The Research Path of Smart City Construction: An Analytical Framework Based on Push-Pull Theory

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Abstract. The construction of smart cities is an inevitable path for urban transformation and upgrading, holding significant practical and theoretical importance in research on smart city development pathways. Constructed upon the perspective of the push-pull theory, this paper establishes an analytical framework for smart city construction, revealing the mechanism where smart city development is influenced by the forces of push, pull, and resistance. Among these, resource and environmental constraints, digital economic development, and urban innovation needs act as forces pushing smart city construction forward. Conversely, advances in key technologies, policy support, and upgraded public demands serve as pulling forces. Obstacles such as insufficient understanding of construction difficulties and operational costs, along with deficiencies in legal frameworks, represent the resistance to smart city construction. Building upon this foundation, this paper explores pathways to overcoming resistance in smart city construction through aspects of laws and regulations, construction processes, and digitalization.

Keywords: Smart city construction, Push-pull theory, Path study.

1 Introduction

At the beginning of the 20th century, with the rapid development of information technologies such as the Internet, Internet of Things, and big data, IBM's President and CEO, Samuel J. Palmisano, to introduce the concept of a "Smarter Planet" in 2008, By 2009, IBM further articulated a vision for "Smarter Earth" and "Smart Cities". The concept of smart cities aims to achieve more scientific development, more efficient management, and better living standards, Supported by information and communication technologies, smart cities enhance urban operational efficiency, improve public service levels, and foster a low-carbon urban ecosystem through transparent, comprehensive information gathering, secure information transmission, and effective, scientific information processing[1]. Promoting the construction of smart cities not only facilitates sustainable urban development, but also advances information technologies, thereby enhancing a nation's international competitiveness.

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2 Overview of Push-Pull Theory

The push-pull theory traces its origins to the 19th century when it was initially developed to analyze population migration and mobility patterns. E.G. Ravenstein, a British geographer, first proposed the "laws of migration," pioneering the study of population movements[2]. Subsequently, D.J. Bagné systematically organized the "push-pull theory," identifying factors influencing population migration as negative factors pushing individuals from their origin (push factors) and positive factors pulling them towards their destination (pull factors)[3]. Building upon these foundations, E.S. Lee expanded upon the theory, establishing a more comprehensive three-dimensional framework. Lee emphasized that both the origin and destination areas exert push and pull forces, with "intermediate barrier factors" such as spatial distance, material obstacles, and cultural differences influencing migration decisions[4]. In China, scholars have extensively applied the push-pull theory to study various fields, including rural-urban migration dynamics[5], migrant worker relocation choices[6], and consumer travel motivations[7]. In the context of ongoing economic and social development, innovative applications of the push-pull theory have emerged, exploring topics such as enhancing national ecological literacy[8] and innovating smart agriculture[9].

Based on the analyses of these scholars, the push-pull theory serves as a dynamic analytical paradigm for understanding the driving forces behind phenomena, decisions, or behaviors. Applied to smart cities as a novel urban form, this theory recognizes the combined effects of social, economic, and environmental factors—termed as push, pull, and resistance forces. Consequently, this paper integrates the push-pull theory to categorize the factors influencing smart city construction into push, pull, and resistance forces, establishing an analytical framework of tripartite forces, and endeavors to explore pathways to overcome resistance in the construction of smart cities.

3 Analysis Framework of the Triforce Effect in Smart City Construction

The construction of smart cities represents a convergence of digital cities and the internet. From the perspective of the push-pull theory, smart city construction can be viewed as a reflection of the combined forces of propulsion, traction, and resistance in urban modernization. The propulsion of smart city construction primarily stems from the challenges faced during transformation, including constraints related to resources and the environment, the development of the digital economy, and the demand for urban innovation. The pull of smart city construction consists of positive factors accelerating transformation and upgrading, such as advancements in key technologies, policy support, and the elevation of public demand. The resistance to smart city construction mainly involves insufficient awareness of the difficulties in construction and operational costs, as well as deficiencies in laws and regulations. Based on this, this paper constructs an analysis framework of the triforce effect in smart city construction, as show in Figure 1.

