The Situation Analysis of Beijing-Tanjin-Hebei Collaborative Innovation from the Spatial Economic Perspective

Zhi-wei YANG\textsuperscript{1,a} and Hao FAN\textsuperscript{2,b,*}

\textsuperscript{1,2}Wuhan University, International School of Software, Wuhan, Hubei, China
\textsuperscript{a}yangzhiwei@cnbmtech.com, \textsuperscript{b}hfan@iss.whu.edu.cn
\textsuperscript{*}Corresponding author

Keywords: Space Economy, Beijing-Tanjin-Hebei Cooperation, Strategic Layout, Resources Allocation.

Abstract. The collaborative development among Beijing, Tanjin and Hebei is an important strategy of regional planning in our country. For their collaborative development, it needs to focus on the collaborative innovation of industry adapted to the region from the spatial economic perspective. This paper chooses to combine the theory of space economics with the collaborative development and innovation among Beijing, Tanjin and Hebei. At present, their collaborative innovation has become a new power. As the center of capital radiation, Beijing plays a leading role and is radiating an increasing influence on Tianjin and Hebei. At the same time, we can find from the patent data that the patent transfer situation among Beijing, Tanjin and Hebei is not suitable for the strategic positioning of their collaborative development. It needs to observe the collaborative development among Beijing, Tanjin and Hebei from the strategic and overall perspective. In order to serve their respective strategic positioning and realize new scientific and technological cooperation among Beijing, Tanjin and Hebei, the resources allocation for regional scientific and technological innovation needs to be improved and the scientific and technological innovation elements needs to be shared in regions.

1. Introduction

No economic activity can escape the existence of space, and need the carrier of certain space. The research of spatial economics is about the resource allocation in the space and the space location of economic activity. Although the location theory has a long history, unlike time, space has not been taken seriously over a long period and has not been able to be included into the research system of mainstream economics.

Beijing-Tianjin-Hebei region has the densest innovation resources and the main body of innovation in China. With the most powerful scientific research strength and innovation ability, this region occupies an important position in the national regional planning. The collaborative development among Beijing, Tanjin and Hebei is a major strategic decision made by the Party Central Committee with comrade Xi Jinping as general secretary. On February 26, 2014, President Xi Jinping convened a symposium in Beijing, to listen to the work report about the collaborative development of Beijing-Tianjin-Hebei region. He emphasized to build new capital economic circle for the future development and promote the innovation of regional development system and mechanism to realize the collaborative development [1]. On March 5, 2014, Premier Li Keqiang pointed out in his government work report to strengthen the economic cooperation in Bo Hai Coastal Region and Beijing-Tianjin-Hebei region. On March 23, 2015, the central economic and financial leadership committee reviewed and studied The outline of the Beijing-Tianjin-Hebei collaborative development plan in the ninth meeting [2]. On April 30, 2015, the Political Bureau of the CPC Central Committee held a meeting and passed The outline of the Beijing-Tianjin-Hebei collaborative development plan [3]. The promulgation of “The outline” marks the completion of the
top-level design for Beijing-Tianjin-Hebei collaborative development, and the main points of implementing this major national strategy are clear.

2. Literature Review

The author used advanced search system to search "space economics" on CNKI and got search results. According to the search results, domestic academic circle have been focusing on the spatial economics theory and doing the research since 1980s and 1990s. At the beginning of the 21st century, it formed a small peak and the overall trend is rising with fluctuation.

![Figure 1. Literature years map for the subject of spatial economics.](image)

According to the theme of literature research, the domestic spatial economics research mainly can be divided into two categories in recent years: one is to directly discuss the connotation of the spatial economics theory and frontier development; the other is to explore and solve the problems of industrial agglomeration and transfer, regional gap according to the development situation in our country. As you can see from these studies, in the process of development, regional development difference is inevitable, thus it is significant to promote the flow of all kinds of factors and market integration for the development of regional collaborative development. All kinds of research provides a new visual angle for our country’s development and deepening of reformation theory. It also provides a new theoretical basis for the establishment of industrial policy and regional policy. Meanwhile, it further expands the development space for spatial economics.

Some scholars thoroughly discussed the origin, connotation development and the frontier dynamic of the spatial economics theory. They sorted out its theoretical logic results and theoretical contexts. The in-depth discussion and research about spatial economics theory and the analysis of its significance and enlightenment to the economy society are significant references to combine theory with practice and solve all kinds of real-life economic problems. The published time of these papers is mainly before 2010 years, which can help us to infer that the research literature of pure theory gradually reduced after theory research was mature and the mainstream became the literature combining the mature theory with actuality.

Qi Liang systematically expounded the tradition and the evolution of spatial economics, explained the difference among spatial economics, regional economics and geographical economics, and pointed out the latest development of spatial economics and its realistic significiarratance. He argued that the spatial economics studied the resources allocation in space and the space location for economic activity [4].

