

Comparative Research on Innovation Capabilities Among Enterprises in Beijing, Tianjin and Shanghai

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Abstract

Enterprises are the primary sources of scientific and technological innovation, and their role in the innovation process and the development of innovation driving force spark concerns in the public at the critical juncture of socio-economic development for China. Beijing, Tianjin and Shanghai act as leaders in technological innovation capacity all over the country; however, as far as enterprise is concerned, there are some differences in enterprises innovation characteristics and capacity among three regions. It deserves in-depth discussion on their respective path to innovation-driven development. By using of innovation indicators system of *European Innovation Scoreboard (EIS)* for reference, this study conducts comparative analysis on technological innovation capacity at industrial and non-industrial enterprises of Beijing, Tianjin and Shanghai in a comprehensive and objective way, probes the innovation characteristics and challenges of companies from the perspectives of four aspects, which include innovation environment, investment, output and performance, then making fundamental assessment on the strength and weakness of Beijing-based companies' innovation capacity.

Keyword: Enterprise innovation, industrial enterprise, non-industrial enterprise, economic benefit

1. Introduction

In recent years, R&D intensity¹ (R&D/GDP ratio) of the whole city in Beijing (BJ), Tianjin (TJ) and Shanghai (SH) have maintained the top three nationwide². As the important innovation leading areas, BJ, TJ and SH are strongly boosting local economic development. Enterprise is the key element in the innovation system as well as the fundamental driving force for regional innovative development. With the innovation capacity differs among BJ, TJ and SH-based enterprises, a comparative analysis is conducive to attaining better insights of innovative development potential and tendency of the three regions. Therefore, the study takes industrial enterprise and non-industrial enterprise as objects, making use of related statistical data in recent years to compare their innovation behavior and features, finally probes the advantages and disadvantages of Beijing-based enterprises' innovation capacity.

¹ R&D intensity refers to R&D expenditure as a percentage of GDP. R&D also called Research and Experimental Development (the same below).

² In 2011, R&D intensity of the whole city in BJ, TJ and SH are 5.76%、3.11% and 2.63% respectively, they are highly above other provinces.

2. Analytic framework of enterprise innovation capacity

This study uses indicator system designed by The *European Innovation Scoreboard (EIS)* in reference, from the perspectives of innovation environment, innovation investment, innovation output and innovation performance, analyzes business innovation capacity, probes Beijing-based businesses' strength and weakness in innovation, and provides reference to relevant departments for formulating S&T policy.

3. Non-industrial enterprise's innovation capacity comparison of three cities

This study adopts key non-industrial sectors with clustered R&D activities and abundant innovation resource. The data collected from the 2nd National 2009 R&D Census, with information transmission, computer services and software industry (information service) as the key research areas.

(1) Beijing innovation environment has no obvious advantage while soft & hardware environment needs optimization

i. In terms of innovation spirit, Beijing enterprise R&D activity coverage is lower than Tianjin and Shanghai

The number of enterprises having R&D activities and its distribution reflect the development degree of business innovation vitality and awareness. In 2009, the percentage of Beijing-based enterprises having R&D activities to total number of non-industrial enterprise was 19.4%, 1.9% and 5.6% lower than that of TJ and SH respectively. Beijing-based enterprise innovation vitality and the importance attached to and support for innovation from their decision-makers need to be enhanced.

ii. In terms of institution construction, less investment fostering R&D institutes of Beijing

The specialized R&D institutes owned by enterprises are the critical environment support to achieve their innovation. In 2009, there were 16 R&D institutes in every 100 non-industrial enterprises on average in BJ, outnumbering TJ by 3 but being 13 fewer than SH, the construction scale of Beijing's institutes was ranked 2nd. What's more, the average spending on devices and equipment of R&D institutes was about 10.031 million Yuan, lagging behind that of TJ and SH.

(2) Overall strong superiority in innovation investment with capital and human resources of Beijing

i. In terms of capital, Beijing enterprise R&D intensity ranks above Tianjin and Shanghai

In 2009, non-industrial business total R&D expenditure in BJ reached 14.88 billion Yuan, about 12.8 times and 2.9 times more than that of TJ and SH respectively. Group by sector, the distribution of R&D expenditure of three cities diverged. The R&D expenditure of information service made up 53.1% in BJ, while TJ invested 82.8% on scientific research, technical service and geological prospecting industry; SH centered on three industries, including construction, information services and scientific research, technical services and geological prospecting.

