

A Review of Studies on National Central Cities: Perspectives and Explorations

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Abstract. National central cities are important spatial carriers for China's development strategies, and focusing on them main research viewpoints has a certain guiding significance for promoting the high-quality development of national central cities and regions. First, the basic connotation, functions and characteristics of national central cities are theoretically summarized. Secondly, based on the perspective of combining national central cities themselves and regional development, three research themes are successively extracted, namely evaluation analysis, spatial effect mechanism and measure, as well as development paths research. Finally, the paper proposes the key directions of the future national central cities exploration.

Keywords: National Central Cities; Evaluation and Analysis; Spatial Effect Mechanism and Measurement; Development Paths.

1. Introduction

In the new development stage, it has become an inevitable requirement to improve the quality of urbanization construction and to accelerate the modernization development processes. The national central cities are modern metropolises which are located in the national strategic positions, carrying interests of the national mission, leading the regional development, participating in the international competition, and representing the national identity and image. In 2005, the Chinese Academy of Urban Planning and Design first proposed the concept of "national central cities". In February 2010, the Ministry of Housing and Urban-Rural Development issued the Outline of National Urban System Planning (2010-2020), which identified the first batch of national central cities, namely Beijing, Tianjin, Shanghai, Chongqing and Guangzhou [1]. In May 2016, the Chengdu-Chongqing Urban Agglomeration Development Plan proposed the goal of building Chengdu into the national central city. In December 2016, the 13th Five-Year Plan for Promoting the Rise of Central China issued by the National Development and Reform Commission included Wuhan and Zhengzhou in the plan of national central cities constructions. In February 2018, Xi'an was proposed as the ninth national central city in the Guanzhong Plain Urban Agglomeration Development Plan. The establishment of national central cities is an important strategic plan made by the central government of China to perfect the national urban system, promote regional coordinated development, enhance the radiation capacity of super-large central cities and succeed in the global competition of urban development. China's super-large central cities compete to be built as national central cities, to further elevate their dominance in regional center priority and resource concentration, and to make full preparations for joining the national central cities "team". The series research on national central cities has also become a hot spot concerned by the government, academia and society. Therefore, it is necessary to sort out the existing theories and research on the construction and development of the national central cities, and to summarize the main research perspectives as well as future research directions of the national central cities. On the one hand, it will enrich the basic theoretical research of the national central cities; On the other hand, the paper provides decision-making basis for the development planning of China's mega-cities with analysis on the rise and development of China's "spire" cities.

2. Research on Basic Problems of National Central Cities

2.1 Connotation of National Central Cities

In academia, the basic connotation of national central cities is defined according to their roles from both international and domestic perspectives. Tian Meiling and Fang Shiming (2015) put forward that the national central cities are the "spire" cities with the highest comprehensive level of politics, economy and culture in China, which also play an important role of super-large central cities in the global network system, such as allocating global resources and optimizing industrial division of labor [2]. Mu Guangjie (2021) suggested the national central cities are the highest level of representation of a country's urban economic development, the main battlefield of national society, economy, innovation and technology, play a strong radiating and driving role in regional economy, and act as important bridges to the communication of domestic and international economic cycles [3]. Therefore, it can be seen that the national central cities are super-large cities that carry the mission of China's development of the times, which have irreplaceable gathering and diffusion functions than other cities in politics, economy, science and technology, culture, society and many other fields, and play a vital node role domestically and internationally.

2.2 Functions of National Central Cities

At present, academic understanding of the functions of national central cities involves major fields such as politics, finance, science and technology, transportation, education, medical care, culture, ecology, information, logistics, international exchanges and so on. Zhou Yang (2012) proposed that the positions of the national central cities as either center, node or hub, determine their diversified comprehensive functions, which can be summarized as functions of control and management, coordination and radiation, urban services and information hub [4]. Ma Xiaoyan, Tian Fenglun (2013) proposed that national center cities should include five functions: comprehensive service function, industrial cluster and logistics hub function, open the highlands and the humanities condensed functions, namely have the effect of lead, radiation, distribution, development of export-oriented economy, promote international cultural exchanges also has a significant role in promoting [5]. Tian Meiling and Fang Shiming (2015) believed that national central cities should have six functions: economic agglomeration, spatial radiation, opening to the outside world, cultural innovation, management services and ecological protection [6]. The research group of National Central Cities Research Institute of Zhengzhou Normal University (2019) proposed that the national central cities have six functional layers: comprehensive service, network hub, scientific and technological innovation, open exchange, cultural cohesion and ecological livability [7].

