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A Review of Innovative Mechanisms for Collaborative Development of Industries in Urban Agglomerations under the Background of Regional Economic Integration

Guanyu Zhu

College of Life and Environmental Sciences, University of Birmingham, Birmingham, B15 2TT, United Kingdom
Corresponding author: GXZ570@student.bham.ac.uk

Abstract:

Against the backdrop of deepening regional economic integration, the core of regional economic development has shifted to urban clusters formed by the union of several cities. Industrial collaboration is an important way for urban agglomerations to achieve high-quality development, and innovation mechanisms play a key catalytic role in this. This article systematically sorts out the internal logic of regional economic integration and the coordinated development of urban agglomeration industries and focuses on analyzing the core functions of the innovation mechanism in the three dimensions of industrial division of labor, policy coordination and platform co-construction. By studying the Beijing-Tianjin-Hebei, Yangtze River Delta and Greater Bay Area, the author summarizes their innovative measures and main challenges faced in the process of industrial collaboration. Research shows that the development trend of regional economic integration provides a foundation for industrial collaboration in urban agglomerations, while collaborative cooperation between the government and the market, innovation in cross-regional governance mechanisms, and sharing of innovative resources are important driving forces for deepening industrial collaboration in urban agglomerations. The research conclusions reveal the positive significance of innovation mechanisms for the coordinated development of urban agglomeration industries and offer quantified guidance for industrial collaboration in other urban agglomerations.

Keywords: Regional economic integration; Urban agglomeration; Industrial collaboration; Innovation Mechanism.

1. Introduction

With the further development of economic globalization, regional economic integration has become a significant trend and a prominent milestone in global economic development. Within this context, regional economic integration has promoted the freer flow of production factors across a wider range by removing institutional barriers (such as trade barriers and market segmentation). This process has led to the gradual blurring of economic boundaries and the increasing mobility of factors of production. It has become difficult for a single city to independently support the development of a complete industrial and innovation chain, and inter-city connections have shifted from „loose connections“ to „cooperative collaboration.“ Urban agglomerations have therefore gained momentum and strategic weight.

But in the process of development, administrative divisions and policy competition among cities often lead to problems such as duplication of industrial layouts and convergence of dominant industries. Furthermore, it is difficult for a single city to independently build a complete and resilient industrial and innovation chain, which can lead to bottlenecks in key technologies, fragmented innovation resources, and missing key links in the industrial chain. These issues require collaborative industrial development among cities, optimizing industrial layout at the city cluster level, jointly building and sharing R&D platforms, and strengthening upstream and downstream links in the industrial chain. To achieve this „synergy“ beyond simple physical superposition and geographical proximity to a more closely connected synergistic development, innovative mechanisms must serve as a core catalyst to promote highly coordinated industrial cooperation, the free flow of factors, and the reintegration of resources across regions, thereby achieving the dual goals of deep regional economic integration and high-quality coordinated industrial development within the city cluster.

Therefore, this article first summarizes the connotations of regional economic integration and its significance to the development of urban agglomerations, summarizes the development logic and characteristics of industrial synergy within urban agglomerations, and further analyzes the role of innovative mechanisms in fostering industrial synergy within urban agglomerations. Next, this article selects the Beijing-Tianjin-Hebei region, the Yangtze River Delta region, and the Guangdong-Hong Kong-Macao Greater Bay Area as case studies, outlining their innovative practices in industrial synergy and analyzing the major challenges they currently face. Finally, based on this information, the author identifies lessons learned from industrial synergy driven by innovative mechanisms, which offer practical insights and guidance for industrial synergy within other urban agglomerations and the high-quality development of regional economies.

2. Regional Economic Integration and Coordinated Development of Urban Agglomeration Industries

As regions gradually replace countries and become the units of global competition, regional economic integration on a global scale has become a significant trend in the process of economic globalization [1]. Regional economic integration is an institutional arrangement implemented by sovereign states or regions to achieve economic cooperation, integration or fusion within and outside the region [2]. Its most essential core is to eliminate the barriers to the flow of factors within a certain region, thereby forming an optimal economic structure with free flow of factors and full competition, rather than a simple integration of regions or countries or „concerted action“ among governments [3].

