



The Author(s). Published by Global Insight Publishing Ltd, USA.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Spatial Polarization and Coordinated Development Pathways in the Chengdu-Chongqing Economic Circle: A Structuralist Perspective on Interstitial Regional Dynamics

Xiao Guo¹, Xinmei Zhou^{2*}, Huazhong Tu^{3*}

Abstract: Since the inception of the Chengdu-Chongqing Economic Circle in January 2020, Sichuan and Chongqing have collaborated to build an international metropolis, achieving significant progress. It is important to note that the urban cluster between Chengdu and Chongqing lacks a gradient scale, exhibiting a phenomenon of two dominant cores while the central region experiences a hollowing-out effect. Beyond Chengdu and Chongqing, the GDP of the two core cities has reached a high level, but the economic development of other towns is relatively behind, failing to create a practical tiered layout. This has resulted in an imbalance in the overall development of the Twin Cities Economic Circle, lacking intermediate levels of support and momentum. The author examines the Chengdu-Chongqing Economic Circle's development process and the issue of Central hollowing-out, which refers to the lagging development of the central region compared to Chengdu and Chongqing. The Central hollowing-out Phenomenon primarily arises from the central region's homogeneous industrial structure, insufficient innovation capacity, uneven resource distribution, and a host of other issues. In response, the construction strategy for the Chengdu-Chongqing Economic Circle should be further refined to bolster industrial upgrading and transformation in the central region, enhance technological innovation capabilities, improve infrastructure, and optimize resource allocation to ensure the overall coordinated development of the Chengdu-Chongqing Economic Circle.

Keywords: Chengdu-Chongqing Economic Circle; Central hollowing-out; Industrial Upgrading; Innovation Capacity; Resource Allocation

1. Research Issues

On January 3, 2020, the sixth meeting of the Central Committee of Finance and Economics resolved to vigorously promote the construction of the Chengdu-Chongqing Economic Circle, and the strategic initiative continues to receive high attention. [1]. On October 21, 2021, the Central Committee of the Communist Party of China (CCCPC) and the State Council jointly issued the *Plan Outline for the Construction of the Chengdu-Chongqing Twin City Region*, an extensive document detailing a new plan to create a new city cluster in China's western regions. [2]. In April 2024, Xi Jinping, general secretary of the Communist Party of China (CPC) Central Committee, emphasized during his visit to Chongqing that the construction of the Chengdu-Chongqing Economic Circle was a major strategic decision made by the Party Central Committee. Chongqing and Sichuan are required to work closely together, constantly upgrade the development level and jointly start a promising new era in western Twin Cities. [3]. However, during the construction of the Chengdu-Chongqing Economic Circle, the scale of urban construction has shown the phenomenon of two dominant cores, yet the central part experiences a hollowing-out, i.e., the proportion of investment in the construction of the Chengdu-Chongqing Economic Circle occupies a large part of the head, and the GDP of other cities is relatively high, except the two core cities of Chengdu and Chongqing. In addition to Chengdu and Chongqing two core cities with high GDP, other cities are lagging, failing to form a reasonable echelon layout, the overall development of the Twin Cities Economic Circle is imbalanced, the a lack of intermediate level of support and drive. Therefore, exploring and solving the phenomenon of Central hollowing-out in the process of building the Chengdu-Chongqing Economic

¹ (First Author) Research assistant at the Baize Strategic Research Institute of Southwest University of Political Science and Law, P.R. China. Email:1372649796@qq.com

^{2*} (Corresponding Author) Research assistant at the Baize Strategic Research Institute of Southwest University of Political Science and Law, P.R. China. Email: 1335889827@qq.com

^{3*} (Corresponding Author) Professor at Southwest University of Political Science and Law, P.R. China. Email: thzthu@126.com

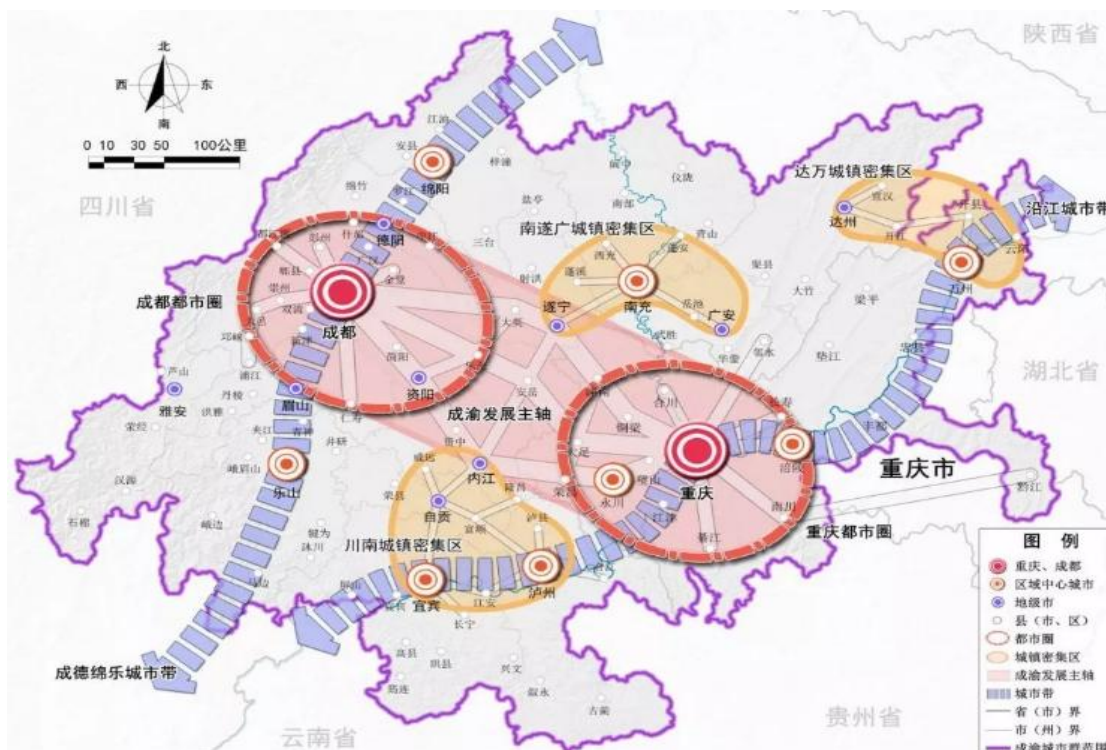
Circle and building a well-structured and orderly city cluster system is the key link in the process of promoting the construction of the Chengdu-Chongqing Economic Circle.

2. Literature review and research progress at home and abroad

2.1 Overview of research on urban-rural integration

Scholars at home and abroad have carried out much research on urban-rural integration. In 1898, Howard put forward the theory of Garden City based on the advantages of city and countryside, and argued the form of organic combination of Town-Country, building a theoretical foundation for the development of urban-rural integration. [4]. In terms of quantitative evaluation, some scholars have conducted research from the perspectives of sustainable development and urban-rural relations, urban-rural education, and urban-rural income gap. [5]. It is believed that the free flow of urban and rural factors has a significant contribution to urban-rural integration and development, and that the rational distribution of resources helps to achieve equalized urban-rural development. [6]. On the basis of scientifically grasping the connotation of urban-rural integrated development, domestic scholars have constructed an urban-rural integrated evaluation index system from multiple perspectives, such as the content of urban-rural integrated development, the background of rural revitalization, and common prosperity, and have used geographic probes, grey correlation, obstacle degree models and other research methods to measure the level of urban-rural integrated development and analyze the influencing factors on different scales of the whole China, provinces (municipalities), and counties, which has led to a multitude of theoretical Achievements.

Figure 1 Overview map of the Chengdu-Chongqing Twin City Region



Source: Sichuan Online. heavy weight! The central government has proposed the Chengdu-Chongqing Economic Circle, and Suining's entry into the circle ushers in a major opportunity, <https://sichuan.scol.com.cn/dwzw/202001/57449148.html>, accessed June 30, 2024.

2.2 Formation and development of the Chengdu-Chongqing Economic Circle

The western region occupies as much as 72% of the China's vast territory, and although it accounts for only 27% of the population, its position in the overall situation of the China's reform, development and stability is extremely critical. In particular, the Chengdu-Chongqing Twin City Region, which enjoys the reputation of Yang Yi Yi Er, [7] is even more important in terms of its economic status, and has a far-reaching impact on the economic pattern of the whole China. [8]

However, factors such as poor natural environment and underdeveloped transportation have constrained its economic development. Since the Reform and Opening-up in 1978, Chongqing has become a pilot city for the comprehensive reform of the national economic system and a nationally planned single-listed city, followed by Chengdu, which became a nationally planned single-listed city with economic management authority at the provincial level. With the successive implementation of policies such as replacing counties with districts and expanding the powers of counties to strengthen them, as well as the in-depth promotion of the socialist market economic system, the economic strength of both Chongqing and Chengdu has been continuously enhanced, the status of these central cities has been continuously consolidated, and their leading dual-core role in the western region has become increasingly prominent. The embryonic form of the Chengdu-Chongqing Economic Circle has basically taken shape. 2000, the Western Region Development Leading Group was formally established, marking the substantive advancement of the strategy of Western development.[9]

During the twenty years from 2003 to 2023, the China has continued to focus on the development of the west, and has successively promulgated a series of significant policy documents, including the *Report on the Preliminary Research of the Key Regional Planning for the Large-Scale Development of Western China*, which clearly defines the strategic direction of regional development; the successive issuance of the documents has embodied the deepening and refinement of the China's strategic deployment of the development of western China, which has vigorously pushed forward the comprehensive economic and social development of the western region. The Chengdu-Chongqing Twin City Region has become a consensus to strengthen cooperation and seek common development. [10] Since 2007, the economic growth rate of the western region exceeded that of the eastern region for the first time, and since then, the economic development rate has been accelerating, and the proportion of GDP in the China has gradually increased. According to the data released by the National Bureau of Statistics of China, in 2023, the western region's GDP was 269,325,000,000 Yuan, an increase of 5.5%, and the growth rate is still the highest among the four regions of the east, center, and northeast.[11] On the plate of China's regional development, Chengdu-Chongqing area occupies a pivotal position, and the construction of Chengdu-Chongqing Economic Circle is an essential strategic task in the current and future period. High-quality development is the primary task of Chinese-style modernization, and in the face of the new tasks and requirements put forward by Chinese-style modernization, the Chengdu-Chongqing Twin City Region can promote the high-quality development of the Twin Cities Economic Circle by upgrading the capacity of innovation and synergistic development, promoting the deep integration of the development of industry and cities, and creating a new height of inland reform and opening-up.[12] Specifically, Chengdu and Chongqing need to follow the objective law, give full play to their comparative advantages, and promote the integrated and coordinated development of the region. [13]