In order to deepen the readers’ understanding and cognition of the spatial economics, Qi Liang cited many domestic and foreign references to systematically explain the origin, modeling strategy, basic model and future development direction of space economics. Qi Liang thought that spatial economics theory was evolving from the classical location theory to new classical location theory [5]. Spatial economics research is about the resource allocation in the space and the space location of economic activity, whose modeling strategy can be classified as four categories: D - S model,
iceberg cost, dynamic evolution and computer. The regional model (center - periphery model), city model (the evolution of the urban hierarchy system) and the international model (industrial concentration and international trade) can be regarded as the basic models of spatial economics. There are at least the following three development directions for future spatial economics: expanding theory menu, seeking empirical research and exploring welfare and policy implications of space economy.

Kairong Hong regarded spatial economics as the general term of multidisciplinary subjects that developed on the basis of locational theory [6]. Although both space and location are considered as the basic variables of research, spatial economics does not have a complete theoretical system and strict logical structure. During its long-term development process, spatial economics has been in the dynamic changes of differentiation and integration. Kairong Hong induced the major aspects and theoretical context of the spatial economics’ development process and analysed its latest theoretical achievement by citing other literature. He also pointed out the potential development direction of spatial economics.

For the spatial economics, Husen An and Tao Jiang introduced the main research object, theoretical basis, model classification, modeling techniques and the core idea [7]. They also gave a brief evaluation on them. They thought that spatial economics was the subject to bring space elements that had been neglected for a long time by the mainstream economics back into the analysis framework of general equilibrium. It discusses the space mode of economic activity. It is the key factors of the element and mechanism for economic activity space model. It can also explain the economic growth through the space process of economic activity.

Wen Chen and Weiguo Lyu expounded the main contribution to spatial economics and the viewpoints of some theories from the perspective of historical development, such as comparative advantage, trade theory, location theory and new economic geography theory [8]. They thought that the spatial equilibrium under sustainable development put forward the new theory requirement for spatial economics. Therefore, the goal of spatial economics research ought to change from traditional economy goal to the comprehensive utility maximization for economy, society and environment. It ought to set up a system analysis framework of spatial equilibrium under the condition of spatial heterogeneity, a rational allocation theory for ecological space distribution and development space of economic activity. Then the theory model will be closer to the reality and the explanatory power of theory will be improved.

Changde Zheng mainly introduced the core - edge model brought up by Paul R. Krugman and discussed the significance of Krugman’s spatial economics theory to the regional economics in our country [9]. He thought the new economic geography created by Krugman of important guiding significance for the basis construction of regional economic discipline theory in our country.

Through reviewing related literature, Guang WeiYan and Ji Li put forward and demonstrated the viewpoint, “Spatial economics is the fusion based on spatial dimension of alleconomics branches related to spatial dimension. New economic geography space is one of the most advanced subject branches of spatial economics” [10]. They also combed the development context of the new economic geography and reviewed the basic ideas and the development direction in future of new economic geography.

Qi Liang and Zhuo Huang described the development of spatial economics and new economic geography in the past 20 years in China, and pointed out that the next development direction of spatial economics in China was to further combine with international trade, urban economics, regional economics and development economics [11]. They also introduced the general situation of 2011 international symposium on spatial economics, explored the papers of reference meaning to our country, and discussed the future of spatial economics research in China.

To this end, this paper chooses to combine the theory of spatial economics with the collaborative innovation and development among Beijing, Tanjin and Hebei. Their collaborative development includes not only the synergy of the economic aspect of the three regions, but also the synergy between technological innovation and industrial development. Beijing ought to play the advantage as the center of national science and technology innovation, and Tianjin ought to play the advantage
as the modern manufacturing center. To achieve mutual benefit and win-win result, the three regions must integrate innovation resources, promote industrial upgrading and improve the cooperation mechanism. The strategic positioning of collaborative development in future for Beijing, Tanjin and Hebei is to focus on Zhongguancun in Beijing and Binhai new area in Tianjin, to promote together the deep integration of innovation chain according to the collaborative development of Beijing and Tianjin and to build innovation and development pattern based on rational division of labor. Therefore, the research of characteristics of technology transfer among Beijing, Tanjin and Hebei is able to provide reference information and decision-making basis for improving the innovation environment for the three regions, improving the innovation ability, promoting the transformation of scientific and technological achievements and optimizing resources allocation of innovation.

3. Data Analysis

The basic data referred in this paper is derived from the information center of the State Administration for Industry and Commerce, which covers the registration information of the national enterprises, the investment information abroad and the basic information of the invested enterprises. The selected data is from 2012 to 2016. At the same time, we used the patent data that the patent office of the State Intellectual Property Office published in its database as the data source. After retrieving the second patent transfer data of the Beijing-Tianjin-Hebei region and doing the quantitative analysis, we totally collected 14,996 data.

3.1 Beijing-Tianjin-Hebei investment situation

Since the collaborative development of Beijing-Tianjin-Hebei became a national strategy in 2014, the mutual investment of companies in three regions has been growing rapidly. From 2012 to 2016, the mutual investment among Beijing, Tianjin and Hebei has achieved RMB546.42 billion. It grew rapidly since 2013. Especially the mutual investment achieved RMB217.88 billion, which is 4.17 times as much as the amount in 2013. Compared with the amount in 2015, it increased by 58.8%. (See Figure 2).