Since the 11th Five-Year Plan in 2006, Chinese government has chosen urban agglomerations as the main vehicle for regional integration. According to the National New Urbanization Plan (2014-2020) and the 14th Five-Year Plan for New Urbanization, a „5+9+6“ urban agglomeration spatial pattern will form in China. Developing urban agglomerations and forming a rational flow and efficient aggregation of factors have become the necessary measures to implement regional coordinated development and release local vitality in the new era [4]. In this context, urban agglomerations and regional economic integration have formed a mutually reinforcing virtuous cycle. Regional economic integration is the macro-environment for the development of urban agglomerations, while urban agglomerations are the spatial carriers and important manifestations of regional economic integration.

However, due to China‘s vast territory, the natural environment, economic foundation and market capacity of each region vary, which also leads to the unbalance and insufficiency in the process of urban agglomerations’ development. Therefore, promoting coordinated industrial development is an important way to resolve regional development imbalances and promote high-quality economic development. It helps optimize the regional industrial spatial layout, streamline the industrial development chain, and form a new industrial development pattern with complementary advantages and close coordination within the region [5].

The essence of industrial collaboration in urban agglomerations is an open system with multiple elements [6]. Making urban agglomeration as a whole closely connected and harmoniously symbiotic organism through continuous competition, cooperation and optimization among the cities is the main purpose of the coordinated development of

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urban agglomeration industries [7]. For urban agglomerations, industrial collaborative development not only helps strengthen the technological innovation and industrial upgrading functions of central cities but also gives full play to the comprehensive comparative advantages of various regions, improves the degree of circuitousness of the industrial chain, and provides strong support for building a new development pattern of dual circulation [8].

3. The Role of Innovation Mechanisms in Industrial Collaboration in Urban Agglomerations

The first step in urban agglomerations' coordinated industrial development is to break the limitations of a single city developing its own industrial chain through innovation in the industrial division of labor model, promote cross-regional industrial chain division of labor to weaken the marginal utility of industrial collaboration, and achieve the effect of upgrading the industrial chain and strengthening the integration of urban agglomerations [9]. In the early days of China's urban agglomerations, the lack of coordination in the development of industries among cities led to the convergence of industrial structures, similar industrial layouts, and duplication of major infrastructure construction within the region [10]. The division of labor in the industrial chain of urban agglomerations will mainly reflect the characteristics of corporate headquarters and R&D centers gathering in core cities and surrounding small cities taking advantage of low-cost production factors to develop manufacturing after the mechanism innovation [11]. With this kind of industrial division of labor, the central city can concentrate on developing the service industry. Core-cities' decentralized manufacturing functions will be taken over by other cities or form manufacturing clusters in core cities, which can significantly boost regional economic development and promote the economic integration of urban agglomerations [12].

Secondly, there used to have some obvious administrative barriers between cities and a lack of awareness of overall benefits in the early stages of China's urban agglomeration development [10]. This situation often leads to a lack of market stability, high costs for factor mobility, and hinders the free flow of factors and resource integration within urban agglomerations. However, through government promotion and cross-regional policy innovation, administrative barriers can be effectively weakened. For example, building an industrial coordination policy system within the city cluster based on standards such as industrial relevance, industrial chain fit, and industrial circle rationality can enhance market stability and promote the free flow of factors [13]. At the same time, the central government also needs to strengthen overall coordination and guidance among local governments to form a synergistic development force, clarify task objectives and improve cooperation systems such as market access, major infrastructure and tax sharing [14]. Government intervention is conducive to creating a good market and institutional environment for the development of industrial collaboration, ultimately mobilizing the market's enthusiasm and initiative in developing industrial collaboration and deepening the development of cross-regional industrial collaboration.