2.3 Characteristics of National Central Cities

Different scholars have expounded the characteristics of national central cities from the perspectives of time (historical development) and space (domestic and international). According to The National Urban System Planning (2006-2020), the national central cities have two characteristics: the centrality of the whole country and the internationality of a certain region [8]. First of all, from the overall point of view, the national central cities have five specific characteristics: the first is the national organization of economic activities and allocation of resources centers; the second is the national integrated transportation and information network hub; the third is the national science, education, culture and innovation centers; the fourth is that they have international influence and competitiveness; the fifth is the "spire cities" with the strongest comprehensive strength in the national urban system. Wang Wei, Luo Xinyue et al. (2017) believed that centrality, openness and leadership are the three basic characteristics of national central cities [9]. Zhang Zhuping (2020) proposed that the national central cities have three distinct core characteristics: historical, contemporary and cosmopolitan [10]. Because national central cities are distributed in different regions of China, and each has its own development model and historical characteristics, and its specific characteristics will

be different. In a word, the characteristics of central cities in different regions have both commonness and individuality.

3. Evaluation and Analysis of National Central Cities

The evaluation of national central cities mainly focus on macro policies and strategic optimization and development, which provide accurate reference for urban development and policy making according to the evaluation results by constructing index system.

(1) Construct the index system and carry out the comprehensive evaluation and analysis of the national central cities according to the focus of attention. Tian Meiling, Liu Siming et al. (2013) constructed an evaluation index system for national central cities based on the Analytic Hierarchy Process (AHP) from the four major functions of guiding innovation, radiation configuration, urban service and comprehensive hub, carried out comprehensive evaluation on six central cities such as Wuhan and Chengdu [11]. Guo Zhiqiang and Lv Bin (2018) used Analytic Hierarchy Process (AHP) to quantitatively evaluate the competitiveness and development level of nine national central cities from the perspectives of the cities themselves and the coordinated development of cities clusters [12]. The National Central Cities Research Institute of Zhengzhou Normal University (2019) constructed the growth index evaluation system of national central cities based on six functional layers of national central cities [8].

(2) Construct the index system to evaluate and analyze the special function of the national central cities. Wang Yufei and Ni Pengfei (2020) based on finance, transportation, culture, information, medical care, science and technology, trade, education and foreign exchanges, carried out accurate evaluation and analysis of national central cities' multi-source data collected from nine special functions and two dimensions of agglomeration degree and connection degree [13]. Some scholars have also carried out special research on innovation ability and innovation efficiency of national central cities. Zheng Guohong (2017) used the super-efficiency DEA-Malmquist index model to evaluate and classify the innovation efficiency of national central cities, and finally summarized the characteristics of innovation efficiency of national central cities, put forward corresponding policy suggestions [14]. Mu Guangjie (2021) based on the DEA model to measure the nine national central cities science & technology innovation comprehensive efficiency from 2009 to 2019, and put forward the effective ways to enhance science and technology innovation efficiency from following aspects: the functions of the government, the role of optimization, the effective integration of innovation resources, talent and technology information sharing platform construction, the support of basic research [15].

(3) With the concept of "high quality development", the corresponding index system is constructed and comprehensive evaluation analysis is carried out. Gong Runa and Zhang Tao (2020) used the global entropy method to measure the high-quality development level of nine national central cities, and put forward policies suggestions to promote high-quality development from three aspects of economic, social and ecological development [16]. Pei Wei (2020) evaluated and analyzed the high-quality development level of nine national central cities by constructing a comprehensive evaluation system from six aspects of structural optimization, green ecology, quality and efficiency improvement, kinetic energy conversion, livelihood improvement, risk prevention and control through entropy weight method combined with efficiency coefficient method [17]. Han Dong (2021) constructed a comprehensive evaluation system for high-quality development and ecological environment of nine national central cities, who carried out a dynamic analysis on their coupling coordination degree [18]. Liu Rongzeng and Wang Jiajia et al. (2021) used entropy method and variance decomposition method to evaluate the sectional and comprehensive bearing capacity of national central cities in terms of economy, environment, resources and society, who analyzed the difference of contribution of the sectional bearing capacity of nine national central cities to the comprehensive bearing capacity [19].

