XX. Literature Review of Smart City Construction and Urban Economic Growth in China Under the One Belt and One Road Initiative

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As the core carrier to promote economic development, cities have significantly contributed to the development of national foreign trade, and smart cities, as a high-level form of future urban development, have an essential impact on the development of urban export trade. Since China officially implemented the construction of smart cities in 2012, it has always considered the construction of smart cities a vital development strategy. Therefore, the study of the impact of smart city construction on urban export trade is of great significance for the effective implementation of smart city construction in China and the exploration of new growth drivers of foreign exchange.

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1 Introduction

Since the reform and opening up, China's economy has shown a blowout development trend, and the rapid development of China's economy cannot be separated from the export trade. With the vigorous development of the digital economy, the impact of digital infrastructure on trade is increasingly prominent. However, in recent years, exports, as one of the "troika" driving China's economic growth, have gradually slowed its growth rate.

Meanwhile, as an essential link to promote high-quality economic development, the Belt and Road Initiative studies its impact on China's foreign trade and can provide empirical evidence for China to expand the scale of trade import and export. It can also evaluate the policy achievements of the Belt and Road Initiative in the past decade, which is of great practical significance for promoting the construction of a digital Silk Road featuring extensive consultation, joint contribution and shared benefits, mutual assistance and win-win results.

With the increasing uncertainty of the international trade environment and the gradual disappearance of population benefits, the future export growth rate may continue to decline. China urgently needs to find new momentum to develop export trade in this context.

2 Research on the Belt and Road initiative and foreign trade

2.1 Trade pattern between China and countries along the Belt and Road

Zou, Liu, and Yin (2015) pointed out that the slow growth of trade between China and Belt and Road countries began in 2001. Following the outbreak of the financial crisis, trade connectivity intensified, marking the beginning of a rapid development phase.

From a regional perspective, Southeast Asia accounts for a significant share of trade volume, and China maintains a high degree of trade reliance on this region. Among China’s key trading partners, ASEAN countries play an increasingly prominent role in China’s trade strategy, followed by West Asia and Middle Eastern nations.

Zhang and Li (2015) emphasised that among the factors influencing trade flows, trade facilitation has a far more significant impact than tariff reductions. Moreover, the Maritime Silk Road has demonstrated a more substantial effect in promoting trade.

Xu and Liu (2019) highlighted that the trade scale between China and Belt and Road regions is characterised by regionalisation, with China's trade volume with East Asia and Africa leading the way. Additionally, China's export structure to Belt and Road countries exhibits a high similarity, with industrial manufactured goods maintaining a strong competitive advantage.

2.2 The impact of the belt and road initiative on foreign trade between China and countries along the Belt and Road

With the opening up and development of China's foreign trade, the total trade volume of Belt and Road Initiative (BRI) countries has been steadily increasing, accounting for an expanding share of China's total foreign trade. By 2020, China's trade with BRI countries represented approximately one-third of China's total trade, with strong potential for further growth.

Sang and Yang (2015) concluded that China, Southeast Asia, Central and Western Europe, and other BRI countries share similar export structures and strong export competitiveness. At the same time, China's trade complementarity is particularly strong with South Asia, Southern Europe, and other regions, indicating substantial future trade development potential.

Sun, Zhang, and Liu (2017) highlighted that the BRI has facilitated the expansion of China's export trade to partner countries, with its impact on export quantity exceeding its impact on export prices. Additionally, the initiative has significantly influenced the export of heterogeneous products more than homogeneous products. Their in-depth analysis of BRI sub-regions found that the initiative's effect is more pronounced in Maritime Silk Road countries. Furthermore, research on bordering vs non-bordering countries revealed that China's export trade with neighbouring countries benefits more significantly from BRI incentives. These findings confirm strong trade complementarity between China and its BRI partners despite differences in export priorities.

Han and Yuan (2021) employed a differential approach to assess ways to enhance the quality of China's export products. They proposed that optimising the institutional environment, mainly through reducing foreign trade costs and improving the quality of intermediate products, can significantly boost exports. Their study further indicated that non-isolated and non-state-owned enterprises benefit more substantially from these improvements.

Yan and Zhang (2022) pointed out that the prolonged Sino-US trade tensions in recent years have severely impacted China's foreign trade. However, implementing the BRI has significantly mitigated these adverse effects, fostering the positive development of China's export trade despite the challenges posed by the Sino-US trade war.

3 Related research on smart city construction

3.1 Concept of smart city

As urbanisation accelerates and the urban population expands, traditional city construction has entered a bottleneck phase, leading to increasingly severe urban challenges (Guo, 2022). In response, IBM introduced the "smart city" concept, marking the beginning of a new era aimed at addressing urban issues through technology-driven solutions.

Liu (2020) suggested that IBM defines a smart city as a system that utilises modern information technology to detect and analyse key urban operation data, enabling intelligent responses to diverse urban needs, including public services, security, and infrastructure management. However, Albert (2020) pointed out that smart cities often intersect with concepts such as digital cities, intelligent transportation, and e-governance, leading to varying interpretations.

