Research on Smart City Construction in Xinyang

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ABSTRACT

With the accelerated expansion of mobile Internet and industrial information technology applications, exploring the efficient path of intelligent urban transformation has become an important issue for urban managers and academia alike. Significant progress has been made in constructing smart cities in China. First-tier and second-tier cities, such as Beijing, Shanghai, Shenzhen, and Wuhan, have formed advanced practical cases. However, it is worth exploring how third-tier and fourth-tier cities can combine local characteristics to realize intelligent transformation. The research group of the present study investigated and analyzed the current situation of smart city construction in Xinyang to put forward relevant suggestions, including optimizing top-level design, improving information infrastructure, and promoting data sharing.

Keywords: *Smart city, urban governance, top-level design*

1. INTRODUCTION

Since the 21st century, rapid population growth and urban expansion have reduced the area of arable land, furthered traffic congestion, increased environmental pollution, and introduced additional problems. As such, refined urban governance has become urgently needed. With the rapid development of blockchain, cloud computing, big data, and other technologies, smart city construction has become an advanced stage of urban governance. In 2016, the 13th Five-Year Plan for National Informatization listed smart city construction as a national priority action. In 2021, the 14th National Five-Year Plan pointed out that the construction of novel smart cities should be promoted in a graded and categorized manner. Many cities in China have constructed novel smart cities and gained remarkable achievements in innovating social management, safeguarding, and improving people's livelihood [1].

2. LITERATURE REVIEW

IBM introduced the smart city concept in 2009, which has sparked a new wave of smart city construction worldwide [2]. Smart cities can make life easier for residents and are associated with economic growth, human productivity, and the competitiveness of local communities. To solve a series of problems caused by rapid urban expansion, Andrea Caragliu et al. [3] posited

that smart cities should be developed in seven dimensions: smart economy, smart environment, smart transportation, smart population, smart home, smart space, and smart government. Through proprietary data, Chiara Del Bo et al. [4] demonstrate that smart cities can raise people's concern for the urban environment and stimulate innovation. Multiple studies have confirmed that smart city construction is an effective path to modernize urban governance and can build jointly constructed, jointly governed, and jointly shared social governance systems in the new era.

Many of the case studies on smart cities in China focus on introducing the current situation and summarizing the experience of smart city development in first- and second-tier cities. For example, Jiang Weiwei et al.[5] selected Shenzhen as a novel smart city construction model in their study "Theoretical Research on Novel Smart City and Practice in Shenzhen," introducing several typical cases for top-level design, institutional mechanism, and cyber security, among others. By calculating the multiple dimensional scores and comprehensive evaluation results of cities around Shanghai, Zhang Haipeng et al. [6] concluded that smart city construction and economic development are closely related spatially in the Yangtze River Delta region, where both present a networked spatial pattern with Shanghai as the core and several cities as the center. Among the available research results, there is a lack of case studies on smart cities in third- and fourth-tier cities. The present

paper presents an objective analysis of the current situation and problems of smart city development using Xinyang City in Henan Province as an example. This paper also proposes solutions based on the characteristics of Xinyang City to provide valuable references for the construction of third-tier and fourth-tier cities, including Xinyang City.

3. CURRENT STATUS OF SMART CITY CONSTRUCTION IN XINYANG

Xinyang City, a prefecture-level city in Henan Province, is located at the intersection of Henan, Anhui, and Hubei Provinces. It is also at the intersection of the Huai River Ecological Economic Zone and the Central Plains Economic Zone, which represents a major national economic location. For five consecutive years, Xinyang City has been ranked on the New Tier 1 City Institute's ranking list of cities' business attractiveness among the third-tier cities. Xinyang City's gross domestic product in 2021 was worth 306.496 billion RMB, with a real growth rate of 6.5% compared to 2020, and the economy has been increasing steadily over the years. As early as 2015, the Xinyang government has mentioned in a report on the work of the government that the construction of a smart digital city would be promoted in greater depth, and the refined, digitalized, and market-oriented management of the city would be continuously strengthened, indicating that Xinyang City has entered the stage of smart city construction.