To sum up, the evaluation and analysis of national central cities is mainly through the construction of an index system, the subjective and objective combined weight assignment, combined evaluation and corresponding policy suggestions are put forward according to the dimensions of measurement purposes. At present, there are abundant evaluation and analysis studies on national central cities, mainly including special functional evaluation, comprehensive strength evaluation and high-quality development evaluation. Due to differences in strategic positioning and factor endowment of national central cities, feasible development paths and suggestions for different national central cities need to be more specific and precise, and the suitability of corresponding policy suggestions should be fully considered to ensure the implementation of specific policies.

4. Mechanism and Measurement of Spatial Effect of National Central Cities

The national central cities not only have the ability to gather all kinds of high-end elements, but also have the ability to interact with the resource elements of its neighboring cities. In research on the function and evaluation of national central cities, some scholars have included the spatial radiation function of national central cities into the index system, but the specific research on the radiation mechanism, radiation effect and influence degree of national central cities remain to be further discussed.

Zhu Hong, Xu Yanchao et al. (2012) compared the influence of the two major national central cities, Beijing and Shanghai, on the radiation pattern of the surrounding hinterland by using the spatial measurement method. The results showed that Beijing's radiation pattern to its hinterland mainly presented a "siphon" effect, while Shanghai mainly presented a "feedback" effect to its hinterland [20]. Xu Zhi, Jiao Xiuhuan et al. (2013) used the method of spatial metrology to measure the impact of technology diffusion in Beijing as well as Shanghai on the economic growth of various regions in China, and explored the effectiveness of the leading & radiating functions of Beijing and Shanghai as national central cities [21]. Luan Qiang and Luo Shougui (2016) introduced a fractal model to measure the radiation power of Beijing, Shanghai and Guangzhou to their metropolitan area by constructing a central city-metropolitan area radiation capability evaluation system, and analyzed the influencing factors [22]. Yang Guoliang, Cheng Hao et al. (2018) studied the policy effect and influence mechanism of national central cities construction on regional collaborative growth based on Synthetic Control Method (SCM) [23]. Li Congrong and Xiang Wenqian (2020) used the improved gravity model to compare the difference in the spatial connection force of central cities in Xi'an and other central and western regions, further more, analyzed the causes from three aspects: urban comprehensive quality, inter-city comprehensive time distance and spatial connection strength of central cities [24]. Zhang Hairong and Li Hao (2021) et al believed that the economic radiation power of the national central cities to the surrounding areas was one of the important ways to measure the coordinated economic development of the national central cities and the surrounding areas. Based on the intersection angles of economic geography, the improved spatial gravity model was used to measure and to analyze the space-time characteristics of the economic radiation of Zhengzhou surrounding cities [25].

To sum up, it can be seen that the research on the spatial interaction between national central cities and regions is mostly combined with the new economic geography theory, and adopt interactive role model of space measuring, research national center city - the city circle - contact space of the urban agglomeration. It is analyzed from the aspects of economic radiation and technology diffusion effects of national central cities.

5. Research on the Development Path of National Central Cities

Due to the diversity and complexity of the development of national central cities, it is impossible to cover everything in the research on the development paths and construction of national central cities, Therefore, combined with the social development background and existing research, we should

explore the development path and construction problems of national central cities from three perspectives of urban construction : the overall construction of national central cities, brand image construction, resilience building.

(1) Propose corresponding development paths based on the overall construction of national central cities. From the perspective of the overall construction of national central cities, Zhang Zhancang (2017) put forward several suggestions on promoting the construction of national central cities, emphasizing that reform and innovation lead urban development [26]. Wang Xuyang and Huang Zhengxue (2017), based on the concept of enhancing the competitiveness of national central cities, put forward corresponding policy suggestions from four aspects: accelerating the integration of national central cities with the construction of global urban network system, improving urban innovation capacity, strengthening comprehensive service functions and establishing green development system [27]. Hu Fan and Lu Jianyou (2017) discussed from the aspects of national central cities and new-type urbanization construction, urban transformation development, and urban innovation efficiency, summarized the characteristics of urbanization development of first-tier, central and western national central cities, moreover put forward corresponding policy suggestions [28]. Yin Zhi and Wang Xiaodong (2017) analyzed the development laws and characteristics of high-level central cities in the United States and the European Union . Based on them management experience, from the perspective of national public governance , they put forward China's national central cities policy connotation and analyzed strategic intent, to cultivate a large number of flat function division of high-grade national center cities, define and implement the strategic responsibilities and construction requirements of national central cities [29]. Zhao Hong and Liu Xianjie (2020) summarized the main characteristics of national central cities, analyzed the practical problems faced in the development of national central cities, and put forward suggestions on promoting high-quality development of national central cities based on the concept of sustainable cities from six aspects [30]. Sun Jiuwen and Zhang Ao (2021) proposed to give full play to the carrying capacity of national central cities to improve economic activities, realizing efficient and intensive development of cities through advantages of scale economy, reasonable urban planning and agglomeration economy, furthermore promote the transformation of China to high-quality regional economy during the 14th Five-Year Plan period [31].

