The Development Status and Model Exploration of New Smart Cities - Taking Shanghai and Hangzhou as Examples

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Abstract. Given our country's rapid economic development, the concept of smart cities has made rapid progress since its introduction and construction. This article divides the development characteristics of smart cities since 2008 into three stages: digital construction, information construction, and the application of new-generation digital technologies.This article finds that the current status of smart city construction in our country has problems, such as defects in the operation mode of smart cities, data sharing and security issues, and a lack of talent and funds. It compares the smart city construction practices of Shanghai and Hangzhou and formulates a smart city development plan accordingly.

Keywords: Smart cities, Development stages, Model comparison.

1 Introduction

1.1 Understanding of Smart City

Komininos proposed in 2002 that smart cities can be regarded as a unique spatial entity, characterized by the ability to provide the necessary environment for technological innovation on the one hand[1].In 2008, IBM first proposed the concept of "Smart Planet" and pointed out that "Smart cities should make timely and

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intelligent responses to various demands including public services, urban operation, environmental protection, and improvement of people's livelihood through information and communication technology, providing a deeper understanding of the concept of smart cities[2]."After that, scholars conducted extensive research on the concept of smart cities. Li Deren proposed that "Smart cities are the combination of the Internet of Things and data city technologies, based on urban digitization, and the measurable and visualizable urban operation status can be achieved by establishing analysis models"[3].Harries believes that a smart city is a city that fully connects IT, physical, commercial, and social infrastructures, and can make full use of collective wisdom. Shan Zhiguang pointed out that a smart city is an essential requirement for cities to move towards green, low-carbon, and sustainable development [4].Liu Shuyan and Li Sirui, from the perspective of public management, believe that a smart city is a way to analyze the intelligent way in which different subjects jointly participate in urban governance through the comprehensive design and systematic theory of technology, people, and the environment[5].Liu Ruijing et al. proposed the development concept for the road traffic construction of the new smart city in Tianjin [6]. Zhang Hongtao gave the architecture of the new smart city under big data technology.In 2024, the National Development and Reform Commission, the National Data Bureau, and other departments jointly issued the "Guiding Opinions on Deepening the Development of Smart Cities and Promoting the Digital Transformation of Urban Areas", proposing specific measures from five aspects, including promoting the digital transformation of cities in all fields and enhancing the support for the digital transformation of cities in all aspects, marking that the construction of smart cities in China has entered a new stage of in-depth development[7].As a result, the concept of the new smart city was proposed and continuously deepened. Because the concept is grand and involves a wide range, there are many types of literature that interpret and explain it, and the scope of research is gradually expanding.

1.2 Characteristics of Smart City

Regarding the characteristics of smart cities, Zhang Yongnian believes that smart cities are a closer combination of human wisdom and information application. Data collection and storage are formed through urban infrastructure detection and sensor systems, including the main characteristics such as deepening intelligence,

interconnection, exchange and sharing, and collaborative application[8].Zhang Taoxin et al. interpreted the concept of smart cities proposed by IBM and proposed that the characteristics of smart cities should be perception, interconnection, and intelligence[9].Gong Jianya et al. compared digital cities and extended the characteristics of smart cities, which are manifested in the acquisition of real-time dynamic information, close interconnection, and the application of analysis, prediction, and decision-making after information generation, and thus obtained the challenges and problems to be solved. However, in recent years, the understanding of the characteristics of smart cities has gradually changed and innovated:

The first is to clarify the people-oriented concept. Due to the gradual maturity of resource sharing, information systems, and data management, in 2016, against the background of the development of big data technology and 5G, Yang Kaizhong et al. believed that the construction of new smart cities should focus on improving local quality and build a people-oriented new smart city by strengthening total quality management [10].Urban planning directly serves the requirements of urban residents through the management of urban space and is problem-oriented [11]. The main characteristics of smart cities have changed to "people-oriented" and "intelligent industries".

Second, the construction subject has shifted from government-led construction to multi-governance. The early stage of the construction of smart cities in China was led by the government, and infrastructure construction plans were formulated according to the development situation, and the relevant responsible departments coordinated the work processes of each link in a coordinated manner.With the rapid development of Internet enterprises, key developing cities seek to change strategies and accelerate residents' participation and facility deployment. The construction of smart cities has shifted from the government-led layout of information infrastructure to the tripartite cooperation of the government, enterprises, and the public, from the "supply side" to the "demand side", insisting on benefiting the people with information as the core of the development of smart cities [12], and paying more attention to the individualized needs of urban residents.