R&D intensity is a widely used comparable index worldwide showcasing a business capacity for independent innovation. Beijing's R&D intensity in information service reached 2.78%, more than 1.03 and 1.05 percentage points of TJ and SH

respectively while maintaining a relatively high level for three consecutive years³, and leading the field.

ii. In terms of talent, Outstanding R&D investment on human intelligence in Beijing

In 2009, BJ owned R&D personnel of 45,000, about 11 times and 2.6 times more than that of TJ and SH. Beijing's R&D personnel intensity at information services hit 7.3%, respectively 1.9% and 1.4% higher than that of TJ and SH. The results highlight the advantages of Beijing's human resources.

(3) Beijing has Outstanding advantage in innovation output while R&D efficiency at middle level

i. Highest technical content in R&D outcome and patent applications

In 2009, the number of patent applications attained by Beijing's non-industrial enterprises reached 5,703, 11.1 times and 1.8 times more than TJ and SH. In BJ, 71.7% of its patent applications were invention patents with higher technique. This proportion was 37.9% and 10.2% higher than that of TJ and SH respectively.

Of them, patent application from Beijing's information service held 85.1% of the share, 58% and 19.3% higher than that of TJ and SH respectively. As concerns patent results of BJ, both quantity and quality had evident advantage with strong sense of intellectual property protection over the original brand manufacturer (OBM).

ii. R&D efficiency of Beijing at the middle level

R&D efficiency demonstrates the capacity of converting research outcome into products and the degree of core competitiveness of an enterprise. In 2009, the pieces of invention patent applications that every 100 R&D personnel produced in non-industrial businesses of BJ was 9.1, and every 100 million Yuan of R&D expenditure resulted in 27.5 patents, the total level was higher than TJ but trailing SH.

Shanghai's information service produced 13.6 patents per 100 R&D personnel, and generated 57.8 patents per 100 million Yuan R&D expenditure. It was respectively 5.2 and 29.6 pieces of patents higher than BJ. The businesses' R&D efficiency of BJ still lags behind SH.

(4) Beijing showed significantly innovation performance but lacking per capita sales revenue

Among the enterprises having R&D activities, the per capita sales revenue⁴ stands for the capability of obtaining benefits from innovation results. In 2009, excluding restructuring businesses in BJ, the total sales revenue of its non-industrial enterprises having R&D activities contributed 512.3 billion Yuan, 19.2 times and 1.4 times of TJ and SH respectively, topping the total revenue ranking in comparison with others. However, Beijing's per capita sales revenue achieved 14.6 million Yuan, merely about 50% of Tianjin and Shanghai's performance. The per capita sales revenue of information service in three cities fell short of average level of cities, as Beijing's per capita sales revenue in information service of 2.5 million Yuan, it was below the amount of TJ and SH (4.6 million Yuan and 5.6 million Yuan respectively).

³ From 2009 to 2011, the Beijing-based enterprises R&D intensity in information service reached 2.78%, 2.5% and 2.5% respectively.

⁴ The per capita sales revenue means that among enterprises having R&D activities, the ratio of sales revenue to R&D personnel.

4. Industrial-enterprises innovation capacity comparison of three cities

In order to conduct in-depth study on Beijing industrial enterprises' innovation capacity, we adopt data from 2010 and 2011 to have comparable analysis with peers in Tianjin and Shanghai.

(1) Strong overall environment, weak in support for small and micro businesses of Beijing

i. Extensive tax reduction and exemption in Beijing

In 2011, 271 Beijing-based industrial enterprises received tax reduction or exemption on R&D expenditure, and 665 enterprises enjoyed high-tech company tax reduction or exemption, making up 7.2% and 17.7% of the total number of industrial enterprises, considerably higher than TJ and SH. The wide coverage of BJ industrial enterprises benefits from the policy support offered at Zhongguancun Science Park, of which enterprises being rewarded with "tax deduction or exemption on R&D expenditure" and "high-tech-business tax reduction" made up 17.1% and 45.6%, which were 14.3% and 40.3% higher than enterprises outside Zhongguancun Science Park boundary.

ii. Higher government funds on R&D expenditure of Beijing

In 2011, in terms of R&D expenditure by sources, government R&D funds of BJ industrial enterprises contributed 1.23 billion Yuan for, or 7.5% of its total R&D expenditure. In addition, among enterprises having R&D activities, there were 25% of them received government R&D funds. Compared with TJ and SH, BJ received relatively more government R&D funds, but its coverage of benefit was quite narrow. By size of enterprise, small and micro businesses in BJ, TJ and SH obtained divergent R&D funds from local government. In 2011, merely 18% of small and micro enterprises having R&D activities in BJ received government funds, it was 19.1% and 6.4% lower than that of TJ and SH.