Furthermore, urban agglomerations can achieve collaborative industrial development by sharing innovative resources. For example, through concerted efforts among cities, innovation platforms can be built. Alternatively, the abundant talent, capital, and technology within urban agglomerations can be fully utilized to foster emerging industries and cultivate new productivity, injecting sustained momentum into collaborative industrial development. At the same time, node regions within urban agglomerations with highly concentrated scientific and technological innovation capabilities can leverage radiation mechanisms to promote the sharing and diffusion of innovative resources, achieving efficient spatial collaboration between science and technology and industry [15]. The joint construction and sharing of major scientific research infrastructure and the joint cultivation of high-tech industrial clusters among cities can also strengthen the cross-regional integration of innovation resources [16].

4. Innovative Practices and Problems Faced by China's Urban Agglomerations

The Beijing-Tianjin-Hebei region, the Yangtze River Delta region, and the Guangdong-Hong Kong-Macao Greater Bay Area are three core urban agglomerations that account for 40% of China's total economic output. They not only shoulder the important mission of continuously injecting momentum into the national economic development but also serve as important examples of high-quality economic development in urban agglomerations under the background of regional economic integration. Therefore, this article uses these three urban agglomerations as cases to analyze the practice of innovation-driven coordinated industrial development in Chinese urban agglomerations and the main problems they currently face.

4.1 Beijing-Tianjin-Hebei - Functional Decongestion and Industrial Reshaping

The symbiotic interaction of the government and market mechanisms plays one of the most significant roles in the coordinated development of regional industries [17]. The Beijing-Tianjin-Hebei region is being built under this approach, guided by the government while taking the lead-

ing role of the market into account. The government has adopted a management model in which a central leading group and local governments coordinate [18]. The local government has taken guiding measures to adjust the industrial distribution pattern of Beijing, Tianjin and Hebei, established an independent organization to coordinate the coordinated development of industries in the three regions and built a reasonable compensation mechanism and coordination mechanism [19]. For example, to actively take over the non-capital functions transferred from Beijing, Tianjin has created a „1+16“ taking-over system that combines comprehensive taking-over platforms with professional taking-over platforms. And Hebei has precisely created a „1+5+4+33“ key taking-over platform system to accelerate the taking over of non-capital functions transferred from Beijing and the industrial transfer from Tianjin. By building such a system in Tianjin and Hebei, the productive service functions of the urban agglomeration have shown a clear trend of agglomeration in Beijing, while Tianjin and Hebei mainly undertake production and manufacturing functions [20]. However, inter-regional competition is still a major obstacle to the coordinated development of industries in this region [21]. Its coordinated development of industries is a long game process [22]. In the process of game, there are problems of interest coordination among market players in three cities. The three cities will take filling their own shortcomings and developing efficiently as their main goal, which will lead to competition among the three regions and affect the coordinated development of industries [19]. In addition, due to problems such as insufficient land supply in the region, while intensifying competition among cities, it has also led to obstructions in industrial transfer and factor flow within this urban agglomeration, thereby hindering its coordinated industrial development.

4.2 Yangtze River Delta - Deep Cooperation to Build an Industrial Collaborative Community

Who plays one of the most significant roles in promoting in-depth industrial collaboration and strengthening economic cooperation among cities in the Yangtze River Delta is the government [23]. In 1992, at the early stage of development, local governments had already formed a certain development consensus and innovatively established a joint conference system. In 1997, with the establishment of Taizhou City, the joint conference system was upgraded to the Urban Economic Coordination Council, which holds formal meetings every two years to strengthen industrial cooperation among cities. Recently, with the guide of the development strategy of Yangtze River Delta integration, governments at all levels in the region have coordinated and implemented a series of innovative policies, effectively breaking down the barriers of administrative boundaries between cities, promoting the smooth flow of various factors between cities, and accelerating the process of coordinated industrial development. For example, the abolition of all toll booths on inter-provincial highways in this region and the cross-provincial handling of some matters for enterprises in the Yangtze River Delta are the direct results of the strengthened coordination [24]. However, the industrial structures of cities within the Yangtze River Delta are highly similar, especially in strategic emerging industries such as electronics and information technology, high-end equipment, and biomedicine, where duplication and homogenous competition exist. For example, Suzhou, Wuxi, and Changzhou are all vigorously developing the integrated circuit and new energy vehicle industries, lacking differentiated positioning and functional complementarity. Homogeneous competition often weakens the advantages of differentiated development, causing problems such as scattered waste of resources and vicious competition, which is not conducive to the coordinated development of industries and regional integration [25].