Third, Shifting from traditional single-scene applications to perceptible multi-scene applications, different cities seek to explore smart city models adapted to their local development environments, such as realizing public service intelligence through smart healthcare, smart grid, smart transportation, smart government, and other scenarios, and realizing industrial intelligence through smart logistics, smart factories,

and so on. At the same time, China's smart city realizes the perception, connectivity, and intelligence of the way from the traditional government to develop the evaluation system to the government and the Internet enterprise operation and management cooperation.

Fourth, it has shifted from the application of information management systems to the application of new-generation digital technologies. The application of technologies such as the Internet of Things and big data plays a greater role in the construction of new smart cities, is more in line with the needs of residents, and develops differentially by using comparative advantages, exploring the value of digital elements. Different cities give full play to their local advantages and characteristics.

1.3 Smart City Practices

Around 2009 in China, in-depth research was conducted on the concept of smart cities, and based on this, plans were made to build smart cities to meet people's needs and facilitate residents' lives. In 2013, the Ministry of Science and Technology and the National Standardization Administration Committee listed 20 cities such as Xi'an, Nanjing, and Chengdu as national smart city pilot and demonstration cities, and they will take the lead in carrying out pilot and demonstration work. The development of smart cities in China officially began. Under continuous attempts and research, the development of smart cities in China can be roughly divided into three main stages:

Smart City 1.0 period: 2009 – 2013. The construction of urban informatization was in its infancy. It was evolving from traditional paper file records to digitalization, and the communication and network infrastructure was not perfect. The construction of smart cities in China mainly relied on telecommunications operators and government investment projects[13], and the construction focus was mainly on information basic networks and smart industries. Meanwhile, each city took the construction of "Broadband China" as the overall goal and developed the construction of "Wireless City", focusing on the construction of wireless networks and optical fiber networks, emphasizing the smoothness and convenience of urban communication and exchanges, and forming an information network with wide coverage and connections to multiple regions. At the same time, the National Development and Reform

Commission proposed that the construction of smart cities is an important part of new urbanization.

Smart City 2.0 Period: 2014-2019. During this period, communication engineering and wireless networks began to take shape, and relatively developed cities built a certain foundation of informatization facilities and achieved regional networking. The development research, planning, and deployment at this stage are significant to developing smart cities.In August 2014, the state approved an important document related to smart cities. As the first systematic document for the construction of smart cities in China, it also proposed the National Information Benefiting the People Project, benefiting the people as the fundamental goal of informatization and smart city construction [14].In 2015, in the "Fourth China Smart City Development Level Evaluation Activity" organized by the Informatization Research Center of the Chinese Academy of Social Sciences and the Guomai Internet Smart City Research Center, 100 cities participated in the evaluation. The development of cities in various regions is unbalanced. Eastern cities are relatively leading [15], but the information systems among various units are relatively independent, and there are certain information barriers.Meanwhile, the overall process is mainly passive governance. Each department of the city uses technical means such as information systems and databases to collect and store data but does not deeply explore the value of data elements and utilize the trend of data analysis in scenario applications, which is not of great help to public services.In the overall development pattern of smart cities, most cities are of the "individual breakthrough" type. Relatively developed cities have advanced concepts and a high degree of completeness of information infrastructure, and there is a large digital divide problem in urban areas.

Smart City 3.0 Period: 2020 - Present. During this period, the application of a new generation of digital technologies has given smart cities a more powerful development engine, from technology-driven in 1.0 to innovation and sharing in 2.0 [16], to intelligent management in 3.0.The construction of new smart cities has been continuously advancing. The cost of data collection and storage has gradually decreased, and the ability to process information has significantly enhanced. For example, in terms of emergency management capabilities, it has shifted from improving the efficiency of solving public problems to using data to predict trends

and avoid highly possible problems.At present, China has completed a large amount of infrastructure construction. In February 2023, the Central Committee of the Communist Party of China and the State Council issued the "Overall Layout Plan for Digital China Construction", proposing the work arrangement of digitally driving Chinese modernization to build a big data platform and provide public services for urban management. Relatively developed cities adopt a digital base to form real-time monitoring of urban data and adjust new models to integrate efficient and convenient service platforms and smart applications.

2 Current Problems in Smart City Construction

Although relatively developed cities have entered the Smart City 3.0 stage through the construction of information infrastructure and the establishment of big data platforms, most cities still face a series of problems.