2.3 Overview of the research on the Central hollowing-out issue

Ba Shu is a family, Sichuan and Chongqing are growing together. [14] [15] Over the past five years, since the construction of the Chengdu-Chongqing Economic Circle was launched, it has taken solid steps on the land of Ba and Shu, evolving from local pilot projects to a full-scale acceleration. In the new era, Chengdu and Chongqing composed a magnificent chapter on the Tale of Two Cities in the western region. Relying on the strategic opportunity of the new era of western development, the future blueprint of the Chengdu-Chongqing Twin City Region is becoming clearer and clearer, and the bright future is full of richer imagination and ardent hope. [16] With the booming development of the two mega-cities of Chengdu and Chongqing, it is obvious that only the two core cities of Chengdu and Chongqing are not enough, and the cities located in between, such as Zigong, Suining, Neijiang, and Ziyang, have encountered a series of serious challenges, including the continuous slowdown of economic growth, the declining population density, and the gradual weakening of the urban functions. [17] In the current Chengdu-Chongqing Economic Circle is upgraded to the important node of the national strategy of China, the development dilemma of the central cities in the Chengdu-Chongqing area is more and more prominent, and has become the focus of attention of all sectors of the society, and this phenomenon has been graphically described as the problem of Central hollowing-out. [18]

Figure 2: Chengdu-Chongqing Economic Circle Central hollowing-out Map



Source: Source. Phoenix News, <https://ishare.ifeng.com/hotNewsShare>, Accessed June 30, 2024.

The phenomenon of Central hollowing-out in the Chengdu-Chongqing Economic Circle is a complex and multidimensional problem in the process of regional economic development. It reflects the reality of unbalanced economic development between regions within the economic circle, especially the relatively lagging development of the areas surrounding the two core cities of Chengdu and Chongqing. The formation of the economic phenomenon involves a variety of factors, including resource allocation, industrial structure, infrastructure construction, and the degree of improvement of inter-regional synergistic mechanisms, etc., reflecting the dialectical relationship between the internal contradictions of the regional economic system and the interaction of external conditions. Looking at this phenomenon from a problem-oriented point of view, it contains at least three meanings. Firstly, compared with the two major core cities, the development of the central cities is relatively lagging, with a gradient difference existing. In terms of space, it has formed a pattern of protrusions at both ends and a depression in the middle. Secondly, compared with the surrounding cities, the central cities show signs of being shrinking cities. Other cities are also experiencing a population growth rate that is lower than the expansion rate of urban construction land area, which means that the population density of central cities is decreasing and the urban agglomeration power is declining. Thirdly, relative to the historical stage, the functions and status of central cities have weakened, and the influence and competitiveness of the cities continue to decline. For example, Neijiang was once known as the Sweet City as its sugar industry was once renowned as the best in the world. However, later on, due to a large-scale loss of labor force, sugar factories successively went bankrupt. The salt industry and chemical industry in Zigong once had significant influence nationwide. With the large-scale production of chemical salt, the traditional well salt technology no longer has a competitive edge, and the economic status of Zigong has gradually declined. The opening of high-speed railways such as the Mianyang-Luzhou High-speed Railway has not only brought convenience but also accelerated the outflow of factors from the central cities between Chengdu and Chongqing. [19]

The Chengdu-Chongqing Economic Circle is a typical regional dual-core structure, which shares similarities with some urban agglomerations in China. To achieve the comprehensive development of this region, the key lies in giving play to the linkage effect of the dual cores, building the Chengdu-Chongqing urban agglomeration, and leading and driving the coordinated progress of the entire region. The rise of large cities is significant. They can serve as growth poles for regional development, drive the economic prosperity of the surrounding areas, effectively alleviate the phenomenon of Central hollowing-out, and realize the balanced development of the entire Sichuan-Chongqing region. [20]

3. Inadequate research at home and abroad

Domestic and foreign scholars have conducted some research on Chengdu-Chongqing urban-rural integration, but the following deficiencies remain:

3.1 There are differences in the selection of evaluation indexes among scholars, and no consensus has been reached yet.

The strategic significance of Chengdu's Eastward Expansion and Chongqing's Westward Extension lies not only in expanding the urban periphery and strengthening the functions of the central cities but also in promoting the opposite-direction development between Chengdu and Chongqing as well as in the Sichuan-Chongqing region, with the aim of solving the problem of the Central hollowing-out. [21] Some research has constructed an evaluation index system for urban-rural integration in the Chengdu-Chongqing Economic Circle from four dimensions: economy, population, space, and society. By means of the improved entropy method, Jenks natural breaks method, obstacle degree model, etc., it has explored the spatio-temporal differentiation characteristics and influencing factors of the urban-rural integration level at the county scale in the Chengdu-Chongqing Economic Circle. [22] Significant differences among scholars in the selection of evaluation indicators among scholars, which stem from differences in research background, methodological orientation, practical experience and academic goals. This diversity has made it impossible to reach a universally accepted and widely recognized consensus on the selection of evaluation indicators.

3.2 There are fewer empirical cases of urban-rural integration development at small and medium scales, such as in counties.

Among the 12 new urban districts in the main urban area of Chongqing, Changshou, Jiangjin, Bishan, and Nanchuan are positioned as the pilot areas for integrated development on a par with the main urban area, while Fuling, Hechuan, Yongchuan, Qijiang, Wansheng are regarded as four important strategic pivot cities. The construction of joint development platforms by these small and medium-sized cities is significant for promoting the in-depth integration of the two metropolitan areas of Chengdu and Chongqing, eventually evolving into a continuous urban belt and advancing the integration process of urban agglomeration. [23] Through the empirical research on these small and medium-sized cities in the county, we can verify and enrich the theoretical model of urban-rural integration and development, and promote the improvement and development of the relevant theoretical system.

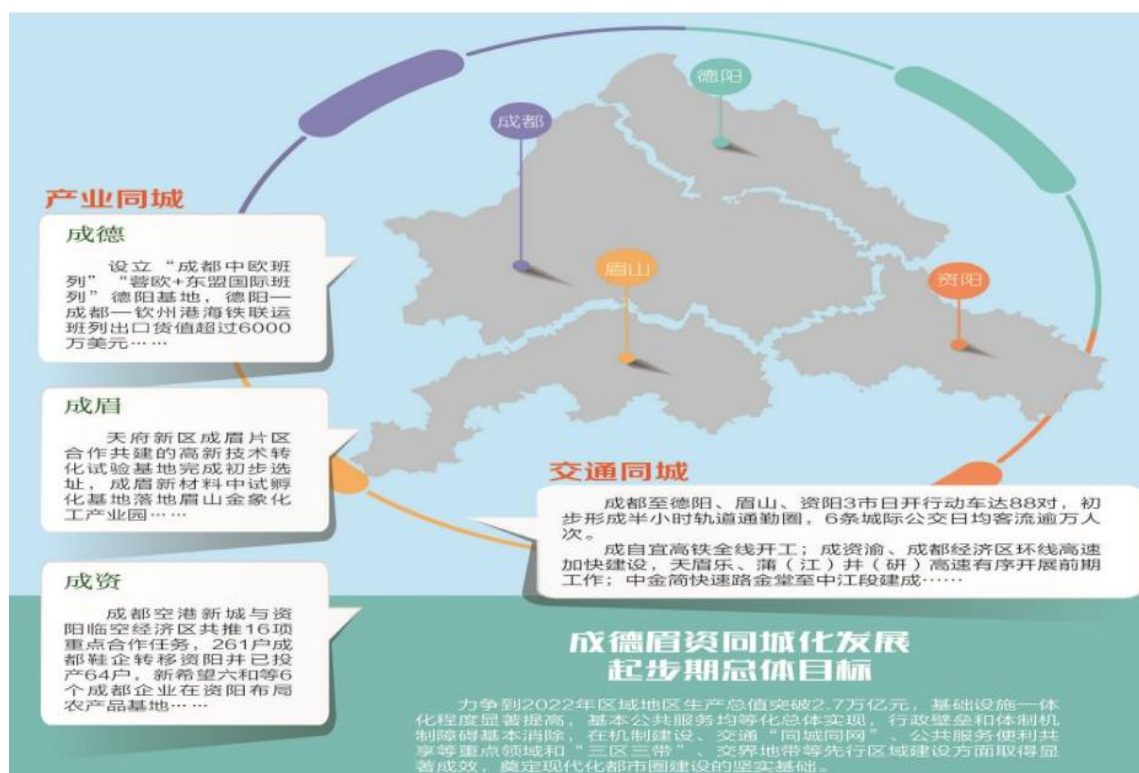


Figure 3: Chengdu, Deyang, Meishan and Ziyang are accelerating their integrated development towards urban agglomeration.

Source: Sichuan Online. Promoting the construction of the Chengdu-Chongqing economic circle: How to play the first move? Chengde Meizi speed up the same city, <https://sichuan.scol.com.cn/dwzw/202003/57514503.html>, accessed on June 30, 2024.