By reviewing relevant domestic and international literature, it is evident that smart cities are typically classified into three main conceptual models:

- Technology-driven smart cities
- Talent-driven smart cities
- Collaboration-driven smart cities

1. Technology-driven smart cities

Smart cities with a technological focus emphasise the application of modern digital tools, such as intelligent computing systems, to enhance infrastructure efficiency and public services, including education, healthcare, and utilities. Wu (2022) described smart cities as functional urban systems developed through the innovative application of information technology to enhance traditional urban management. Zhang (2021) highlighted that information technology is the foundation of smart cities, facilitating cross-sector integration of technology and governance to create brighter urban environments.

2. Talent-driven smart cities

Jin (2013) emphasised that talent-led smart cities focus on attracting and nurturing highly skilled professionals, as human capital is a critical driver of urban development. The concentration of high-level talent serves as a key factor in advancing smart city initiatives. Xu (2013) further elaborated that smart city construction requires a diverse range of professionals, including:

- Technological innovators
- Leadership professionals with strong management and coordination skills
- Comprehensive experts with top-level strategic design capabilities

Developing smart cities through talent cultivation is essential for accelerating national talent development strategies and fostering high-quality economic and social progress. The two primary strategies for talent acquisition in smart cities involve:

- Attracting external talent
- Developing internal talent within urban institutions

3. Collaboration-driven smart cities

Karima (2012) proposed that collaboration-driven smart cities prioritise user experience over technological intelligence, stressing the importance of engagement between various urban stakeholders. This perspective underscores cities' need to

mobilize diverse resources to maintain global competitiveness. Yigitcanlar (2008) identified practical cooperation among urban actors as the core principle of smart city governance, ensuring that cities function as integrated and dynamic ecosystems.

Most scholars tend to focus on a single aspect of smart city development or combine elements from the three models without fully integrating them. However, the optimal approach to defining and building smart cities should not be limited to a singular perspective. Instead, the successful realisation of smart cities necessitates a comprehensive and synergistic approach, combining technological innovation, talent development, and collaborative governance.

3.2 Effect evaluation of smart city construction

In 2012, China's first batch of smart city pilots was only more than 10 years ago, but scholars on smart city-related research have been relatively wealthy. Domestic scholars' research on China's smart city construction mainly focuses on evaluating the effect of smart city pilot policies, mainly from the four aspects of economic development, innovative development, industrial development and ecological environment. From the economic development perspective, Zhang (2021) empirically tested by DID and concluded that smart city construction significantly promotes economic growth momentum and results. Zhou (2020) further analysed that smart cities can drive regional economic growth by optimising resource allocation, improving economic agglomeration levels, and promoting upgrading industrial structures. In addition, Tang (2020)] said the construction of smart cities can also enable high-quality economic development by improving the total factor productivity of cities. However, the effect of this promotion effect is different in different cities. Zhao (2020) found that the promotion effect of smart city pilots on high-quality economic development is more significant in the eastern and western regions, and the promotion effect is more evident in the cities with low population density, low administrative level and low innovation degree. Based on the perspective of innovation and development, He (2021) adopted multi-phase DID and PSM-DID methods to test and found that smart city construction significantly promoted urban innovation. There was no lag in the play of innovation effect, and the impact of smart city construction increased dramatically with time. Through Yao's (2022) further analysis, smart cities can promote urban innovation output by increasing urban scientific research investment, optimising information

infrastructure, introducing high-tech talents, and promoting industrial structure upgrading. At the same time, for cities with different locations, grades and initial innovation levels, the policy effect is different to some extent, and the innovation effect of smart cities is more significant in the cities with high human resource endowment, low city grade and eastern and central cities.

Based on the perspective of industrial development, scholars have different views on the impact of smart city construction on industrial structure based on the combined relevant literature. Both Zhao (2019) and Wang (2020) proved through empirical tests that smart city construction has a significant positive promoting effect on the rationalisation and upgrading of industrial structures. Zhang (2022) found that although smart city construction can significantly improve the advanced level of urban industrial structure, it can not enhance the rationalisation level of industrial structure. Through further analysis, constructing a smart city can effectively promote upgrading urban industrial structure through three channels: financial development, technological innovation and human capital. In addition, after considering the heterogeneity of regional and city size, it is found that the impact of smart city pilot policies in less developed areas on the upgrading of local industrial structure is greater than that in developed regions (Lin & Wand, 2021; Fan et al., 2021). The smart city pilot policies in medium-sized cities are more conducive to promoting the rationalisation of industrial structure. In contrast, smart city pilot policies in large-scale cities are more conducive to promoting upgrading industrial structures (Fan et al., 2021).