2.1 The Operation Mode of Smart Cities Still Needs Improvement.

Most cities have a shallow understanding of smart city construction. The construction direction does not conform to their own actual situation, or is similar to the management mode of other cities, ignoring their own development advantages and characteristics.The construction of smart cities has still not broken away from the government-led model. Currently, the development of smart cities urgently requires the government to carry out various plans for the overall goals, conduct in-depth investigations, and clarify the development priorities. Most provincial and municipal governments have launched government affairs websites and convenient software to improve the level of services for the benefit of the people, but there are generally problems such as data lag and low management efficiency. The institutional mechanisms for the construction of smart cities still need to be improved.

2.2 Data Sharing, Governance, and Security Issues Need to be Further Improved.

At present, most of the smart city information systems are still in the early stage of construction. There is a big gap in the development of high-tech industries in the city, and the data platform construction still needs to be improved. However, with the

expansion of the application of information systems and the adoption of new digital technologies such as big data and cloud computing, data-related problems in smart cities need to be solved urgently.

First,there are information gaps and digital barriers. Collaborative cooperation among different institutions requires data sharing and information exchange to ensure the real-time consistency of participants from various departments in the smart city.In the absence of a good management system, data can not be deeply excavated and empowered, which usually complicates daily work and also prevents effective data sharing between departments, resulting in poor data interoperability.

Second, it is necessary to shift from "passive governance" to "active governance". The response to internal urban problems changes from seeking solutions after the problem occurs to being able to predict trends based on data and prevent the development of some situations in advance. Since smart cities need to increase the concentration of information and there is a large amount of data to be processed in the same period, it is necessary to establish an effective early warning mechanism to improve the efficiency of problem-solving, use data analysis and artificial intelligence to assist in decision-making and simulate the policy-making process. Use information system technology to build an urban simulation system to detect and calculate the results of variables.

Third, data security issues need attention. While requiring the sharing of data analysis results, government information, and industrial information also need security protection. Data security is one of the most important issues after the development of smart cities has entered the 3.0 stage. China has issued legal policies on security rights and interests, which still need to be continuously practiced and explored.

2.3 The Lack of Talent Technology Funds

The capital required for construction and operation is increasing, and the requirements for specialized personnel, technological upgrading, and capital investment after the start of the project are increasing, and the financial pressure on the finances of some cities continues to rise and become unsustainable.

3 Advanced Experience of Smart City Construction

Shanghai and Hangzhou have deployed smart city construction respectively. The continuous exploration of technology applications and management mechanisms presents a new way of smart city development for relatively developed cities in the 3.0 stage of a smart city.

3.1 Shanghai City Integrated Operation Platform

The main characteristics of the construction of a new type of smart city in Shanghai are the unified deployment of the whole city, high technical level, and rich application scenarios.

The unified command system and grassroots governance system of the whole city.
Shanghai first established a complete command system, and its construction principle was to assign responsibilities to individuals and combine departments. Smart city managers are effectively allocated according to departmental functions. At the same time, attention is paid to innovating the grassroots governance system, and the fragmented work is decentralized to the network and subdivided into the network.At present, Shanghai has a total of 16 districts, 234 county-level management units, the construction of 5,307 responsibility networks, and the full realization of personnel equalization. Departmental personnel form a management coverage network from top to bottom, forming a linkage with the intelligent discovery of the smart platform, and conducting manual verification of related issues. The entire system has a reasonable deployment of responsibilities, and the problem-solving is efficient, with full integrity and unity.

The unified data platform of the whole city. Shanghai adopts a unified big data platform as the urban database, combines grid management, establishes different processing modules, builds a "server" that accompanies the flow and operation of the city, uses the application of big data and cloud computing to connect information in series, and drives the intelligent platform to automatically analyze the current problems and demands of the city.Geographic layers were input into the intelligent platform, including component, pipeline, construction site, community, and personnel

management information. Urban portraits were depicted with geographic information, and precise models of landscapes and buildings were constructed to form a data-supported 3D virtual city. At the same time, a problem discovery mechanism of "active + passive + automatic" was established, and information models were used to prevent problems and improve the efficiency of solving urban problems.