3.3 The research on factor integration and driving mechanism is not in-depth, and the exploration of the driving mechanism and driving process of urban-rural integrated development, as well as typical geographical patterns or geographical patterns of urban-rural integrated development, still needs to be strengthened.[24]

The Chengdu-Chongqing Economic Circle has already achieved remarkable results, especially in the dimensions of green safety and co-creating and sharing, which are gradually on a par with developed regions. But China's central and western cities started late, there are still many aspects of development have not taken into account in place, multiple comparisons can be found, Chengdu-Chongqing Economic Circle and the other three major economic circle is still a distance. [25] In terms of economic aggregate, compared with the other three major urban agglomerations, the economic aggregate of the Chengdu-Chongqing Economic Circle is only 78% of that of the Beijing-Tianjin-Hebei (BTH) region in the north, 27% of that of the Yangtze River Delta (YRD) region in the east, and 60% of that of the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) in the south. In terms of science and technology innovation, there are still problems such as relatively insufficient investment in research and development, high-capacity innovation platforms to be improved, cooperative innovation structure to be optimized, and science and technology innovation financial development relatively lagging behind. [26] In terms of specific data, the Chengdu-Chongqing Economic Circle's R&D investment intensity is weak, with the Twin Cities Economic Circle's investment intensity in scientific research and experimental development at 2.2% in 2021, which is lower than the national average by 0.23 percentage points, and at the same time much lower than that of the other three major economic circles. [27] In 2021, about 20,000 invention patents will be authorized in Sichuan Province, and about 10,000 invention patents will be authorized in Chongqing Municipality. Although high-value innovations are growing rapidly in the total value, the number of high-value invention patents per 10,000 people is lower than the national average, and the gap with Guangdong, Jiangsu and other provinces with leading levels of innovation development is even more significant, which is insufficient to build a scientific and technological innovation center with national influence. [28] In terms of openness and cooperation, the southwest region where Chengdu-Chongqing Economic Circle is located is landlocked, does not have the geographical location advantage of coastal cities to open up to the outside world, and lacks the experience of foreign exchanges, so that the scale of foreign trade and the amount of foreign investment in place has always been low. [29]

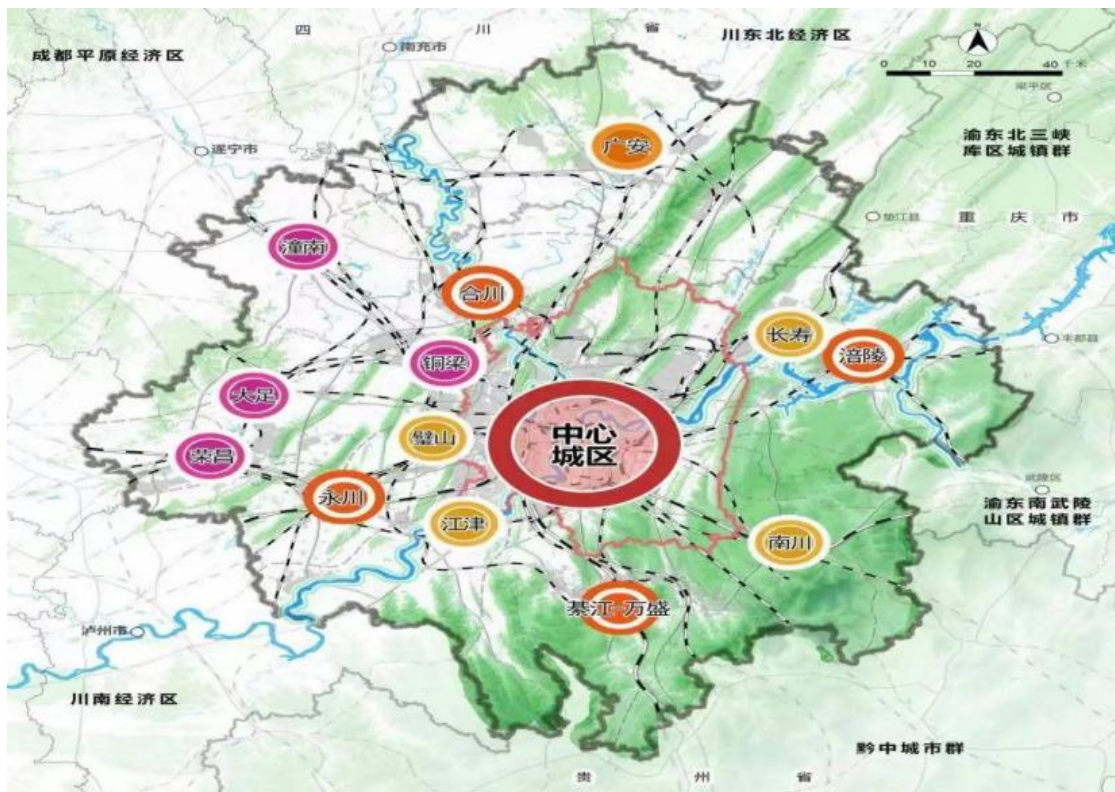
4. The Central hollowing-out Phenomenon and Its Causes in the Construction of Chengdu-Chongqing Economic Circle

4.1 Chengdu-Chongqing region, the central city of economic development is relatively lagging behind

First, in the Chengdu-Chongqing urban agglomeration, the dual cores of economic development stand out prominently, while the development of the marginal mountainous areas lags behind, and the regional economic disparities are intensifying. The Chengdu-Chongqing urban agglomeration is located in the Sichuan Basin, where the climate is relatively humid. The Sichuan Basin has a long history of development. It is worth noting that the marginal areas of the Chengdu-Chongqing urban agglomeration region are mainly composed of mountainous areas, surrounded by mountainous regions such as the Qinling-Bashan Mountains, Wuling Mountains, and Wumeng Mountains. The development of transportation roads in the mountainous regions is relatively backward, and the development history is also relatively short, with a relatively low level of economic development. Historically, there has been the saying that The roads in Sichuan are extremely difficult, even more difficult than ascending to the sky. Under the influence of the cumulative causation effect, regional economic disparities are becoming increasingly significant. [30].

Second, the transportation location affects the level of economic development within the region through resources such as the flow of people and goods in the region. Accessibility is one of the important indicators for evaluating the quality of regional transportation. In the Chengdu-Chongqing urban agglomeration, the continuous improvement of transportation infrastructure and the increasing density of the transportation network have led to the formation of county-level areas with a significantly high level of accessibility distributed in a circular pattern. These county-level areas have a complete transportation network, including various transportation modes such as expressways, railways, and aviation, which makes the flow of resources within the region more convenient and efficient, and promotes the rapid development of the economy. The marginal areas of the Chengdu-Chongqing urban agglomeration have complex terrains, with numerous mountains, hills, and crisscrossing rivers. The difficulty and high cost of transportation construction have resulted in areas with a low level of accessibility. This has restricted the flow of resources, the introduction of talent, and the expansion of the market in the region, and the economic development is relatively lagging behind. [31]

Figure 4: The Transportation Development Plan for Chengdu-Chongqing Metropolitan Area



Source: Twin Cities Economic Circle Watch, <https://sina.cn/index/feed?from=touch&Ver=10>, accessed June 30, 2024.

Thirdly, the Chengdu-Chongqing urban agglomeration dual-core dominant economy, the core area of industrial development, the edge of the mountainous areas of industrial adjustment and upgrading is slow. The development process of county economy is closely connected with the adjustment of industrial structure, and the advantages and disadvantages of economic development essentially depend on the level of industrial development. [32] The Chengdu core area and the Chongqing core area constitute the most densely distributed industrial area in the Chengdu-Chongqing urban agglomeration. [33] This has led to a low proportion of secondary and tertiary industries and a slow process of industrial restructuring. [34]

4.2 There is no effective echelon layout between the twin cities

In 2021, the Chengdu-Chongqing Economic Circle realized a gross domestic product (GDP) of 7,391.92 billion yuan, an increase of 8.5% over the previous year, with an economic growth rate of 4.5 percentage points higher than that of the previous year, and generally showing a steady reinforcement, a steady improvement in quality, and a steady improvement in the development trend. Among them, the Sichuan part of 4806.02 billion yuan, an increase of 8.5%; Chongqing part of 2585.9 billion yuan, an increase of 8.5%. The economic growth rate was 1.2 percentage points lower than the national average in the first quarter. The gap with the national average in the first three quarters, and surpassed the national average for the whole year, being 0.4 percentage points higher than the national level. The total economic volume of the Chengdu-Chongqing Economic Circle accounted for 6.5% of the country's total. [35] In the Chengdu-Chongqing urban agglomeration, the GDP distribution of the 29 districts and counties in Chongqing extends westward from the 9 core areas in the main urban area in the east, showing a decreasing trend towards the western area of Chongqing. [36] During the first two decades of the Western Development Strategy, the primary task of the two major cities of Chengdu and Chongqing was to focus on rapid urban economic growth and secure a dominant position in China's urban competition in order to capture more development opportunities. This has led to a significant agglomeration effect of resources in the two core cities and a relative lack of impetus to spread to the surrounding areas, and the development of the central belt of the Chengdu-Chongqing urban agglomeration has shown a clear hierarchical gap. [37]

In 1957, the French geographer Jean Gottmann first put forward the concept of the metropolitan circle and defined it as a territorial development unit with excellent comprehensive strength and global influence that has gradually developed under the background of global economic integration. [38]. A mature world-class urban agglomeration usually needs to

fulfill four major criteria: the first condition is a huge volume, with a city population of more than 25 million, and a total economic volume of trillions of dollars; [39]. There are key transportation nodes with international seaports, airports and information ports as bridges to the outside world. [40] The process of urbanization, industrialization and informatization is relatively lagging behind, the level of scientific and technological development is not high in general, the development capacity and competitiveness of the core cities are low, the level of industrial foundation and modernization of industrial chain also needs to be upgraded, and the regions have not yet formed a strong synergy of development. [41] In the Internet information industry, Chengdu and Chongqing are in vicious competition, racing against each other. This has made it difficult to effectively integrate and utilize the advantageous resources, advanced elements, and industrial structures of the two places in the short term, and it is difficult to fully exploit the positive effects of complementary advantages and coordinated development. [42]

4.3 Single industrial structure in the central area of Chengdu-Chongqing Twin Cities

The core of twin-city integration lies in industrial synergy. From the observation of industrial structure, Chengdu-Chongqing region is similar to other city clusters, the proportion of the tertiary industry is the largest, followed by the secondary industry, and the primary industry accounts for a relatively small proportion of the overall industrial structure evolution is in line with the laws of economic development, showing a significant optimization trend. At the same time, the Chengdu-Chongqing region also has its unique industrial structure characteristics. First, the proportion of primary industry is relatively high, accounting for 8.3%, exceeding the national average by 1 percentage point. Secondly, the proportion of the secondary industry has declined rapidly, down 7.9% since 2015, only lower than the Beijing-Tianjin-Hebei region, showing a tendency of excessively rapid deindustrialization with the manufacturing industry declining too fast and the proportion of the service industry rising too fast. As an industrial town in Southwest China, in order to cope with the complex global geopolitical, economic and financial risks, Chengdu-Chongqing region should continue to stabilize the proportion of secondary industry and consolidate the foundation of the real economy, so as to stabilize the general economic situation. [43]. Third, the proportion of tertiary industry in Chengdu-Chongqing region is low. The development of tertiary industry can make economic growth more stable and sustainable, but the proportion of tertiary industry in Chengdu-Chongqing region is only 53.2%, the lowest among the four major city clusters, and 10 percentage points lower than that of Beijing-Tianjin-Hebei region. In short, the industrial pattern of Chengdu-Chongqing Economic Circle is characterized by: the rapid development of the service industry, which has replaced the traditional industry as the main industry, and the gradual weakening of agriculture, the overall industrial pattern shows the characteristics of the post-industrial era, which is in line with the law of modern industrial development, and the industrial structure still needs to continue to be adjusted and optimized. [44].