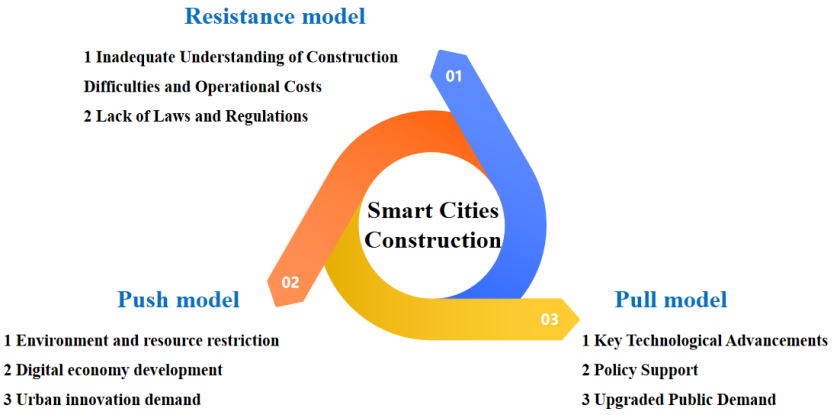

Fig. 1. analysis framework of the triforce effect in smart city construction

3.1 Propulsion Analysis of Smart City Construction

3.1.1 Propulsion from Resource and Environmental Constraints.

Cities are the economic centers of nations. With the deep integration of digital technologies such as the Internet of Things, cloud computing, and artificial intelligence with the physical economy, cities are increasingly dependent on networked information. In recent years, issues such as inefficient use of urban land resources, outward sprawl of construction land, and loss of arable land resources have coexisted during urban construction and the urbanization process of rural migrant workers. Therefore, under constraints related to land and ecological resources, there is an urgent need to explore a transformation of current urban development patterns to enhance the quality of urban development, thereby achieving green and sustainable urban development.

3.1.2 Propulsion from the Development of the Digital Economy.

The digital economy is driving profound changes in production methods, lifestyles, and governance. With the rapid development of next-generation information technologies and continuous improvement of digital infrastructure, the development of the digital economy has entered a new stage of deep integration and extensive empowerment. As cities expand in scale and population grows, various contradictions emerge. For example, severe traffic congestion significantly increases people's time costs, resulting in commuting times far exceeding estimated durations. Therefore, the current stage of digital economic advancement promotes urban development, enabling transparency in some public transportation data and facilitating innovative urban development.

3.1.3 Propulsion from Urban Innovation.

Innovation is a prominent characteristic of new productive forces, involving not only technological and business model innovations but also management and institutional innovations. Cities are significant achievements of human civilization. Currently, due to the amplification of information dissemination effects and public emotions by the Internet, urban issues related to social realities and psychological aspects have become increasingly severe. For instance, individual crimes that were previously concealed are now exposed in the era of social media, highlighting not only security issues but also contemporary psychological concerns. Therefore, finding innovative urban forms that prioritize psychological well-being becomes particularly important.

3.2 Analysis of the Pull of Construction of Smart Cities

3.2.1 The Pull of Key Technological Advancements.

Historical evidence proves that the advancement of science and technology is a significant factor in promoting changes in production methods and creating new application scenarios, thereby facili tating urban transformation and upgrading. For cities, the deep integration of science and technology with digital cities is the core of achieving economic modernization, and the progress in key technologies forms the foundation of smart city construction. With the rapid development of next-generation information technology, digital cities are further intelligentized. Particularly, leveraging the Internet of Things enables intelligent perception, recognition, positioning, tracking, and supervision. Meanwhile, cloud computing and intelligent analysis technologies facilitate the processing of large volumes of information and decision support. These technologies have made breakthrough progress and supported the realization of smart cities, thereby driving the development of smart city construction.

3.2.2 The Pull of Policy Support.

As the core of economic modernization, the development of smart cities receives high attention from the state, which has recently introduced relevant policies to support smart city construction. For instance, the National Bureau of Statistics, together with relevant departments, issued the "Guiding Opinions on Deepening the Development of Smart Cities and Promoting Urban Comprehensive Digital Transformation." The opinions focus on overall requirements, promoting the comprehensive digital transformation of cities in all areas, enhancing the support for urban digital transformation comprehensively, optimizing the urban digital transformation ecosystem throughout the process and ensuring measures, all aimed at advancing the comprehensive digital transformation of cities. Therefore, policy support is a major driving force for smart city construction.