Rich application modules of smart technologies. Shanghai has developed multiple application modules of smart technologies. First, the application of historical and cultural relics protection. Using Internet of Things sensors for automatic sensing to achieve information collection and processing. For example, in the protection of historical buildings, the platform information can be quickly combined to determine the processing flow. Second, the application of illegal building handling. Human-computer interaction is adopted, and relevant information on illegal buildings is obtained through database comparison and big data analysis. Artificial intelligence connects the monitoring situation of unmanned aerial vehicles, combines remote sensing automatic identification and manual on-site verification, and pushes relevant information to areas where illegal construction is more likely to occur, increasing the number of active inspections. Third, the application of gas handling. User behavior analysis is conducted for non-residential users who do not change gas tanks for more than one month, and the main characteristics and behavioral motivations of users are investigated to improve the efficiency of property management in the community. Fourth, the application of glass curtain walls. Use artificial intelligence to analyze the reasons for the damage of 30 glass curtain walls, study the life cycle of glass curtain walls, use artificial intelligence to check the safety of curtain walls, and at the same time set up glass cleaning robots to clean the glass curtain walls on time.

3.2 Hangzhou 's Smart City Upgrade Based on Traditional Digital Urban Management

Hangzhou, unlike the unified deployment of Shanghai, uses traditional exploration experience to carry out model upgrades and technology upgrades respectively, and adopts a new operation mode of scene-based and grid-based.

Upgrade the traditional grid management model with "Five Major Managements". First, management of people. Relying on the ten-thousand-meter

unit network, through purchasing services, people, positions, and areas are determined in the grid to ensure that there is at least one manager in each network, responsible for the management of city appearance, land, planning, housing management, and traffic management.

Second, management of matters. Everything should be implemented and everything should have a reply. Take the rainwater well-cover facilities as an example. Classify the facility category as municipal public facilities. Refer to the "Regulations on Urban Appearance and Environmental Sanitation Management of Hangzhou City", summarize the filing conditions and responsible subjects, and divide the management period by professional departments.

Third, benchmarking management. Complete the overall planning and construction of smart cities according to national standards, and pay attention to public opinions.

Fourth, management of objects. Carefully manage the data storage and data update of the parts database.

Fifth, the scene management. Through the way of streaming media, traffic, city appearance, and other issues, and improve the moral quality of residents.

Upgrading citizen participation in urban management through "caring city management". Citizens can participate in the city's internal problems, through text voice messages, site photos, etc., the process of handing over, the public's concerns to adjust the improvement of standards. Improve the efficiency of service to the public through open forms of data, such as finding parking spaces, path guidance, and parking resource utilization;Establish convenient service points, such as for unlicensed vendors in the same location, for the same event, with the same norms, and unified guarantee; reflect humanistic care, such as inquiries about fishing spots near home; implement the "maximum one visit" government service reform for residents.

Upgrade the construction path of smart cities with "Exploration of Smart Scenarios". Hangzhou has carried out the scene-based exploration action of smart cities. At the municipal level, a "cockpit" is constructed for overall planning. Various line systems, such as parking, tourism, and environmental protection systems, conduct data aggregation at the municipal - district - street levels and complete data exchange in the urban brain center.

4 Scheme Design for the Construction of Smart Cities

To solve the problems in the construction of the smart city, and concerning the advanced exploration of Shanghai and Hangzhou, a program for the construction of the smart city is proposed:

4.1 The Deployment Method Combines the Unified City-Wide And Intelligent Technologies.

Build a unified digital platform, or select different scene modules to subdivide the tasks of smart cities. The information module is required to have the ability to detect problems and arrange manual verification of the work progress in real-time.

Strengthen data mining and analysis, including retrospective analysis (performance assessment), guiding analysis (simulating scenarios to guide work, matching personnel with positions and personnel affairs to generate the maximum management efficiency), and decision-making analysis (reducing management risks and forming early warning and prediction).

Functional positioning:

Peace and comprehensive governance: Population, cases, monitored objects, hidden danger points and risk points, and ways of reporting cases.

Urban management: Clean and orderly, empowerment of the grid platform, and ecological network of the grid platform.

Livelihood services: Key community management, unified standard principles at the grassroots level of streets and towns.

4.2 Explore the Scene-Based Grid Upgrade Method Step by Step.

Cities should be based on traditional grids, utilize the new generation of digital technologies, and combine a specific event or scene, such as component physics, information collection, management responsibilities, service deepening, and grassroots governance, to deploy the construction of smart cities. In terms of specific deployment methods, each department needs to achieve individual breakthrough innovations through self-organization.

5 Conclusion

Smart cities enable management departments to make the transition from passive governance to active governance. Their construction needs to implement individualized development according to the different conditions of cities. However, advanced urban cases can be used for reference as guidance. The construction policies pioneered by cities such as Shanghai and Hangzhou help improve the efficiency of other cities in information systems and urban information management. Our country should continue to attach importance to the construction of smart cities and promote deployment and planning in different fields.

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