The development of strong industry is a key step for the Chengdu-Chongqing region to catch up. On the one hand, Chengdu-Chongqing and other places have successively integrated advantageous industries, based on key industries such as automobiles, electronic information, etc., to accelerate the creation of advanced manufacturing clusters, and to promote the high-quality development of the manufacturing industry. 2022, the industrial enterprises above the scale of the Twin Cities Economic Circle of the Chengdu-Chongqing area realized an increase of 3.9% in business revenue and 6.3% in total profit over the previous year, which is higher than the national average level of 10.3 percentage points. [45] On the other hand, although traditional industries such as the automobile industry account for a relatively high proportion of the advantaged industries in Chengdu-Chongqing, the profitability of the industry is not strong, and the scale of the high-end manufacturing industry and the emerging strategic industries needs to be further developed. In the list of 45 national advanced manufacturing clusters released by the Ministry of Industry and Information Technology of the People's Republic of China 2022, only three industrial clusters in the Chengdu-Chongqing Economic Circle have been selected, which is fewer than the 18 in the Yangtze River Delta region and the seven in Guangdong-Hong Kong-Macao Greater Bay Area. The output value of packaging and testing in Chengdu City will account for more than 85% of the IC industry in 2021, indicating that the electronic information industry in the Chengdu-Chongqing region is still concentrated in the low-value division of labor, and the high-value-added industrial chain is still in its infancy. [46]

Table 1: Data on changes in the industrial structure of the four major national urban agglomerations

Change from 2015 in 2022	Percentage of primary industry	Percentage of secondary industry	Percentage of tertiary industry
Yangtze River Delta Area	1.0%	—3.0%	2.0%
Beijing-Tianjin-Hebei Area	—0.7%	—8.8%	9.5%
Guangdong-Hong Kong-Macao Greater Bay Area	—0.3%	—7.6%	7.9%

Chengdu-Chongqing Economic Circle	—1.7%	—7.9%	9.6%
--------------------------------------	-------	-------	------

4.4 Insufficient innovation capacity in the central cities of Chengdu-Chongqing region

Enterprises are the main source of innovative power, have a decisive role in the transformation of scientific and technological achievements, and are the main force to promote the docking of basic research and industrial innovation and development. [47]. The research and experimental development expenditure of the Chengdu-Chongqing Economic Circle will account for 2.5% of GDP in 2021, which is far lower than the 4.1% of the Beijing-Tianjin-Hebei metropolitan area, and the 3% of the Yangtze River Delta Area and Guangdong-Hong Kong-Macao Greater Bay Area; the number of patents granted per 10,000 people is 19, which is only 15.7% of that in Guangdong-Hong Kong-Macao, 38.8% of that in the Yangtze River Delta, and 50% of that in Beijing-Tianjin-Hebei, and the level of innovation output is low. [48]. At present, there is still a big gap between the strength of scientific research funding and the output level of innovation results in the Chengdu-Chongqing Economic Circle and other large urban agglomerations, which will affect the speed of development of its high-tech industries, the efficiency of traditional industry transformation and the construction of a modern industrial system. [49] According to the *Monitoring Report on the Innovation Capabilities of National Innovative Cities 2022*, the innovation capabilities of Chengdu and Chongqing rank 14th and 38th respectively among all cities in China, which is highly inconsistent with the positioning of the two cities as the Fourth Pole of the country. [50] It shows that Chengdu-Chongqing region has few major scientific infrastructure layouts and weak cutting-edge basic innovation capabilities, and needs to deeply promote innovation-driven realization of scientific and technological breakthrough. [51]

5. The Chengdu-Chongqing Economic Circle construction in the Central hollowing-out Phenomenon caused by the impact of

5.1 Uneven urban development in the central region

Chengdu-Chongqing Economic Circle construction of the Central hollowing-out Phenomenon will lead to uneven urban development in the central region, specifically from the following aspects of analysis. First, it will affect the quality of urbanization in the central region. The phenomenon of Central hollowing-out leads to slower development of industrialization in the central region, obvious differences in the industrial structure of the county, industrial support is not strong, weak agricultural base, resource and environmental constraints are becoming more and more serious, and the pressure on ecological security has increased and other issues. Second, it affects the growth rate of urban and rural residents' incomes. There is a lack of momentum in consumption upgrading, and it is difficult to solve the issues related to agriculture, rural areas, and rural people. It is challenging for farmers to increase their incomes. The reform of the household registration system is proceeding slowly. The permanent residents are unable to fully enjoy the basic urban public services. Rural social undertakings lag behind the levels of economic and social development. Thirdly, it affects the synergistic development of urban agglomerations. Currently, the institutional mechanism for the synergistic development of cities in the central region is still unsound, which to some extent hinders the overall progress of the city cluster. Megacities, such as the main urban areas of Chengdu and Chongqing, are expanding at an excessively rapid pace. Some large, medium-sized and small cities as well as small towns are faced with the problem of a reduction in economic and population size. Except for the main urban areas of Chengdu and Chongqing, there are only six Type II large cities with an urban population exceeding one million, namely Luzhou, Yibin, Nanchong, Mianyang, Dazhou and Zigong. [52] The Central hollowing-out Phenomenon has led to a lack of resilience, risk resistance and urban governance capacity in the central region. [53].

5.2 Core city backward development of regional economic shortcomings are obvious

The core cities develop in opposite directions, that is, during the development process, two or more core cities fail to form an effective coordination mechanism. They act independently, resulting in significant shortcomings in the overall development of the regional economy. This development pattern not only weakens the overall competitiveness of the city cluster, but also exacerbates the unbalanced development within the region, posing a serious challenge to the sustainable development of the regional economy. In recent years, Yibin City in Sichuan Province has witnessed an astonishing economic development speed. It has overtaken Deyang City and has a substantial lead over it, and is getting very close to Mianyang City, which is the second largest city in Sichuan Province. The advantage of its development lies in the fact that in recent years, leading enterprises have gradually formed industrial agglomeration effect and scale effect by adjusting industrial structure, which provides fundamental guarantee for its development. On the contrary, Suining City, in recent years, the ability to attract investment has improved, but for its industrial restructuring has brought many uncertainties: First, the industry is at the low end of the chain, did not build a high

5.4 Low degree of connectivity in transportation infrastructure construction

The high-speed transportation mode represented by high-speed rail has the characteristics of large capacity, high speed, good stability and comfort, which can accelerate the flow of factors between cities and promote regional development. However, existing studies show that the positive effect of high-speed transportation is mainly reflected in large regional central cities, while the negative effect will be produced for small and medium-sized cities along the route. [56] Under the traditional transportation network layout, the radiation power of Chengdu-Chongqing and Chengdu-Chongqing cities is relatively limited, resulting in the central region of Chengdu-Chongqing, especially Zigong, Neijiang, Suining, Ziyang, etc., becoming a weak zone of influence, and urgently needing the development of sub-core cities to fill the development gaps, so the central region possesses significant development potential and space. With the official operation of the Chengdu-Chongqing high-speed railway, the time distance between the two endpoint cities of Chengdu and Chongqing has been significantly shortened, accelerating the exchanges and connections between the two cities. The influence of the two endpoint cities expands rapidly, resulting in the weakening of the urban functions of Zigong, Neijiang, Suining and Ziyang, which were originally secondary cities. [57]

6. Eliminate the Chengdu-Chongqing Economic Circle in the construction of the Central hollowing-out ideas

6.1 The development of the central region small double core city economic circle to further optimize the allocation of resources

For a long time, in the vast areas outside the two cores of Chengdu and Chongqing, the industries have been weak, and the phenomenon of net population outflow has been widespread. The economic development levels of urban districts and counties are relatively low, forming a Central hollowing-out state with a decreasing gradient compared with the two core cities. Generally, small and medium-sized cities have inaccurate positioning. They are unable to plan the industrial layout from the perspective of national strategies. Their locational disadvantages are infinitely magnified, making it difficult for them to gather advantageous resources. [58] Since the implementation of the strategy of the Chengdu-Chongqing Economic Circle, the speed of resource element aggregation in the areas outside the two cores has significantly accelerated. Some small and medium-sized cities have seized the opportunity to speed up industrial transformation and upgrading. Momentum-rich small dual cores such as Yibin in Sichuan Province and Yongchuan in Chongqing have begun to emerge, and the bottleneck of the Central hollowing-out is being addressed. [59] Yibin City's remarkable economic performance has attracted much attention. In the long term, Baijiu (Chinese liquor) and coal once accounted for more than 60% of the city's industrial output value. However, later on, the traditional development mode became unsustainable, and the industrial economy once experienced negative growth. Over the past five years, emerging industries in Yibin City, such as power batteries for new energy vehicles, intelligent terminals, and rail transit, have risen rapidly. [60] In the workshop of Sichuan Times New Energy Technology Co., Ltd. in the Sanjiang New Area of Yibin, after the power batteries for new energy vehicles are produced and packaged, they can appear on the production lines of multiple vehicle manufacturers in Chongqing and Chengdu within 3 hours. These manufacturers include Chongqing Changan Automobile Co., Ltd. and Chongqing Hengtong Bus co., ltd, as well as Volvo Car Chengdu Factory. Yibin City focuses on the development of power batteries for new energy vehicles. Currently, 32 supporting enterprises have settled there, and in the future, a production park with a scale of hundreds of billions of yuan will also be built. [61]

In Yongchuan District, Chongqing, emerging industrial clusters have also risen strongly, shining brightly in concert with Yibin and forming a small dual-core outside the dual cores of Chengdu and Chongqing. Yongchuan, located in the western part of Chongqing, used to have only scattered auto and motorcycle parts industries. In recent years, Yongchuan has given full play to its advantages of being located at the junction of Sichuan and Chongqing, and has gone all out to participate in the joint construction of advantageous industrial clusters such as automobiles and motorcycles, and information technology in Sichuan and Chongqing. It has promoted the establishment of industrial chain and supply chain relationships between Great Wall Motor Company Limited (GWM) in the district and seven supporting enterprises in Sichuan. At the GWM Yongchuan production base, all automated production lines are operating at full capacity. Popular models such as the Tank 300 and the GWM Pao are all produced here. The person in charge of the base said, The construction of the Chengdu-Chongqing Twin-City Economic Circle makes us more optimistic about the development prospects of the Sichuan-Chongqing region, and we will increase investment in the future. By the end of 2021, GWM produced 120,000 units of GWM Pao and 80,000 units of Tank 300 in Yongchuan throughout the year, with an output value exceeding 30 billion yuan, a year-on-year increase of 173%. On December 31, 2021, Yongchuan added another enterprise with a production value of tens of billions of yuan. The Yongchuan complete vehicle factory of Yadea Technology Co., Ltd went into operation. After reaching full production capacity, it can produce 3 million to 6 million electric vehicles annually. . [62]