![Figure 2. The mutual investment among Beijing, Tianjin and Hebei from 2012 to 2016.](image)

Beijing has become the capital radiation center of the three regions, whose capital radiation influence on these regions is increasing. According to investment flows, from 2012-2016, the total investment of Beijing achieved RMB414.775 billion to Beijing and Tianjin. However, the total investment amount of Tianjin and Hebei in these years to Beijing is only RMB93.533 billion, equivalent to 22.6% of Beijing’s total investment amount. Therefore, Beijing has become capital radiation center of the three regions. Beijing’s investment to Tianjin and Hebei had been growing rapidly since 2014 and it achieved RMB111.466 billion and RMB65.468 billion respectively.
2016, which accounted for 51.2% and 30.1% of the total amount of Beijing-Tianjin-Hebei mutual investment in 2016. (see figure 3)

![Bar chart showing investment of Beijing to Tianjin and Hebei from 2012 to 2016 (UOM: 10 billion).](chart)

3.2 The situation of collaborative innovation among Beijing, Tianjin and Hebei

(1) The rapid growth of joint patent applications amount and the authorization amount among the three regions

The pace of joint innovation among Beijing, Tianjin and Hebei has accelerated significantly. From 2012 to 2016, the total amount of joint patent applications was 14,996 and the total amount of authorizations was 10,583. The joint patent applications and authorizations had been increasing since 2014. The fastest growth appeared in 2014: the total amount of joint application and authorization were respectively equivalent to 1.6 times and 2.4 time as much as the total amount in 2013; the joint patent authorization amount achieved a new breakthrough in 2016, which was up to 3069, equivalent to 2.5 times as much as the amount in 2013 (see Chart 4).

![Bar chart showing the number of joint patent application and authorization among Beijing, Tianjin and Hebei from 2012 to 2016.](chart)

(2) Collaborative innovation are concentrated in infrastructure, science and technology services, manufacturing and other fields

The joint patent application and authorization of Beijing, Tianjin and Hebei are concentrated in four major industries: infrastructure (electricity, heat, gas, and water production and supply), scientific research and technical services, mining and manufacturing, which account for 82.6% of the application amount and 83.0% of the authorization amount. (See Table 1)
Table 1. The industry allocation of joint patent application and authorization among Beijing, Tianjin and Hebei from 2012 to 2016.

<table>
<thead>
<tr>
<th>Industry Item</th>
<th>Percent of jointly applied</th>
<th>Percent of jointly licensed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity, heat, gas and water production and supply</td>
<td>54.80%</td>
<td>52.90%</td>
</tr>
<tr>
<td>Scientific research and technical services</td>
<td>10.80%</td>
<td>9.60%</td>
</tr>
<tr>
<td>Mining</td>
<td>9.90%</td>
<td>12.10%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>7.10%</td>
<td>8.40%</td>
</tr>
<tr>
<td>else</td>
<td>17.40%</td>
<td>17.00%</td>
</tr>
<tr>
<td>Total</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Data source: Longxin Data Research Center

(3) Beijing has become the core driving force of the collaborative innovation among the three countries

Beijing plays the leading role in the collaborative innovation. From 2014 to 2016, the number of joint patent applications and authorizations of enterprises in Beijing and Hebei were 5,691 and 5,055 respectively, accounting for 51.29% and 58.53% of the total amount of joint applications and authorizations among the three regions in the same period. The number of joint patent applications and authorizations of enterprises in Beijing and Tianjin were 5,221 and 3,370 respectively, accounting for 47.05% and 39.02% of the total amount of joint patent applications and authorizations among the three regions. Beijing plays the leading role in the collaborative innovation among the three regions (see Figure 5, Figure 6). However, the collaborative innovation between Tianjin and Hebei or among the three regions is relatively little.

![Figure 5](image1.png)

Figure 5. The number of joint patent application among Beijing, Tianjin and Hebei from 2012 to 2016.

![Figure 6](image2.png)

Figure 6. The number of joint patent authorization among Beijing, Tianjin and Hebei from 2012 to 2016.
4. Conclusion

The collaborative development of Beijing, Tianjin and Hebei is an important strategy in China’s regional planning. Their collaborative development needs to focus on the collaborative innovation of industry adapted to the region from the spatial economic perspective. At present, their collaborative innovation has become a new power. As the center of capital radiation, Beijing plays the leading role and is radiating an increasing influence on Tianjin and Hebei. At the same time, we can find from the patent data that the patent transfer situation among Beijing, Tianjin and Hebei is not suitable for the strategic positioning of their collaborative development. It needs to observe the collaborative development among Beijing, Tianjin and Hebei from the strategic and overall perspective. In order to serve their respective strategic positioning and realize new scientific and technological cooperation among Beijing, Tianjin and Hebei, the resources allocation for regional scientific and technological innovation needs to be improved and the scientific and technological innovation elements needs to be shared in regions.

References