National central cities are important pivots of the new type of urbanization development strategy in China, scholars research on the paths of national central cities construction mainly based on the reality in the great cities of the developing background, around the new urbanization, national central cities in the development of high quality connotation, requirements, implementation method, promote the regional harmonious development, etc, especially putting forward the corresponding policy and suggestions of development, which have strong reference value in practice [32].

(2) Researches are carried out from the perspective of national central cities brand image construction. Tang Yingying, Zhao Zong (2014) summed up the experience that can be used for the construction and development of Beijing from the development process of cultural center cities in developed countries. The cultural participation of citizens and the development of cultural exchanges at home and abroad have put forward corresponding approaches [33]. Yan Xinjie (2020), based on the perspective of brand relationship, researched Zhengzhou's strategy of building the national central cities brand image, from the perspectives of Zhengzhou's resources and environment, image positioning, image identification, stakeholders in urban management, communication channels, social evaluation and crisis response. Finally, a total of seven aspects were put forward the conception paths of urban image dissemination, and suggestions for promoting the construction of Zhengzhou national central city were provided [34]. Kui Hui (2021) based on network environment, studied the construction of Wuhan "national central city" brand image, standing on the national central cities construction positioning and strategy, from the connotation of the concept, visual symbols, promotion behavior three aspects to build urban brand image system, and advocating the standardization as well as consistency of the campaign. The research helped to form the resultant force of urban communication and enhanced the cohesion of people, which was an important

accelerator for the construction of national central cities [35]. Yu Shan, Xu Zhiping (2021) analyzed the development level of Xi'an's national central city construction and the promotion role of the "14th National Games" in the process of Xi'an's construction and city image shaping. They also analyzed the development of Xi'an's urban infrastructure, sports, and city image. The development paths were proposed from the perspectives of urban image, urban civilization, and economic environment of Xi'an [36].

At present, existing studies focus more on the role of economy, finance, science and technology, transportation and other functions in promoting the construction of national central cities, while ignoring the construction of characteristic history, culture and brand image of national central cities. Strengthening the brand image construction of national central cities are conducive to enhancing their visibility and influence, which is rooted in the development process and realistic background of major national central cities, and explores the corresponding characteristic brand image of cities, laying a solid foundation for improving the soft power of cities, facilitating cultural communication, education and medical care and other functions.

(3) Put forward corresponding measures from the perspective of enhancing the resilience of national central cities. Barnett (2001) proposed that urban resilience is the ability of a city to make relatively rapid response, to adapt quickly, to give dynamic feedback and maintain development in the face of sudden social crisis [37]. As the national central cities are the cities with the highest level at the national scale, Li Guoping and Yang Yi (2021) believed that the national central cities have the characteristics of functional diversity, dynamic evolution complexity, population and economic mobility, so it will have higher requirements for the construction of resilient cities. Then, measures for resilience construction were proposed from the spatial structure, economy, infrastructure, society and system of national central cities [38]. Xu Yanhong (2021) optimized the evaluation index system of national central cities construction from six aspects: comprehensive service, network hub, scientific and technological innovation, open exchange, cultural exchange and ecological livable based on the concept of resilient cities construction and the problems in the evaluation process of national central cities in the context of COVID-19 [39].

In light of the current social development background, as major national central cities are facing the novel coronavirus outbreak of sudden public health events and the complex economic development environment, it is imperative to enhance the risk-resistant capacity of national central cities, optimizing the effectiveness of urban governance and enhance the resilience of cities. For the national central cities, the relevant research on the construction and evaluation of the resilience cities index system based on the coordination, diversity and complexity of the urban system need to be improved.