Relying on the strong new momentum of industry, the economic development of the two places into the fast lane. Yibin

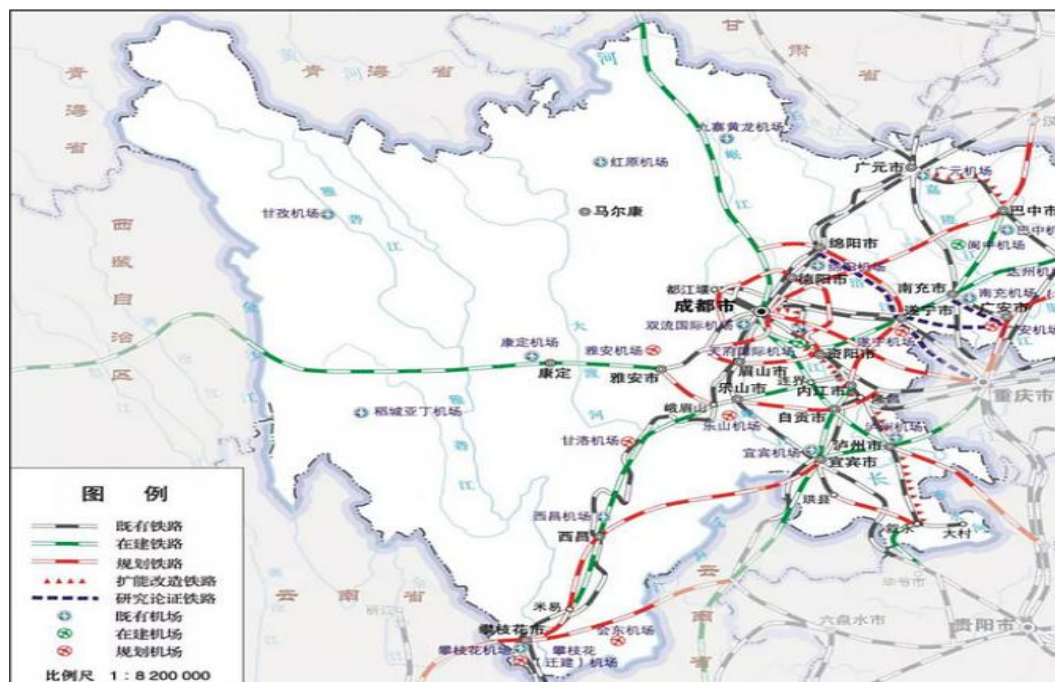
City, the total economic output of 314.808 billion yuan in 2021, the growth rate for three consecutive years leading the province; Yongchuan District, the total economic output of 114.1 billion yuan in 2021, the past five years, an average annual growth rate of 8.8%, the growth rate of the city's forefront, and the two places have become a net inflow of population city. Under the leadership of the small double core, the former Central hollowing-out region is also rising. Sichuan and Chongqing 2021 economic data show that is located in the middle of the Chengdu-Chongqing area in southern Sichuan, Chongqing, western cities and counties, most of which exceeded the growth rate of the province and city, and some of the urban areas and counties of the growth rate in the forefront. With the previous years lower than the province and city growth rate in sharp contrast. [63]

6.2 Increase the construction of transportation infrastructure, linking the development of cities in the central region

The Chengdu-Chongqing Twin-City Economic Circle needs to accelerate the construction of a three-dimensional transportation network covering railways, aviation, water transportation, and highways. It is committed to building an international-level comprehensive transportation hub. The top priority is to expand the comprehensive transportation corridor network. Based on the existing east-west, north-south four-directional corridors, accelerate the eastward construction of the high-speed railway along the Yangtze River and freight railways; in the southward direction, promote the China-Europe Express Freight Train to expand towards the New International Land-Sea Trade Corridor, and take the lead in carrying out joint operation pilots. In the westward direction, plan the Lanzhou-Chongqing high-speed railway to unleash the freight potential of the Lanzhou-Chongqing Railway; in the northward direction, optimize the freight capacity of the Xiangyang-Chongqing Railway to ensure the regular operation of the Chongqing-Manzhouli-Russia freight train. Conduct national research, and draw on the advanced experience of the development model of Hongqiao Airport + Hongqiao High-speed Railway Station. Carry out scientific and reasonable planning around the high-speed railway stations on the central line between Chengdu and Chongqing. The construction of Chongqing's second hub airport aims to achieve a seamless connection of aviation + high-speed railway + rail transit, accumulating profound superimposed experience for development. At the same time, set up a Science City Station in the western trough valley area of the high-speed railway on the central line between Chengdu and Chongqing, and add a High-tech Zone Station on the already completed Chengdu-Chongqing Passenger Dedicated Line on the south side, thus forming a layout of two high-speed railway stations in the north and south of the western trough valley. This development layout will effectively shorten the distance between the main urban area and the western Chongqing area, thus solving the problem of getting out of the city. [64]

At present, although the Chengdu-Chongqing Expressway connects Rongchang's east and west, but Rongchang's north and south still do not have a convenient high-speed channel. For Rongchang, the transportation bottleneck of the north-south corridor is related to the construction of the Chengdu-Chongqing city cluster. In October 2013, the Department of Transport of Sichuan Province signed an inter-provincial connection agreement with the Chongqing Municipal Party Committee for the Nanchong-Dazu-Rongchang-Luzhou expressway. Construction was planned to start in 2015 and was completed and opened to traffic in 2018. [65] At the same time, Rongchang district also stepped up to Guangshun, Fenggao two railway stations to upgrade, reconstruction and expansion, help Rongchang logistics mode upgrade. 2015 Chengdu-Chongqing high-speed rail was completed and opened to traffic. Rongchang's locational advantages, which enable it to reach Chongqing within 20 minutes and Chengdu within 40 minutes, are fully revealed. It has gathered a large amount of popularity and business vitality from the surrounding districts and counties, which has greatly contributed to its large-scale urban development. [66]

Figure 6: Transportation Network Map of Chengdu-Chongqing Twin Cities



Source: Chengdu-Chongqing Urban Agglomeration Rail Transit Approval, Operation and 14th Five-Year Plan Status, <https://xueqiu.com/8534846093/180052326>, accessed June 30, 2024.

Focus on transportation construction. By the multi-level and integrated three-dimensional comprehensive transportation network, build an international comprehensive transportation hub city that connects the East and the West, links the North and the South, reaches the rivers and the seas, and connects all directions. Plan ten major external comprehensive transportation corridors to connect with the principal national urban agglomerations and interface with the six major national economic corridors. [67] In the eastern direction, construct a comprehensive three-dimensional transportation corridor of the Yangtze River Economic Belt to connect with East Asia and the Asia-Pacific region; in the southern direction, optimize and improve the planning of the New International Land-Sea Trade Corridor in the west to connect with Southeast Asia and South Asia; in the western direction, enhance the channel capacity of the China-Europe freight train, and jointly promote the freight train channel connecting China, Mongolia and Russia in the northern direction, to reach West Asia and Europe. In the *Chongqing 2024 state-owned construction land supply plan*, the construction of transportation is highlighted. According to the plan, Chongqing is supplying 11,000 hectares of land for transportation and water use this year, a sharp increase of 61.76% year-on-year. This is also the only land supply plan site over 10,000 hectares of the sector. [68] *The 2024 State-owned Construction Land Supply Plan of Chongqing* shows that to promote the transportation connectivity in the Chengdu-Chongqing Twin-City Economic Circle and build the New International Land-Sea Trade Corridor in the west at a high level, a water network pattern of one main trunk with multiple branches, one core with multiple nodes, three pivotal points with five diversions, and multiple sources for mutual support should be constructed. Focus should be placed on ensuring the land for projects such as the dedicated railway line of Longtou Port, the widening of the original Chengdu-Chongqing Expressway, the regulation of the Fujiang River waterway, urban rail transit, the water resources allocation project in Western Chongqing, the Chongqing-Yichang High-speed Railway, the Chongqing-Xiangxi High-speed Railway, the Xiangyang Reservoir, the Tiaodeng Reservoir, etc., to further make up for the shortcomings in infrastructure. [69]

6.3 Building a cooperative mechanism for collaborative innovation

High-quality development driven by innovation is the key to solving problems. First, enhance the innovation capacity in basic fields. Create a number of advanced national laboratories, major scientific installations and other major scientific and technological basic research facilities, dedicated to connecting up the funny innovation and technology network in Sichuan and Chongqing, and promote the development of new quality productivity; the establishment of efficient scientific and technological achievements transformation mechanism is the key. Need to break through the

existing system of university restrictions, fully stimulate the entrepreneurial enthusiasm of talents. To strengthen the supporting role of fiscal policy. The Sichuan Provincial Party Committee and the Provincial Government issued the *Opinions on Supporting the Four Cities in the Hilly Areas of Central Sichuan to Build a New Highland for Industrial Development and Accelerating the Rise of the Central Region of the Chengdu-Chongqing Area* (hereinafter referred to as the *Opinions*). It is proposed that by 2027, remarkable achievements will be made in the construction of the new highland for industrial development; by 2035, the new highland for industrial development will be basically established, and it will become a dynamic emerging growth pole in the modernization drive of the Chengdu-Chongqing area. The *Opinions* define the development positioning of the four cities in the hilly regions of central Sichuan with the concept of one belt and three zones, that is, to build a new emerging agglomeration area for advanced manufacturing, a demonstration belt for modern, efficient and characteristic agriculture, a pilot zone for in-depth integration and development of culture and tourism, and a superior bearing area for modern commercial trade and logistics. [70]

First, accelerate the implementation of innovation-driven development strategy. [71] In order to promote the vertical development of scientific and technological innovation, we need to devote ourselves to improving the level of market-oriented innovation, and to open up the channels for the exchange and sharing of advanced production resource elements, such as talents, technologies, equipment and markets. At the same time, we should accelerate the market-oriented practical application of innovation achievements, and actively develop new technologies, new products, new business forms and new modes, in order to promote the deep integration of science and technology innovation and economic and social development. Construct a new market oriented by technological innovation and enhance the level of modernized industry. Secondly, to build industrial ecosystem and innovate industrial chain, it is necessary to make full use of the talent and resource advantages of colleges and research institutes in Chengdu-Chongqing area, and to promote the deep integration of science and technology innovation and science and education resources. [72] Implementing the demonstration pilot of the reform of the ownership and long-term use right of functional scientific and technological achievements, realizing comprehensive sharing in platforms, resources and talents, and committing to jointly promoting the transformation of achievements by organizing various forms of domestic and international exchange and cooperation conferences. Third, promote the synergistic development of the entire industrial chain. The government applies targeted incentive policies, and in order to promote the development of science and technology innovation, we should establish a talent evaluation mechanism oriented to innovation ability and innovation quality, and develop a list of talent needs for key projects. On this basis, we should actively introduce and cultivate a group of outstanding talents who master specialized science and technology, and at the same time increase the financial investment in science and technology innovation. In addition, it is necessary to give full play to the leverage of the state-funded venture capital fund in order to raise the proportion of funding for basic research in science and technology in total social research and development funds (R&D) expenditures. Every effort should be made to create a quality ecological environment suitable for the development of high-end talents, promote the transformation of scientific and technological achievements, and enhance the market utilization of high-end scientific and technological achievements on the ground.