3.1. Multiple Policy Initiatives to Bolster Urban Development: A Strategic Focus

In 2015, the General Office of the Henan Provincial Government issued the "Work Plan for Promoting the Healthy Development of Smart Cities in Henan Province (2015–2017)," which made deployments to promote the construction of smart cities from multiple aspects and integrate urban governance and digitalization. The Guiding Opinions on Accelerating the Construction of Novel Smart Cities released by the General Office of the Henan Provincial Government in 2020 provided cities within the province with a roadmap to promote the construction of smart cities and enhance the modernization of the city's urban governance. In response to the policy initiative, Xinyang City has made "vigorously developing the digital economy" a necessary action in the "14th Five-Year Plan for Economic and Social Development of Xinyang City and 2035 Long-Term Objective Planning." Several goals are proposed to promote the construction of smart cities in central urban areas, accelerate the construction of 5G base stations, build a fully 5G-covered network in townships and rural areas and beyond, and build 3-5 demonstration counties of the digital countryside.

In 2021, the Development and Reform Commission of Xinyang City formulated the "Three-Year Action Plan for the Digital Economy of Xinyang City (2021-2023)," which listed "implementing the construction project of a novel smart city" as a key task, aiming to promote the experience and practices of various places in exploring development paths, management methods, promotion models, and guarantee mechanisms through selecting typical application scenarios, to strongly advance the process of smart city construction of Xinyang City.

3.2. The Construction of Information Infrastructure has Become Increasingly Sophisticated: Infrastructure Support

By the end of 2021, there were 5109 operational 5G base stations in Xinyang City, covering the county, townships, and rural hotspot areas. The broadband network speed improved when China Mobile opened its first group of 5G 700M base stations in the Youhe Township of Shihe District on September 27, 2021. Since the widespread use of the Internet, smart city applications have gradually encapsulated people's daily lives. The establishment and implementation of information infrastructures, such as 5G and big data, are becoming increasingly sophisticated, thus improving the intensive management level of the city. Xinyang has been strengthening its cooperation with three major communication groups, such as by developing a platform for digital urban management with China Mobile, developing platforms for smart police and smart traffic with China Unicom, and building the cloud-based government information system of the Xinyang Branch with China Telecom, all of which have led to a boost in Xinyang's information infrastructure. The rapid development of "Digital Xinyang" has incorporated all critical areas, such as education, insurance, medical care, agriculture, and transportation, into the network platform management. Taking the digital city management center platform as an example, it has handled nearly 200,000 urban management issues between 2017 and 2020, tackling hot spots and addressing public concerns, further modernizing urban governance.

3.3. Applications in Typical Scenarios to Improve Citizens' Lives: A Data-driven Approach

Xinyang City has integrated data elements with knowledge in multiple fields and utilized various smart applications in different scenarios to improve citizens' quality of life and sense of well-being [7]. In the medical center, Xinyang City has transformed traditional practices into intelligent ones and improved the informatization of medical infrastructure through increased investment, thereby improving the efficiency of people's medical treatment and alleviating the burden of medical treatment during epidemics. In terms of

logistics, the Xinyang government collaborated with JD.com on the Smart Logistics of the Dafang City project to reduce logistics costs and improve the distribution network, providing residents in Xinyang with better services. In tourism, Jigong Mountain Scenic Area in Xinyang City has been developing a smart interactive platform for immersive cultural tourism based on VR and AR technology since 2017. It enabled the interconnection of multiple systems and enhanced tourist experiences. Moreover, based on the characteristics of the tea industry in the city, Xinyang Government Services and Big Data Agency and China Construction Bank of Xinyang Branch jointly launched a cloud-based platform for tasting Maojian tea from Xinyang. This project promotes the transformation and upgrade of Xinyang's tea industry through exchanging data related to the tea industry, thus benefiting people's livelihoods. Xinyang City has developed several typical applications and cases designed to enhance residents' quality of life by taking advantage of its data empowerment.