6. Conclusions and Prospects

At present, the task and mission of the national central cities are to optimize the spatial structure of our country, participating in international competition on behalf of the country, promoting the coordinated and healthy development of the region as growth poles. The construction of national central cities is a long-term and continuously developing systematic project, with rich research contents and diversified perspectives, involving many disciplines, including economics, geography, statistics, public administration, urban planning and so on. First of all, this paper focuses on the connotation, function and characteristics of the national central cities. Although different scholars have different emphases and methods in defining the concept of national central cities, they are relatively clear about the basic connotation, function and characteristics, and the theoretical research of national central cities is in the stage of continuous enrichment and expansion. Secondly, three major research topics are extracted, which are the evaluation and analysis of national central cities, the mechanism and measure of spatial effect of national central cities, and the development paths of national central cities. It is found that the research topic of national central cities are highly related to social development background and regional macro policy, which have the characteristics of

diversified content, interdisciplinary and dynamic hotspot. In order to promote the development of national central cities, the series research on national central cities can be carried out from the following aspects in the future:

First, continuously improve the construction and evaluation of the index system. In the construction of the national central cities index system, attention should be paid to the coordinated development of various functional layers of the national central cities, especially the relationship between economic construction and ecological livability. Effectively avoiding the "stubborn diseases" in the development of super-large cities is conducive to maintaining long-term competitive vitality. In terms of data sources, most of the existing studies rely on the original data of the National Bureau of Statistics, but there is a certain lag in reflecting the actual development of cities, and the specific differences between heterogeneous cities cannot be accurately reflected. In the future, methods such as questionnaire survey and network multi-source data collection can be considered to obtain more real and accurate data. In terms of evaluation methods, there are currently five common types of comprehensive evaluation methods, namely qualitative evaluation, quantitative evaluation, evaluation based on mathematical statistical analysis, evaluation based on target planning model, and evaluation based on multi-method fusion [40]. Future research should be problem-oriented, clarify the research purpose, and design a scientific and effective index system suitable for heterogeneous cities as the main research object, so as to avoid the evaluation process being generalized and the index selection being redundant and ignoring the problems which we really want to explore.

Second, We will explore effective ways for national central cities to play radiating and driving roles. It is of great significance to improve the level and core competitiveness of national central cities, giving full play to the radiation, demonstration and leading roles of national central cities in promoting regional coordinated development. However, there is still controversy over the spatial spillover effect of national central cities in academia. Does it have a negative "polarization" effect on the surrounding hinterland or a positive "radiation" effect? With the time passing by, the spatial spillover effect and the evolution characteristics of individual urban development, the specific scope of influence on the surrounding hinterland, and the intensity of the impact are still worthy of further discussion. Moreover, most studies focus on the economic radiation effect of national central cities or super-large cities, and the research on the spatial effect of national central cities from the perspective of innovation spillover, cultural exchange and other functions remain to be improved. In the future, based on the strategic positioning and historical development background of major national central cities, we will clarify various advantageous resources of national central cities, and combine the two dimensions of time and space to further analyze the agglomeration and diffusion effects of heterogeneous national central cities on the surrounding hinterland. Action mechanism and actual effect, follow up the practical research of major national central cities, in order to provide important reference for government departments at all levels.

Third, continue to pay attention to the evaluation of the policy effect of national central cities construction. Due to the short period of the national central cities policy, there are relatively few studies on the evaluation of their policy effect, and most of them focus on economic growth. For super-large cities, it is extremely important to get rid of the competition concept of "GDP first", and the internal relationship between urban economy and economic development quality, green and sustainable development should not be cut off at will. Therefore, about national central cities, the construction of the relevant policy impact on the quality of economic growth and the sustainable development of green mechanism analysis, the key factors affecting the recognition, as well as urban heterogeneity analysis is still worthy of the further research, such as exploring the supporting policies at the national central cities for urban construction design of the impact of sustainable development, including analysis of industrial development, education level, foreign investment and other factors [41].

Fourth, to actively seek effective ways to improve the quality of economic growth in national central cities under the new situation of economic development. In December 2021, the Central Economic Work Conference pointed out that China's overall economic development was facing triple

pressures of "demand contraction, supply shock and weakening expectations", and the impact of COVID-19 has made the external environment more complicated and severe. Based on the new situation of current economic development, how to adhere to the development tone of "seeking progress while maintaining stability", how to reduce the uncertainty in the development process and mitigate the risks brought by external shocks, and how to activate the power of economic development of national central cities are important questions that need to be answered and explored in the future. On the one hand, we have to strengthen the crisis management of national central cities, improve the construction of institutions and mechanisms, formulate detailed crisis response plans, and improve the governance level and anti-risk ability. On the other hand, we will continue to implement the "innovation-driven development strategy", and pay attention to the optimization and improvement of economic development and industrial structure by the innovation driving force of mega-cities. We will explore innovative development models, enhance the comprehensive carrying capacity as well as toughness of national central cities, and promote high-quality development of national central cities.

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