6.4 Strengthening cooperation to promote industrial upgrading and transformation

Utilize the development advantages with the characteristics of Chengdu and Chongqing to promote high-level regional opening-up. Firstly, jointly discuss, construct, and share the New International Land-Sea Trade Corridor. Collaborate with the provinces and cities along the corridor, use the existing operation platforms and logistics hubs, and expand and strengthen the international brand of the new corridor. [73] Secondly, enhance the operation efficiency of the China-Europe Express Freight Train. [74] Implement the subsidy policies for all China-Europe Express Freight Train routes nationwide. Discuss specific matters such as prices, line leases, and the construction of distribution points with the countries along the routes. Establish an orderly withdrawal mechanism for the government and a strict supervision mechanism, aiming to be the first in the country to build an effective market mechanism. [75] Thirdly, deepen cooperation in the construction of the Belt and Road Initiative. We need to explore the joint construction of a series of economic and trade cooperation zones at important nodes along the Belt and Road routes to further promote the development of international trade. [76] At the same time, we should use the southern wing of the economic circle to build an inland, southward-opening gateway for our country. [77] Luzhou, Longhuang's Tuojiang Railway Special Bridge and Luzhou Tuojiang Special Bridge are under intense construction. The completion of these two bridges will closely link Sichuan, Chongqing and Southeast Asia, and become an important part of the new western land and sea corridor, linking up the southern Sichuan and western Chongqing areas, shortening the time from Luzhou to Chongqing to half an hour, and will become the preferred place for the distribution of materials for many enterprises.

7. Future Prospects

Looking ahead, it is recommended to strengthen key points and expand the scope, promoting the formation of more new growth points outside the dual cores of Chengdu and Chongqing. This would deepen the internal potential of the Chengdu-Chongqing Twin-City Economic Circle and construct a more diversified and balanced economic landscape. [78]

7.1 Reflecting changes in spatial patterns

The Outline of the Construction Plan for the Chengdu-Chongqing Economic Circle divides the economic circle into the main axis of Chengdu and Chongqing, the northern wing composed of Northeast Chongqing and Northeast Sichuan regions, and the southern wing composed of southern Sichuan and Western Chongqing regions, presenting a spatial pattern of one axis and two wings. Apart from the main axis, how to make the northern and southern wings take off is a problem that must be solved. [79] The emergence of the small dual cores reflects the changes in the spatial pattern of the Chengdu-Chongqing region. In places such as Yibin, Luzhou, Yongchuan and Jiangjin in southern Sichuan and western Chongqing, it can be seen that solving the problem of the central depression is promoting the formation of the spatial pattern of one axis and two wings. The pace of regional coordinated development in various areas is accelerating, and new growth points outside the dual cores of Chengdu and Chongqing are on the verge of emerging.

On November 16, 2021, Sichuan and Chongqing jointly issued *the Overall Plan for the Integrated Development Demonstration Zone of Luzhou, Yongchuan, and Jiangjin*. Luzhou City in Sichuan Province, Yongchuan District, and Jiangjin District in Chongqing Municipality will work together to build the integrated development demonstration zone. Ruan Jie, the Chief Economist of the Development and Reform Commission of Luzhou City, said, In 2020, the total permanent population of Luzhou, Yongchuan, and Jiangjin was 6.86 million, and the total economic volume was 427.9 billion yuan. The goal of the three places is that by 2025, the permanent population will reach more than 7.1 million, and the total economic volume will exceed 800 billion yuan. The three places will actively explore the reform of the appropriate separation of economic zones and administrative regions and build the demonstration zone into a financial center at the junction of Chongqing, Yunnan, and Guizhou, an essential functional supporting area for the dual cores of Chengdu and Chongqing, a southward opening and cooperation gateway in the Chengdu-Chongqing region, and a demonstration zone for green development in the Yangtze River Economic Belt. [80]

With the in-depth promotion of the strategy of Chengdu-Chongqing Economic Circle, the location disadvantage of some small and medium-sized cities between Chengdu and Chongqing is being transformed into a location advantage to further serve the national strategic overall situation. [81]. For example, Yibin has firmly grasped the new pattern of opening up to the outside world, which features coordinated linkage between the land and the sea at home and abroad and mutual assistance between the east and the west in a two-way manner and has made all-out efforts to build itself into a bridgehead for Sichuan's southward opening up. It has transformed the locational disadvantage of being far away from the dual cores of Chengdu and Chongqing into a locational advantage for developing an export-oriented economy. In 2021, Yibin achieved a total foreign trade imports and exports value of 23.65 billion yuan, ranking third in Sichuan Province. This figure has quadrupled compared with that in 2017. The import and export value with countries along the Belt and Road Initiative reached 5.38 billion yuan, an increase of 83.4%. [82]

Meanwhile, Yongchuan, Yibin and other cities have utilized the structural layout of the local manufacturing industry to create a unique higher vocational education. [83] While promoting the adjustment of the industrial structure, Yibin has built a university town. Closely following the needs of industrial development, it has successively introduced 10 universities, including Sichuan University, University of Electronic Science and Technology of China, Southwest Jiaotong University, Sichuan University of Light Chemical Technology, Xihua University, etc. The number of college students on campus has increased to more than 80,000, providing intellectual support for the high-quality development of industries. Yongchuan District already has 19 vocational education schools, with 150,000 students on campus and an employment rate of over 97%. The construction of the key modern manufacturing base and the Western Vocational Education Base not only cultivates technical talents for many leading enterprises but also helps various places find a development path suitable for small and medium-sized cities. [84]

7.2 Strengthening points and expanding surfaces to enhance the ability to serve the overall situation

The Chengdu-Chongqing region needs to cultivate more small dual-core to promote the balanced development of large, medium and small cities, and positive interaction. [85] The southern wing of the Chengdu-Chongqing Twin-City Economic Circle has significant locational advantages, such as the New International Land-Sea Trade Corridor in the west and the Golden Waterway of the Yangtze River. It should ride on the momentum of national strategic support, seize the favorable development opportunities, and promote the southern wing region to achieve breakthroughs first to enhance the ability of the Chengdu-Chongqing Twin-City Economic Circle to serve the overall national strategic

situation. *The Outline of the Construction Plan for the Chengdu-Chongqing Twin-City Economic Circle* proposes the Leaping Development of the Southern Wing, which endows this region with the mission of driving the accelerated development of the junction area of the four provinces and cities, reflecting the expectations of the strategic plan. However, a single breakthrough point is still challenging to shoulder this heavy responsibility, and there is an urgent need to "strengthen key points and expand the scope. [86] Sichuan Province can seize the good development trend of Yibin, give resources and policies tilted, and create a regional economic leader as soon as possible. Tang Jiqiang suggests that Yibin, Luzhou, Zigong, Neijiang and other cities have been exploring the economic integration of southern Sichuan for many years, and should accelerate into the substantive stage, and join hands with Chongqing to push forward the integration and development of southern Sichuan and western Chongqing as a whole, to form a new power source of the Twin Cities Economic Circle, and to drive the combined area of the four provinces and cities to realize the catching-up type of development.

At present, we should seize the opportunity of the industrial transfer of the eastern coastal region and the general manufacturing industry function of the Chengdu-Chongqing dual core to ease the manufacturing density of the southern wing of the economic circle, and utilize the industrial manufacturing characteristics of each city to carry out the advantageous industrial division of labor and synergistic development. [87] Strengthen the connections between the southern wing region of the Chengdu-Chongqing Economic Circle and international economic corridors such as the China-Indochina Peninsula Economic Corridor and the Bangladesh-China-India-Myanmar Economic Corridor. Deeply participate in the division of labor in the global industrial chain. Actively explore the vast emerging market of more than two billion people in South Asia and Southeast Asia. Further, it builds an inland southward opening gateway and better serves the overall national strategic situation. .

Author Contributions: Conceptualization, methodology design, software, formal analysis, investigation, resources, writing—original draft preparation, writing—review and editing, validation, Xiao Guo; Corresponding Author,Xinmei Zhou ,Huazhong Tu . All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the Chongqing Social Science Funding Projects (2023ZDSC02), the Intelligent Policing and NSRM Laboratory of Sichuan 970 Police College (ZHKFYB2305), the International Cooperation Development Research center of Sichuan University of Science & Engineering (ZYB(K)-2024-03), Sichuan Provincial Social Sciences Funding Projects (SCIJ24ZD74), Ethnic and Religious Affairs Commission of Hubei Province(HX20240044),and Changchun Institute of Shehuizhuyi(HX20240177).

Data Availability Statement: All data used in this investigation was sourced from publicly available sources. The specific datasets were accessed through the following platforms: the CNKI platform for Chinese papers and the Google Scholar platform for foreign papers and books. For electronic materials, please refer to the links provided in the References section for detailed acquisition information. No new data were generated throughout the research process. Additionally, there were no instances where data was inaccessible due to privacy or ethical concerns, as all data utilized was public. We are committed to maintaining the accessibility and transparency of data to facilitate further exploration and reproducibility of academic research.

8. References

- [1]. Gou, X.Z, (2024). Digital Economy, Demographics and High-Quality Development of Twin-City Economic Circle in Chengdu-Chongqing Region. *Western Economic Management Forum*, 3, 42 - 57.
- [2]. The Central People's Government of the People's Republic of China. (2021, October 20). Chengdu-Chongqing Region Twin Cities Economic Circle Construction Plan Outline. Retrieved September 11, 2024, from https://www.gov.cn/xinwen/2021-10/20/content_5643915.htm.
- [3]. Xiu, J., & Fu, Z.Q., & W, H.W. (2024). Chengdu-Chongqing Economic Circle, One of the Advice Record: Singing a Good 'Tale of Two Cities' and Building a 'Fourth Pole'. *People's Political Consultative Conference Daily*, May 20, 2024.
- [4]. Huang, X.Y., (2011). Realistic Conceptualization of Urban Utopia: Reading Howard's <The Idyllic Cities of Tomorrow>. *Resources and Habitat*, 12, 73 - 74.
- [5]. Knickel k, Almeida a, Galli f, et al. (2023). Transitioning towards a Sustainable Wellbeing Economy: Implications for rural-urban relations. *Land*, 10 5, 512.