4. PROBLEMS IN THE SMART CITY CONSTRUCTION IN XINYANG

4.1. Insufficient Top-level Design and Over-emphasis on Strategy Over Implementation

Xinyang City has introduced several policy initiatives, such as the "Master Plan for Novel Smart City (2018-2025)" and "Three-Year Action Plan for the Digital Economy of Xinyang City (2021-2023) ", which demonstrate the importance the government attaches to the construction of smart cities. Although the introduction of these policies provides some high-level guidelines for smart city construction in Xinyang, the specific contents of the policies are too broad and vague to be useful in practice. Too many leading departments and executive departments are involved in the process, causing almost all levels of government at the city, county, and district levels to be involved. The leading departments do not coordinate the work on the digital economy well. Furthermore, they have limited authority to manage executive departments, which inevitably results in each department managing itself in its own way, leading to a waste of resources.

Compared with large cities like Shanghai and Shenzhen, Xinyang City started its smart city construction relatively late. Due to the construction theory and the lack of understanding of the concept of a smart city, the government blindly followed the trend of smart city construction during the top-level design and ignored project implementation. Although the Xinyang government invested hundreds of millions of dollars to build smart communities and industrial parks, the lack of project monitoring and assessment has ruined some parks. When smart city construction projects cannot be thoroughly and thoughtfully carried out, it will only increase the financial burden and violate the principle of sustainable development.

4.2. Unequal Infrastructure Development and Low Public Participation

Xinyang City has already begun smart city construction in counties with better information infrastructure, such as Guangshan County. It plans to gradually improve the smart level of the entire county and region. The beneficiaries, however, are not adequately covered. By the end of 2021, the number of rural residents in Xinyang City was 3,022,500, accounting for 49% of the city's population. A large proportion of rural residents receive poor quality public services in terms of medical care, education, employment, and so on. They do not fully benefit from technological advancements. Due to the complex terrain and inconvenient traffic, some rural areas do not have access to 5G networks. Moreover, smart city construction has not been widely applied in the application terminals [8]. According to the results of online research on the situations of residents during the construction of the Xinyang Smart City conducted by Xinyang Government Services and Big Data Agency in 2020, some existing government affairs platforms are not digitalized enough and are less personalized, making it challenging to meet the needs of various types of residents.

Furthermore, some residents in poor areas do not know about the innovative platforms and are still accustomed to using manual methods for handling personal business activities, reflecting the low level of participation of the public in intelligent applications. Though the digital grid management method has been used in Xinyang City's central urban area to screen, monitor, and dynamically track individuals infected with COVID-19 during the epidemic, most counties and districts are still manually collecting information and conducting door-to-door inspections. These methods reduce working efficiency and make it difficult to socially distance residents.

4.3. Data Integration is Difficult and Technical Limitations Have to Be Overcome

In recent years, Xinyang City has launched several important informatization projects, including intellectualizing the design of the digital city management system and integrating video surveillance network applications for Xinyang's public security, which ultimately improves the level of refined urban governance. However, there is a lack of coordination between these projects. The project data of different construction units are not effectively integrated, resulting in difficulty in data management, querying, and updating. Government-enterprise cooperation projects often face problems in fully sharing data and exploring their

economic value due to objective reasons, including ineffective mechanisms, uncoordinated interests, and inconsistent systems. As part of the construction of smart cities, data integration is an important element. Additionally, determining how to break down the barriers between the various levels of government and industries is essential for speeding up the construction of smart cities.

Security issues have emerged in the construction of smart cities. While Xinyang City has invested in information security and periodically updated its software and hardware to enhance its security, the combined influence of inadequate professionals and the improper use of funds makes it difficult for local projects to overcome technical difficulties. Besides, because cloud platforms and database construction heavily rely on external systems, local information management becomes a passive activity, and security issues, like leaks and illegal disclosures, remain a serious problem.

5. RECOMMENDATIONS TO PROMOTE SMART CITY CONSTRUCTION IN XINYANG

5.1. Optimize Top-level Design to Guarantee Sustainable Development

Smart city planning is a long-term, dynamic process. Its top-level design needs to maintain a certain level of flexibility and extensibility. To fit the social characteristics of the rapid iteration of information in the new era, smart city construction in Xinyang City should be adjusted in terms of the details and boundaries based on the existing planning. Since Xinyang City enjoys a superior ecological environment and the primary conditions for developing high-tech, high-efficiency, low-energy, and low-pollution industries, extending and deepening the green smart industry deployment and quickly establishing joint management enforces an upper and lower linkage pattern. The government departments in Xinyang need to open vertical and horizontal communication channels, provide timely feedback on work progress, and complete planned tasks with sufficient quality and quantity.