From the perspective of the ecological environment, scholars generally analyse the impact of smart city construction on the ecological environment from two aspects—first, the effect of policies on green economic development. Lin and Wang (2022) and Du et al. (2020) proved through empirical methods that smart city construction can significantly improve the green total factor productivity and green development efficiency of Chinese cities. The PSM-DID method was used to test and find that constructing smart cities can significantly promote green technology innovation. Second, the impact of policies on carbon emissions. Through empirical tests, Zhang and Zhong (2022) concluded that implementing smart city pilot policies would help reduce the scale of carbon emissions at the county level and increase the carbon sequestration level of regional land vegetation. Shi et al. (2018) concluded through research that the construction of smart cities can significantly reduce urban

environmental pollution, and the larger the city scale, the more significant the effect of reducing environmental pollution.

4 Research on smart cities and foreign trade along the Belt and Road

In 2012, China launched its first batch of smart city pilot projects, and although just over a decade has passed, research on smart cities has become increasingly extensive. Domestic scholars primarily focus on evaluating the impact of smart city pilot policies, particularly in four key areas:

1. Economic development
2. Innovation
3. Industrial development
4. Ecological environment

1. Economic development and smart cities

Zhang (2021) employed a difference-in-differences (DID) approach and found that smart city construction significantly promotes economic growth by strengthening growth momentum and economic output (Zhang, 2021). Zhou (2020) further analysed the mechanisms driving this economic growth, identifying three key pathways (Zhou, 2020):

- Optimizing resource allocation
- Enhancing economic agglomeration
- Facilitating industrial upgrading

Tang (2020) argued that smart cities contribute to high-quality economic development by improving total factor productivity (TFP). However, the effectiveness of this impact varies across different cities. Zhao (2020) found that the positive effects of competent city pilots on high-quality economic development are more pronounced in eastern and western regions and cities with low population density, lower administrative levels, and weaker innovation capacities.

2. Innovation and smart cities

From an innovation perspective, He (2021) applied multi-phase DID and propensity score matching DID (PSM-DID) models, demonstrating that smart city construction significantly boosts urban innovation levels without any delays in its impact (He, 2021). Additionally, Yao (2022) identified multiple mechanisms through which smart cities enhance innovation output, including (Yao, 2022):

- Increased scientific research investment
- Optimized information infrastructure
- Attraction of high-tech talent
- Industrial structure upgrading

Furthermore, policy effects differ based on city characteristics. The innovation impact of smart cities is most significant in the towns with (Tian, Zhao, & Zhang, 2022):

- High levels of human capital
- Lower administrative grades
- Located in eastern and central regions

3. Industrial development and smart cities

Scholars hold divergent views regarding the impact of smart city construction on industrial structures (Jiang & Wang, 2021). Both Zhao (2019) and Wang (2020) empirically demonstrated that smart city development plays a crucial role in industrial upgrading, particularly in enhancing industrial structure rationalisation (Zhao, 2019; Wang, 2020).

However, Zhang (2022) found that while smart city initiatives significantly advance industrial structure sophistication, they do not necessarily improve industrial structure rationalisation (Zhang, 2022). Further analysis revealed that smart city construction promotes industrial upgrading through three primary channels (Zhang, 2022):

- Financial development
- Technological innovation
- Human capital improvement

Regional and city-size heterogeneity also plays a role. Findings indicate that (Wang, Li, & Ma, 2020):

- Smart city policies in less developed regions have a more significant impact on local industrial upgrading
- Medium-sized cities benefit more in terms of industrial rationalisation
- Larger cities experience more substantial industrial upgrading effects

4. Ecological and environmental impact of smart cities

Scholars analyse the environmental impact of smart cities through two primary lenses:

Green Economic Development. Lin (2022) and Du (2020) applied empirical models and found that smart city construction significantly enhances Green total factor productivity (GTFP) and Green development efficiency in Chinese cities. Further studies confirmed that smart cities substantially promote green technology innovation using the PSM-DID method.

Carbon Emissions and Pollution Control. Zhang (2022) conducted empirical tests and found that smart city pilot policies contribute to reducing county carbon emissions while enhancing regional land vegetation's carbon sequestration capacity. Similarly, Shi (2018) demonstrated that smart city initiatives significantly reduce urban environmental pollution, with larger cities experiencing even more pronounced pollution reduction effects.

5 Literature review

Through combing and analysing the existing research results of domestic and foreign scholars on smart cities and the "Belt and Road" under the background, most literature combine the research of smart cities and the quality of economic

development and explains that smart cities promote the birth and reform of new financial models. There is little literature on the impact of smart cities on international economic and trade cooperation, and the existing research results are mainly elaborated from a single perspective, such as Internet construction or e-commerce development.

The research results on trade in the context of the "Belt and Road Initiative" are relatively complete, mainly focusing on the influencing factors and effects of the initiative on economic and trade development, the development of trade patterns of cooperation platforms, etc. No literature studies the impact of smart cities on foreign trade in the context of the initiative. Therefore, based on the background of the "Belt and Road" initiative, this paper builds a multi-dimensional index system for smart cities and studies it in combination with foreign trade, which is conducive to reasonably seizing opportunities based on national conditions and promoting the prosperity and development of China's foreign trade.

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