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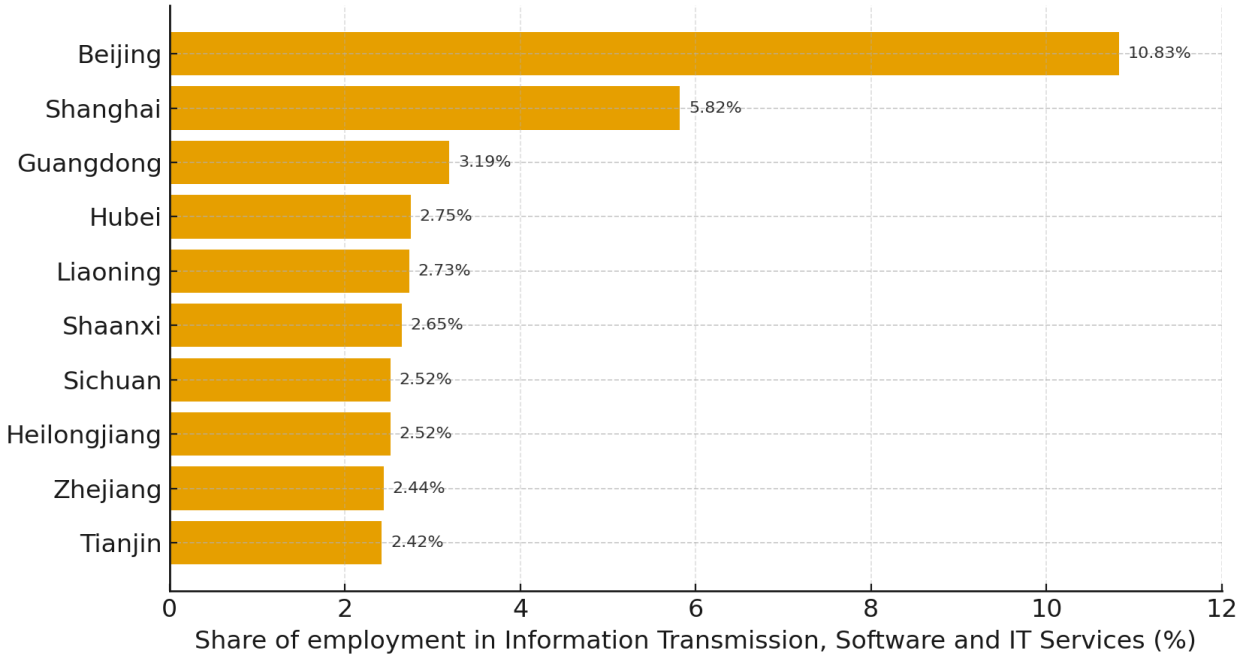

Fig. 1 Employment share of the information transmission, software and IT services industry in various Chinese cities in 2021

The Yangtze River Delta is a massive urban agglomeration, and within it, there are issues such as uneven regional development leading to uneven distribution of innovative resources. While core cities like Shanghai and Nanjing boast abundant scientific and technological resources and innovation platforms, surrounding smaller and medium-sized cities are relatively underserved in terms of talent, funding, and technology. This imbalance leads to uneven allocation of resources and widening of the competitiveness gap between regions, making it difficult for the entire region to form an organic and coordinated economic development [26].

