It is also the first training base and display experience center in the pilot project of "Smart City" in China. The overall project of the construction of urban training base is cooperated with China Hewlett-Packard Limited Company. The project construction covers: the construction of intelligent learning and training platform for smart city training base, the display center of smart city achievements, the interactive experience center of smart city, the simulation control center of smart city, the multimedia conference center and an Internet Chinese will boxing academy[11]. The construction project of the city training base uses multimedia technology such as photo electricity to present the past, current situation and future of Bengbu smart city in an all-round way. Through anthropomorphic means, each organic system of the smart city is interactively displayed. At the same time, it becomes an important interactive teaching, experience and practice base and carrier for training personnel. The construction of urban training base can not only provide professional talents in design, management and operation at all levels for the construction of "Smart Bengbu City", but also cultivate and deliver excellent talents for surrounding cities and related fields.

4. Promotion Path of "Smart Bengbu City" Construction

The above analysis shows that the construction of "Smart Bengbu City" has made remarkable achievements, meanwhile, some shortcomings have been exposed: the problem of balancing the relationship between government governance and smart city construction, the rationality of urban planning and urban positioning, the problem of citizen participation and satisfaction, the allocation of urban public resources and the adjustment and upgrading of urban industrial structure. In view of the above problems, the following aspects can be optimized:

4.1. Rationalizing the Relationship between Smart City and Smart Governance

Smart governance refers to making full use of the interoperability, automation and intelligence of information technology to enhance the effectiveness of social governance and civic services [12]. The essence of smart city is to use the new generation of information science and technology to connect, integrate and coordinate the various service systems in urban operation, so as to realize the interconnection and efficient intelligent operation of urban resources. Therefore, the construction of smart city is also a booster for the government to transform from traditional social governance to smart governance. Smart governance is the core driving and goal guidance of the deepening construction of smart cities. Smart governance of cities needs to consolidate the foundation of smart city construction, create the concept cognition of smart society, and provide necessary hardware and software for smart society [13].

4.2. Pay Attention to the Overall Layout, Reasonable Planning and Accurate Positioning of Bengbu City

The construction planning of smart city should be appropriate to the geographical location, historical culture, politics, economy and the goals and tasks of urban construction, and should be overall layout, reasonable planning and accurate positioning. Located in the northern part of Anhui Province, Bengbu is in the middle reaches of the Huaihe River. As one of the birthplaces of Huaihe River culture, Bengbu is also an important comprehensive transportation hub city in East China and an important comprehensive industrial base in Anhui Province, with the reputation of "King Yu Meeting vassals Spot; Huaishang Pearl City". As the "Huaihe River Basin Central City" defined by the National Development and Reform Commission and the "Northern Anhui Central City" defined by the 12th Five-Year Plan of Anhui Province, Bengbu carries six major functions: financial services, commercial logistics, educational technology, medical services, integrated transport and tourism distribution. Therefore, the construction planning of "Smart Bengbu City" must be unified with the urban construction positioning, functions and development direction of Bengbu City, and the layout should be scientific, reasonable and accurate. It is required to gradually promote the construction of intelligent finance, intelligent education, intelligent medical treatment, intelligent tourism and intelligent transportation, and soon build a central city in the Huaihe River Basin and northern Anhui.

4.3. Improving Citizens' Participation and Satisfaction

The construction of smart city relies on the guidance, co-ordination, participation and cooperation of the government, enterprises and related organizations, and the active participation and cooperation of the general public. Citizens are not only important participants in the construction of smart cities, but also beneficiaries of smart city construction. They are not only representatives of their own interests, but also participants in the construction planning process and supervisors of smart city construction. Therefore, in the construction of smart city, it's important to avoid "favour one more than another", that is, focus on the planning and construction of smart city projects, but ignore the promotion, investment and use of smart city projects after completion, so that the participation and satisfaction of citizens are affected. Government departments should not only let the public know what smart city construction projects contain, but also let the public truly realize that these smart city projects bring efficient, convenient and high-quality services to their work, life and learning, so as to enhance the participation and satisfaction of citizens, improve the quality of life of citizens, and better promote the construction of smart cities. Therefore, relevant departments should effectively use newspapers, radio, television, the Internet and other means to strengthen the publicity and popularization of the knowledge of smart city construction, create a good atmosphere for all people to participate in the construction of smart cities, and encourage citizens to actively

participate in smart city projects, so that citizens can truly feel the changes brought about by the construction of smart cities and share the construction achievements of smart cities.

4.4. Integrating Urban Public Resources and Strengthening Regional Cooperation

The public basic resources, such as information resources, data resources, hardware and software resources which are needed in the construction of smart city, show two characteristics: the first one is the scattered distribution in various government departments, that is, the common phenomenon of "information island"; secondly, the distribution of resources in urban areas is not balanced. Most of the resources are concentrated in economic development zones and new urban areas, while resources in the old urban areas are less. The direct consequence of the excessive dispersion and unbalanced distribution of these huge and complex types of public infrastructure resources is the large waste of various resources, which leads to relatively low resource utilization and high difficulty in operation and maintenance, and the cost of government information construction has also significantly increased. The excessive dispersion of data hinders the systematic combing, deep knowledge mining and utilization of urban data, hinders the optimal utilization of data, and the value of data cannot be reflected. Application systems belonging to different departments are isolated from each other, unable to achieve interconnection and interaction, and the development of government collaborative work is difficult [14]. Therefore, in the construction of smart city, it is necessary to strengthen the cooperation between various departments and urban areas, break the "information island" and uneven distribution, and connect the interconnection, interoperability and integration of urban public resources between departments and regions, so as to improve the efficient operation of urban resources.

4.5. Promoting the Adjustment, Optimization and Upgrading of Urban Industrial Structure

As the old industrial base in the central region, the important comprehensive industrial base in Anhui Province and the core city of Hefei-Wuhu-Bengbu independent innovation comprehensive experimental zone, Bengbu has a strong industrial foundation. It has great advantages in traditional industries, such as building materials, textiles, wine making, and tobacco. In recent years, Bengbu City has made full use of regional advantages to accelerate the adjustment and optimization of urban industrial structure. At present, a "1+3" characteristic innovation industry system has been formed, which is led by new silicon-based materials and dominated by intelligent equipment manufacturing, biological manufacturing and high-end electronic devices. Moreover, the four municipal districts of Bengbu, relying on their own regional advantages, have formed distinctive leading industries in each region. These provide a good industrial foundation for the construction of "Smart Bengbu City".

With the development of human society, cities have grown greatly in number, scale, and population. The problems encountered in urban development are also increasing. The goal of smart city construction is to use the new generation of information science and technology to achieve its comprehensive, in-depth and coordinated integration with urban modernization, and promote efficient urban governance and green sustainable development. Small and Medium-sized cities should seize this favorable opportunity to gradually and orderly promote the construction of smart cities and realize the informatization, industrialization and urbanization of cities as soon as possible.

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