Considering the trend of blindly following construction and neglecting project implementation, it is urged that the government should explore the establishment of a performance management mechanism for the entire life cycle of key projects to provide continuous assurance for the success of projects. Project performance management should strengthen the performance evaluation before and during the project and assess the project effects. Therefore, any problems can be corrected in time to keep the project on track, and the project's quality can be improved. In addition, the Xinyang Government can improve the guaranteed system

in terms of policies, such as amending preferential policies in terms of finance and taxation, by providing credit support for projects that promote a low-carbon economy. This will encourage smart industries to pay attention to saving energy and reducing emissions to promote the sustainable development of the city.

5.2. Strengthen the Information Infrastructure and Promote Co-construction by Multiple Parties

According to the target in the "Three-Year Action Plan for Digital Economy Development in Xinyang City (2021-2023)," Xinyang City should build 8,000 5G base stations by 2023 to achieve a comprehensive network coverage in areas above townships. It is recommended that the municipal departments adopt an integrated model for the unified management and construction of informatization projects during the construction process. The departments should consider each county's construction scale, financial level, and technical guarantee to effectively solve the problem of unequal informatization levels from region to region. To accelerate the construction of 5G base stations, it is recommended that the approval procedure should be reformed, a fast channel for the construction of 5G base stations should be established, and the approval items and period should be reduced.

The arrangement and application of information infrastructure need to be oriented by public demand and give full play to the benefits of various resources. The government of Xinyang should further strengthen cooperation with local universities, research institutions, enterprises, and other social organizations; provide financial and political support for communication among different parties; and stimulate the passion of various civic groups to participate in the construction of the smart city for co-constructing a smart city. Xinyang City needs to proactively explore the employment of advanced information technologies in education, agriculture, manufacturing, and other fields; promote the application of online government affairs platforms, and sustainably enhance the well-being of residents through the improvement of information infrastructure construction.

5.3. Promote Data Sharing and Ensure Cyber Security

At present, the smart city construction in Xinyang is dominated by every department's separate development of different databases and information systems. However, in the future, it will be necessary to build a unified and citywide big data platform and strengthen the convergence and integration of data resources across the city. In terms of management, government departments need to set up a dedicated team to develop the city's unified data resource directory, establish working

standards for tracing data, and bring together data from various industries and fields to the city's big data platform in a timely and efficient manner. Moreover, it is recommended to set up a data-assisted system for decision-making. Through data integration, processing, and analysis, the government can better follow and manage the progress of essential tasks, like epidemic prevention and control, which is vital to making scientific decisions. The government can be held accountable in cases where individual departments do not cooperate in sharing resources and affect the quality of data processing. In terms of technology, an innovation mechanism combining industry, academia, and research should be established; investment in the research and development of core technologies for smart cities should be increased; and professional technical talents should be introduced to overcome the technical challenges of data sharing. Using technology wisely can also encourage data sharing and minimize cyber security risks. For example, blockchain technology is decentralized. A network platform built using blockchain technology can enhance the trustworthiness of government data, and the security and reliability of data use between different parties.

6. CONCLUSION

Driven by urban demand and mature technologies, smart cities are rapidly developing under the government's leadership [9]. Though Xinyang City is a late starter in the building of smart cities in China, it has achieved some achievements in digital city management, smart logistics, and smart tourism with the combined efforts of departments at all levels. Based on the in-depth research on the process of smart city construction in Xinyang City, this paper offers suggestions and countermeasures, including optimizing top-level design and guaranteeing sustainable development, improving information infrastructure, and promoting joint construction by multiple players, as well as facilitating data sharing and ensuring cyber security. This paper is intended to provide valuable references for the construction of smart cities for Xinyang City and other cities with similar development backgrounds.

PROJECT FUND

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