4.3 Greater Bay Area - Industrial Collaborative Development in a Cross-Border Context

The Greater Bay Area is a representative urban cluster in China, which is mainly composed of Hong Kong, Macau and Guangdong. It is built under the „One Country, Two Systems“ policy. And it has a leading group for its development that established by the central government to oversee its innovative development strategy. Its unique cross-border nature makes its measures for collaborative industrial development highly innovative. First, in recent years, the Greater Bay Area has actively promoted integrated cross-border transportation. The internal connection and transportation accessibility of the urban agglomeration have been strengthened by building cross-sea channels, rail transit and other infrastructure [27]. A comprehensive city cluster-level transportation system can effectively mitigate the cross-border barriers to the flow of factors, promoting in-depth exchanges and coordinated development among cities. At the same time, a sound cross-border complementary industrial structure has also been formed within the region. Hong Kong and Macao actively leverage the advantages of the Pearl River Delta‘s physical industrial base and development space to promote cooperation in science and technology innovation industries, thus improving the difficulties of a single industrial structure, hollowing out of science and technology innovation and manufacturing industries caused by historical and geographical factors [28]. And with the influence of two special administrative regions, the industrial richness of mainland cities in the Greater Bay Area has been significantly improved [29]. For example, Shenzhen and Guangzhou have formed industrial clusters focused on artificial intelligence, next-generation biomedicine, and information technology, with intelligent manufacturing at their core. Zhuhai, Shenzhen, and Foshan have formed a smart home appliance industry cluster. Shenzhen, Guangzhou, and Foshan have formed a smart equipment industry cluster.

Although the unique cross-border background provides a series of advantages for the urban agglomeration, the special background adds certain difficulties to its coordinated development of industries. A prominent problem in the process of industrial collaboration is the inadequacy of market-driven mechanisms and interest distribution coordination mechanisms [30]. Although the government has made policy innovations, the deeper flow of factors is still subject to differences in rules among the three places. At

the same time, foreign exchange restrictions have also reduced the efficiency of cross-regional resource allocation among market players. In the current division of labor, core cities like Hong Kong, Shenzhen, and Guangzhou often dominate high-end value chain links like R&D and design, brand marketing, and financial services, reaping the lion‘s share of profits. Other cities, on the other hand, primarily handle production and manufacturing, with relatively slim profit margins. This uneven distribution of benefits has also, to a certain extent, constrained the coordinated development of industries and regional integration.

5. Conclusion

This article systematically examines the theoretical logic and practical approaches to the coordinated development of urban agglomeration industries within the context of regional economic integration, focusing on the core driving role of innovation mechanisms. Through theoretical summarization and case studies, three conclusions are drawn.

Firstly, the trend of regional economic integration provides macroeconomic impetus for innovation in industrial collaboration within urban agglomerations. This trend has prompted cities to actively remove administrative barriers and promote the flow of factors. This has pushed urban agglomerations from „loose connections“ to „deep collaboration,“ creating favorable conditions for industrial collaboration and innovative cooperation.

Secondly, innovative mechanisms are the key to promoting industrial collaboration in urban agglomerations from low-level physical superposition to high-level deep integration. Through the innovation of industrial division of labor model, a complete industrial chain can be built at the city cluster level, and the industrial layout of the city cluster can be optimized. And policy innovation can weaken administrative barriers and promote the free flow of factors. Jointly building an innovation platform can also promote the sharing of innovation resources and the transformation of scientific and technological achievements.

Finally, the effective implementation of innovation mechanisms requires a dual drive from both the government and the market. The government should play a coordinating role in planning, institutional design, and platform development, while the market should play a decisive role in resource allocation, industry selection, and innovation activities. Only through the coordinated efforts of both can sustainable and high-quality development of industrial collaboration be achieved.

This article systematically examines the innovation mechanisms underlying the coordinated industrial development of urban agglomerations within the context of regional economic integration and provides case studies based on China‘s three major urban agglomeration. While representative and valuable, this article fails to cover emerging urban agglomerations such as the Chengdu-Chongqing region and the middle reaches of the Yangtze River. The lack of in-depth analysis of urban agglomerations in central and western China may affect the generalizability of the conclusions.

Future research could be deepened in the following areas. First, research on small or medium-sized urban agglomerations and emerging urban agglomerations, such as the Chengdu-Chongqing regio, could broaden the scope and representativeness of research. Second, a quantitative evaluation system could be developed to measure and compare the level of industrial coordination and the effectiveness of innovation mechanisms within urban agglomerations, providing a more scientific basis for policymaking. Third, Comparative studies of Chinese urban agglomerations with those of other countries can be conducted from an international perspective, drawing on the development experiences of international urban agglomerations to promote the modernization of China‘s urban agglomeration governance system.

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