- [6]. Anlimachie m a, avoada c, heynemanh s p. (2020). Socio-economic Impact of Closing the rural-urban Gap in Pre-tertiary Education in Ghana: Context and Strategies. *International Journal of Educational Development*, p. 102236.
- [7]. Yang Yi Yi Er was a famous saying in ancient China, indicating the economic status of Yangzhou and Yizhou. Yangzhou was the most prosperous city and Yizhou was the second during a certain historical period in ancient China
- [8]. Guangming net. (April 23, 2024). New Ideas Lead a New Journey " Riding the Momentum to Promote the Formation of a New Pattern in the Development of the Western Region. Retrieved June 30, 2024, from <https://baijiahao.baidu.com/s?id=1797083047211566314&wfr=spider&for=pc>.
- [9]. Sun, J.X. (2024). The experience, shortcomings and future direction of the high-quality development of the Chengdu-Chongqing region's twin-city economic circle. *New West*, 2, 85 - 89.
- [10]. Pan H, Yang C, Quan L, et al. (2021). A new insight into understanding urban vitality: a case study in the Chengdu-Chongqing area twin-city economic circle, China. *Sustainability*, 13, 18, 10068.
- [11]. Liu, S.M. (2024). Chengdu-Chongqing Bicity Circle's 'New Task'. *Huaxia Times*, 2.
- [12]. Sun, J.X. (2024). Experiences, Shortcomings and Future Direction of High-Quality Development of Chengdu-Chongqing Economic Circle. *New West*, 2, 85 - 89.
- [13]. Chongqing Political Consultative Conference Newspaper. (July 30, 2020). Building a Twin-City Economic Circle and Promoting the Integration of Sichuan and Chongqing. Retrieved June 30, 2024, from https://www.cqzx.gov.cn/cqzx_content/2020-07/30/content_10046546.htm.
- [14]. Tong, X.Y., & Yu, X.Y. (2024). Singing a Good Western 'Twin Cities Story' in the New Era. *PLA Daily*, 10, 70 - 76.
- [15]. Throughout Chinese history, the Ba region, which is mainly today's Chongqing, and the Shu region, centered around today's Sichuan, have always been closely connected in culture and history. Their dialects are alike, their food cultures are similar, and their folk customs are much the same. Their development has always influenced and supported each other. The saying "Ba and Shu are like one family; Sichuan and Chongqing grow together" well describes this special relationship.
- [16]. Qi N, Tan X, Wu T, et al. (2022). Temporal and Spatial Distribution Analysis of Atmospheric Pollutants in Chengdu-Chongqing Twin- City Economic Circle. *International Journal of Environmental Research and Public Health*, 19, 7, 4333.
- [17]. Wu, Z.M., & Gao H., (2023). The Causes of Chengdu-Chongqing's Central hollowing-out from the Perspective of the Regional Dual-Core Structure. *Sichuan Province Situation*, 11, 17 - 19.
- [18]. Yu, R.J., & Liang, H.L. (January 4, 2020). The central first mentioned 'Chengdu-Chongqing region dual-city economic circle', how big is the impact?. Retrieved June 18, 2024, from https://m.thepaper.cn/baijiahao_5428119.
- [19]. Chuanguan News. (February 10, 2024). "City and State Observation | Building a Circle and Strengthening a Chain" and "Salt Culture+", "Millennium Salt Capital". Retrieved June 30, 2024, from <https://baijiahao.baidu.com/s?id=1790482335365382483&wfr=spider&for=pc>.
- [20]. H, L., (2010). The Merger of Neijiang and Zigong in the Construction of the Chengdu-Chongqing Economic Zone. *City*, 6, 15 - 19.
- [21]. Wang, L.Y., (2023). Measurement of urban-rural integration level and analysis of obstacle factors in Chongqing. *Rural Science and Technology*, 3, 26 - 29.
- [22]. Z, Y., & Su, W.C., (2024). Research on the spatio-temporal differentiation of urban-rural integration and influencing factors in the twin-city economic circle of Chengdu-Chongqing region. *Regional Research and Development*, 43, 2, 28 - 34.
- [23]. Sina Finance. (May 12, 2020). Twin-city economic circle heavy opening to crack the Central hollowing-out: Chengdu eastward expansion of Chongqing westward expansion. Retrieved June 18, 2024, from <https://baijiahao.baidu.com/s?id=1666528282264924958&wfr=spider&for=pc>.
- [24]. H, X.Y., (2011). The Realistic Conception of Urban Utopia: Reading Howard's <The Idyllic City of Tomorrow>. *Resources and Habitat Environment*, 12, 73 - 74.
- [25]. Jie Y., & Hanying M., (2006). The Integration and Sustainable Development of Chengdu-Chongqing Urban Agglomeration. *Chinese Journal of Population Resources and Environment*, 4, 3, 3 - 10.
- [26]. M, L.L., (2022). Research on Population Development Trends and Countermeasures of Chinese Mega-Cities: Taking Chengdu as an Example. *Population and Society*, 1, 81 - 93.
- [27]. Cheshmehzangi A., & Tang T., (2022). Chengdu-Chongqing city cluster: From an economic zone to a major economic circle in the Western China, China's city cluster development in the race to carbon neutrality. *Singapore: Springer Nature Singapore*, 77 - 92.

- [28]. People's Government of Sichuan Province. (April 25, 2022). Press Conference on Intellectual Property Protection and Development in Sichuan Province in 2021. Retrieved June 30, 2024. from <https://www.sc.gov.cn/10462/10705/10707/2022/4/25/ea9582a014d9419da192254ba4c6dfab.shtml>.
- [29]. X, J.X., (2024). Analysis of Population Gathering and Development Status of Chengdu-Chongqing Economic Circle. *Business and Exhibition Economics*, 11, 27 - 30.
- [30]. Li, Z.R., & Xu, D.Y., & Lei, S.Y., et al. (2018). Analysis of county economic differences and their causes in the Chengdu-Chongqing urban agglomeration. *World Geography Research*, 27, 3, 76 - 85.
- [31]. Zhang, X.L., & Zhang, M.D., & Xiao, H., (2018). Research on the Spatial Pattern and Formation Mechanism of Urban Shrinkage in Chengdu-Chongqing City Cluster. *Journal of Chongqing University (Social Science Edition)*, 24, 6, 1 - 14.
- [32]. Wei, H.K., & Nian, M., & Li, Y.Y.,(2020). "14th Five-Year Plan" China's Regional Development Strategies and Policies. *China Industrial Economy*, 5, 5 - 22.
- [33]. Yu, J.H., & Zhang, W.Z., & Li, J.H., (2024). China's innovation chain, industrial chain spatial synergistic configuration and regional economic layout research. *Proceedings of the Chinese Academy of Sciences*, 4, 641 - 650.
- [34]. Li, Z.R., & Xu, D.Y., & Lei, S.Y., et al. (2018). Analysis of county economic differences and their causes in the Chengdu-Chongqing urban agglomeration. *World Geography Research*, 27, 3, 76 - 85.
- [35]. Chongqing Daily. (March 31, 2022). 2021 Chengdu-Chongqing Area Twin Cities Economic Circle Realized GDP of 7,391.92 billion yuan with a year-on-year growth rate of 8.5% Economic Development Growth Rate Leads the West. Retrieved June 30, 2024. from <https://baijiahao.baidu.com/s?id=1728796690393911108&wfr=spider&for=pc>.
- [36]. 21st Century Business Herald. (May 13, 2019). Can the Chengdu-Chongqing city cluster become the fourth pole? Dual core overpowering Central hollowing-out is a hurdle. Retrieved June 18, 2024. from <https://gov.ifeng.com/c/7mdgJMe2Et6>.
- [37]. Lv, W.J., (2019). Policy Evolution, Summary of Laws and Development Trend of Coordinated Development of China's City Clusters. *Development Research*, 3, 33 - 39.
- [38]. Liu, J.X.,(2004). Metropolitan Area“ Strategy is an Important Way to Achieve Coordinated Regional Economic Development”, in Theory Exploration, No. 6, 2004, pp. 55-57.
- [39]. Aydin,. (2019). A Study of Historical Urban Form in Soviet Period and Modern Kazakhstan. Master's thesis, China University of Mining and Technology, 2019.
- [40]. T, R., (2020). Research on the Coordinated Development of Science and Technology Innovation in the Twin-City Economic Circle of Chengdu-Chongqing Region - Based on the Comparative Perspective of Beijing-Tianjin-Wing, Yangtze River Delta, Guangdong-Hong Kong-Macao City Clusters. *Chongqing Administration*, 5, 80 - 82.
- [41]. Li, H.Q., (July 25, 2019). Joining Forces to Build a World-Class Chengdu-Chongqing City Cluster. Retrieved June 18, 2024. from <https://weibo.com/ttarticle/p/show?id=2309404397958262030382&comment=1>.
- [42]. Zheng, Z.Z., (2021). The Strategic Evolution and Promotion Strategy of the Construction of Chengdu-Chongqing Economic Circle. *Journal of Southwest Petroleum University (Social Science Edition)*, 4, 17 - 23.
- [43]. Zhou, X.X., & Zhou, W., (20201). Characteristics and Mechanisms of Population Urbanization in the Twin-City Economic Circle of Chengdu-Chongqing Region. *Population and Society*, 37, 4, 76 - 88.
- [44]. Tan, X.P., (2024). The Realistic Basis and Path Choice of Building a Modern Industrial System in the Chengdu-Chongqing Economic Circle - Based on the Comparative Analysis of the Four Major Domestic City Groups. *Sichuan Metallurgy*, 2, 46, 7 - 12.
- [45]. Hong, L.J., (2004). Chongqing: Opportunities and Risks. *The China Quarterly*, 178, 448 - 466.
- [46]. Dasgupta, & Partha, & Joseph Stiglitz. (1980). Industrial Structure and the Nature of Innovative Activity. *The Economic Journal*, 90, 358, 266 - 293.
- [47]. Zheng, G.N., (2021). Innovation Chain Synergy in Guangdong, Hong Kong and Macao Greater Bay Area: Mechanism, Evaluation and Countermeasure Suggestions. *Regional Economic Review*, 6, 85 - 92.
- [48]. Jia, G.L., (2013). New Thinking on the Third Industrial Revolution and the New Industrialization Path - From the Perspective of Evolutionary Economics and Economic History. *Journal of Renmin University of China*, 27, 2, 43 - 52.
- [49]. Fan, J., (2024). Theoretical Exploration, Strategic Innovation and Path Choice of China's Coordinated Regional Development during the Tenth Five-Year Plan Period. *Proceedings of the Chinese Academy of Sciences*, 39, 4, 605 - 619.
- [50]. Sichuan Statistical Society and Chongqing Statistical Society. (2024). The Energy of 'Growth Poles' - Report on the Development Index of the Twin-City Economic Circle of the Chengdu-Chongqing Region in 2022. *Sichuan Provincial Situation*, 3, 33 - 34.