3.2.3 The Pull of Upgraded Public Demand.

From Maslow's hierarchy of needs theory, the needs can be roughly divided into five categories: physiological, safety, social, respect, and self-actualization. The first four are lower-level needs concerning an individual's basic necessities, work security,

emotional needs, and self-respect and respect from others, all of which are essential needs. Failure to meet these needs can directly threaten a person's life; higher-level needs emerge only after lower-level needs are satisfied. These higher-level needs are not essential but contribute to health, longevity, and mental vitality. Thus, as society satisfies people's lower-level needs such as clothing, food, housing, and transportation, demand levels rise to higher spiritual levels, thereby promoting urban development and reform, exerting a driving force on the construction of smart cities.

3.3 Analysis of Resistance in Smart City Construction

3.3.1 Resistance from Inadequate Understanding of Construction Difficulties and Operational Costs.

The construction of smart cities is a long-term process that should proceed gradually with clear assessments of investment amounts, construction costs, benefits, and potential risks. At the current stage, smart city construction has entered a phase of deepened development. However, many cities lack objective awareness, correct understanding, and rational policy guidance regarding their own development and smart city construction. In order for smart cities to truly serve their residents, continuous improvement of infrastructure and governance models according to practical needs is necessary, requiring substantial financial investment. These factors collectively hinder the progress of smart city construction.

3.3.2 Lack of Laws and Regulations.

As China's smart city construction enters a new phase of deepened development, there are deficiencies in the laws and regulations governing this domain. In some more mature smart city projects, inadequate regulation among certain smart communities may exist, such as the absence of necessary laws and regulations to uphold the authority and legality of smart cities [10]. Just as human societies evolve from moral constraints to mandatory legal constraints in becoming rule-of-law societies. The absence of relevant laws and regulations impedes the development of smart city construction processes.

4 Breakthrough Paths in Smart City Construction

4.1 Establishment of Sound Laws and Regulations

During the operational stages of smart city construction, it is imperative that laws and regulations be established as a guarantee for the advancement of smart city construction. Smart city construction places increased emphasis on human agency, with personal data security being a significant concern. Risks of data leakage exist throughout the stages of data generation, dissemination, storage, and usage, necessitating corresponding laws to ensure personal information security. Moreover, as smart city construction progresses, existing laws and regulations may prove inadequate in addressing new challenges and demands. Therefore, there is a need to refine and innovate laws and regulations to adapt to smart city construction.

4.2 Integration of Smart City Construction with Digitalization

The construction of smart cities is an inevitable trend in history and a pinnacle in the realm of information. Underpinned by digital technologies and data-driven approaches, cities can conduct more precise analyses and predict future development trends and demands, thereby formulating more scientific planning. For instance, in the context of big data, urban planners can gather insights into aspects such as population movements, land utilization, and transportation needs, optimizing urban layout and spatial utilization to achieve rational urban development and resource allocation.

4.3 Rational Planning of Smart City Construction Processes

Smart city construction is a gradual process that varies by city. Each city's current landscape is shaped by objective factors such as geographical location, economic foundation, and population size during its development. In order to achieve the same goal—smart city construction, the focus of the city will be different. For instance, in the case of cities with distinctive attributes, it is advisable to integrate the principles of smart city construction with the specific characteristics of the city in question, in order to achieve the optimal outcome. The digital infrastructure is a fundamental aspect of smart city construction. As the construction process continues, it is essential to ensure that the infrastructure is kept up to date. This is a significant investment, and therefore, a slow process that requires careful planning.

5 Conclusion

The development of smart city construction conforms to the historical trend, bringing profound changes to various fields such as urban management, education, healthcare, real estate, transportation, utilities, and public safety. For instance, it has spawned application systems such as smart manufacturing, smart trade, smart energy applications, and smart public services. Looking ahead, smart city construction will continue to advance and evolve. By leveraging current advanced technologies, it aims to achieve more sophisticated urban governance and public services, thereby promoting green and sustainable urban development and constructing a better future cityscape.

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