- [51]. Longworth, Richard C. (2012). urban america: u.s. cities in the global era. *Journal of International Affairs*, 65, 2, 97 - 110.
- [52]. Type II large cities refer to cities with an urban resident population of more than 1 million and less than 3 million.
- [53]. Tian, Y.P., (2018). Liu Mingyue, and Zhang Weiguo, "The Impact of Urbanization Process on the Level of Regional Science and Technology Innovation. *Urban Issues*, 4, 4 - 11.
- [54]. Yibin Municipal People's Government. (December 18, 2023). From the Three Rivers to the World - An Overview of the High-Quality Development of Yibin's Liquor Industry. Retrieved June 30, 2024. from http://www.yibin.gov.cn/xxgk/jryb/tpbd/202312/t20231218_1936639_wap.html.
- [55]. Chongqing Administrative College. (October 28, 2020). An Analysis of the Problems and Countermeasures of the Construction of Chengdu-Chongqing Economic Circle. Retrieved June 30, 2024. from https://cqdx.gov.cn/bmwz/xyzje/xyydn/content_7317.
- [56]. Wang, F., & Yao, S J, & Zhang, F., (2020) Research on the impact of opening high-speed railroad on the economic growth of cities along the route. *Quantitative Economic Research*, 11, 4, 105 - 117.
- [57]. Luo, X.H., & Chen, X.Y., & Chen, L.P., (2024). Problems and Suggestions of Transportation Integration Construction in the City Cluster in the Middle Reaches of the Yangtze River. *Journal of Chongqing Jiaotong University (Social Science Edition)*, 24, 1, 57.
- [58]. Western Branch of CIRC. (May 7, 2021). "Chengdu-Chongqing Economic Circle" Series Research: A Primary Exploration of Population and Urbanization Development in Growing Metropolitan Areas - Taking Chengdu Metropolitan Area as an Example. Retrieved June 30, 2024. from https://mp.weixin.qq.com/s/3r767yOj7apuEVc7ZNTamg?search_click_id=18140080386716199377-1741058725559-8711514230.
- [59]. Cai, H.B., (2021). A Study on the Path of Industrial Upgrading and Synergistic Development of the Twin-City Economic Circle in China's Chengdu-Chongqing Region. *Economic Management Research*, 6, 6, 99 - 100 + 105.
- [60]. Xiong, X., & Yu, X.H., & Wang, Y.M., (2022). Research on the Interaction between New Urbanization and Industrial Structure Upgrading in the Twin-City Economic Circle of Chengdu-Chongqing Region. *Economic System Reform*, 2, 42 - 49.
- [61]. Economic Reference News. (March 22, 2022). Changes and Challenges in 'Five Trillion Sichuan'. Retrieved June 30, 2024. from http://www.jjckb.cn/2022-03/22/c_1310524338.htm.
- [62]. Chongqing Municipal People's Government. (February 15, 2022). between Chengdu and Chongqing emerged 'small double core' reflecting the change of spatial pattern. Retrieved June 30, 2024. from http://www.cq.gov.cn/zt/cydsqjqq/chscjjhjq/202202/t20220215_10397356.html.
- [63]. Economic Reference News. (February 15, 2022). Small Dual Core" between Chengdu and Chongqing Reflects Changes in Spatial Patterns. Retrieved June 30, 2024. from <http://baike.sc.xinhuanet.com/sc/a/2424.htm>.
- [64]. Mishra A, & Agarwal A, (2019). Do Infrastructure Development and Urbanisation Lead to rural-urban Income Inequality? Countries. *International Journal of Sustainable Economy*, 11, 2, 167 - 183.
- [65]. Chongqing Municipal People's Government. (April 22, 2024). Chongqing's New Dream: From 'Super-sized' to 'Internationalized Super-sized'. Retrieved April 22, 2024. from https://www.cq.gov.cn/zwgk/zfxgkml/zcjd_120614/mts/202404/t20240422_13149519.html.
- [66]. CPC News. (January 10, 2014). From Central China's Hollowing-out to Central China's Rise. Retrieved January 19, 2024. from <http://cpc.people.com.cn/n/2014/0110/c87228-24076052.html>.
- [67]. Wei, Q.F., & Xu, X., & Yang, C.L., (2021). Research on the Coupling Coordination Degree of Scientific and Technological Innovation and High-Quality Economic Development in the Twin-City Economic Circle of Chengdu-Chongqing Region. *Science and Technology Progress and Countermeasures*, 14, 54 - 61.
- [68]. Chongqing Municipal People's Government. (April 22, 2024). Chongqing's New Dream: From 'Super-sized' to 'Internationalized Super-sized'. Retrieved April 22, 2024. from https://www.cq.gov.cn/zwgk/zfxgkml/zcjd_120614/mts/202404/t20240422_13149519.html.
- [69]. Chongqing Administrative College. (October 28, 2020). An Analysis of the Problems and Countermeasures of the Construction of the Twin-City Economic Circle in the Chengdu-Chongqing Region. Retrieved October 28, 2020. from https://cqdx.gov.cn/bmwz/xyzje/xyydn/content_7317.
- [70]. Sichuan Provincial People's Government. (2 May 2023). Our province supports the four cities in the hilly areas of central Sichuan to build a new high ground for industrial development, targeting and accelerating the rise of central Chengdu-Chongqing region. Retrieved June 30, 2024. from <https://www.sc.gov.cn/10462/10464/10797/2023/5/21/01c26f03bc17459190964f770ee89a75.shtml>.

- [71]. Yang Yi & Huang Songmei. (2023). Research on the Impact of Fintech on Regional Industrial Structure - Based on the Empirical Data of the Twin-City Economic Circle in Chengdu-Chongqing Region. *Regional Finance Research*, 11, 15 - 22.
- [72]. People's Government of Zengcheng District. (April 14, 2023). Guangzhou: "Zengcheng Insists on Leading High-Quality Development with Innovation Drive". Retrieved June 30, 2024. from https://www.gz.gov.cn/xw/zwlbgqdt/zcq/content/post_8921583.html.
- [73]. People's Daily. (December 8, 2023). High-Quality Development Research Line | High-Level Co-Construction of New Western Land-Sea Corridor. Retrieved June 30, 2024. from https://www.gov.cn/lianbo/difang/202312/content_6919065.htm.
- [74]. Chen, D., (2024). The Impact of Digital Infrastructure Construction on Technological Innovation in Chengdu-Chongqing Region. *Western Economic Management Forum*, 35, 2, 13-22.
- [75]. Su, L.Y., & Zhang, T., & Zeng, S.Y., etc. (2024). Research on Quality and Coordination of High-Quality Development of Chengdu-Chongqing Economic Circle. *Journal of Chongqing Polytechnic University (Natural Science)*, 2, 322 - 332.
- [76]. Zhou, Y., (2024). Promoting Common Wealth in Development: An Uneven System Perspective. *Journal of Changzhou University (Social Sciences)*, 1, 1, 1.
- [77]. Luzhou Municipal People's Government. (March 19, 2024). Longhuang Railway, Yukun high-speed railroad Sichuan-Chongqing section, National Highway 353, Shilongyan dock. This Year, Luzhou Key Transportation Construction Runs at Accelerated Speed. Retrieved June 30, 2024. from https://luzhou.gov.cn/xw/jrxx/content_1020482.
- [78]. Yao Shujie & Fang Jing. (2024). Developing New Productivity to Promote the Construction of a National Strategic Hinterland for the Chengdu-Chongqing Economic Circle. *Journal of Chongqing University (Social Science Edition)*, 30, 4, 1 - 17.
- [79]. New Chongqing-Chongqing Daily Commentator. (2024). Promoting the Construction of the Twin-City Economic Circle in a Deeper and Deeper Way. *Chongqing Daily*, 6, 22.
- [80]. Xiong, J.X., (2024). Analysis of Population Gathering and Development Status of Twin Cities Economic Circle in Chengdu-Chongqing Region. *Business and Exhibition Economics*, 11, 27 - 30.
- [81]. Liu, M., & Li, X.L., (2024). administrative governance to promote the synergistic development of the region - Chengdu-Chongqing Economic Circle synergistic promotion of the standardization of the work of the organs of the standardization of the work of the example. *Journal of Chongqing University (Social Science Edition)*, 290 - 305.
- [82]. Xu, R.A., (2024). Accelerating the Construction of a Strong Transportation City and Striving to Build an International Comprehensive Transportation Hub in the West. *Chongqing Administration*, 25, 2, 12 - 13.
- [83]. Yang, Y., & Xu, C.Y., (2024). Theoretical Logic, Practical Innovation and Optimization Path of Regional Coordinated Development of Twin-City Economic Circle in Chengdu-Chongqing Region. *Journal of Southwest University (Social Science Edition)*, 50 3, 41 - 52.
- [84]. Economic Reference News. (February 15, 2022). The Emergence of 'Small Dual Core' Between Chengdu and Chongqing Reflects Changes in Spatial Patterns. Retrieved June 30, 2024. from http://nyncw.cq.gov.cn/zwxx_161/rdtt/202202/t20220215_10394639.html.
- [85]. Li, W.D., (2023). County-wide integration into the construction of the Chengdu-Chongqing region's twin-city economic circle and strive to build a high quality economic and social development of the county Wuxi example. *Chongqing Administration*, 24, 6, 22 - 24.
- [86]. China.gov.cn. (October 21, 2021). CPC Central Committee and State Council Issues <Chengdu-Chongqing Region Twin Cities Economic Circle Construction Plan Outline>. Retrieved June 30, 2024. from https://www.gov.cn/zhengce/2021-10/21/content_5643875.htm.
- [87]. Xinhua. (February 17, 2023). Specialized, Specialized and New Embracing the Opportunities of the Twin Cities. Retrieved June 30, 2024. from <https://cj.sina.com.cn/articles/view/2810373291/a782e4ab02002h6at>.