(2) Beijing has significant strength in innovation investment and high-tech sectors dominates⁵

i. In terms of capital, Beijing overtook Shanghai and top the list in R&D investment

In 2011, the R&D intensity of BJ industrial enterprises reached 1.05%, at top of the country. It was 0.05 percentage points higher than that of TJ and SH. Three cities' R&D intensity in high-tech sectors all towered the city's average level. However, Beijing's R&D intensity showed the highest growth rate.

ii. In terms of talents, Beijing maintain the edge in human resources

In recent two years, Beijing's human capital investment intensity in industrial sector was ranked ahead of TJ and SH as the R&D personnel intensity stood at 5.7% in 2011, 1.1% and 2% higher than TJ and SH. Benchmarked with 2010, three cities all experienced an increase in various degrees. The R&D personnel intensity in high-tech sectors of the three cities were all above cities' average level.

⁵ The high-tech sectors include 5 major high-tech manufactures. They are Manufacture of Medicines; Manufacture of Special Purpose Machinery; Manufacture of Transport Equipment; Manufacture of Communication, Computer, Other Electronic Equipment; Measuring Instrument, Machinery for Cultural and Office Work.

(3) Both Strength and weakness coexist of innovation output but foreign funded enterprises⁶ outshine in Beijing

i. Extend advantage in Beijing industrial enterprise patent applications

In recent two years, Beijing's intellectual property rights (IPR) input-output efficiency has not only maintained but extended the lead. In 2011, the piece of invention patent applications every 100 R&D personnel and every 100 million Yuan of R&D expenditure in BJ produced 10.4 and 42.4 respectively, it was higher than SH (2.2 and 18.6), while also higher than TJ (4.1 and 21.5).

Group by Registration Status of enterprises: though foreign-funded enterprises in Beijing had relatively lower weight in sales revenue of all types of enterprises than that of TJ and SH, the patent input-output efficiency of them exceeded their competitors in TJ and SH by a wide margin.

ii. Beijing was beaten by Shanghai on new products

In 2011, Beijing-based industrial enterprises achieved sales revenue of new products 348.03 billion Yuan, shared 22.1% of the sales revenue, 0.6% lower than Shanghai but 3.9% higher than TJ. Group by registration status, foreign funded enterprises significantly exceeded domestic funded enterprises.

(4) Beijing's Innovation Performance Hovers in the Middle while Small and Micro Enterprises Show a Greater Potential

i. Beijing overtakes Shanghai into second place in performance

The ratio of income as a percentage of sales used to gauge an enterprise's profit level. In 2011, BJ industrial enterprises' ratio registered 7.2%, which was below TJ by 2 percentage points and outperforming SH by 0.6 percentage points. In terms of business size, profit margin at Beijing's small and micro enterprises reached 6.4% in 2011, which was outscored TJ and SH by 0.9% and 0.3% respectively

ii. Beijing Ranks between Shanghai and Tianjin in the adjustment of industrial structure

For the recent two years, BJ hovered between SH and TJ with the ratio of gross output value of high-tech sectors to total industrial enterprises. In 2011, this ratio of BJ was 20%, 1.8% lower than SH, while 7.2% higher than TJ. Group by business size, BJ enjoyed overwhelming advantage in small and micro business contest, as they achieved 15.1% in 2011, 9.1% and 7.3% higher than TJ and SH respectively.

5. Basic Assessment

(1) Advantage of Beijing-based Enterprises Innovation

Strong R&D Intensity: R&D intensity in both industrial and non-industrial businesses has remained relatively high, an indication that Beijing's enterprise innovation capacity was superior to Tianjin and Shanghai. Beijing has placed acceleration of change of economic development mode driven by innovation as priority, deepened the production-university –research institution coordinating innovation system led by enterprises. The municipal government has enhanced support for businesses to establish advanced R&D institutes and taken measure to improve the innovation incubating mechanism. Enterprises' independent capacity of innovation has steadily developed. Industrial enterprises R&D intensity ranked the first in the country

⁶ Foreign funded enterprises include enterprises with funds from Hong Kong, Macau and Taiwan.

in 2011, and R&D intensity at software industry has also remained a high level.

High quality IPR output: Beijing-based enterprises boast high quality patent output, mainly reflected in enviable patent input-output efficiency at industrial sector and high ratio of invention patent applications at non-industrial sector. It indicated that Beijing's research outcome and core competitiveness are ahead of Tianjin and Shanghai. In the process of speeding up capital's IPR strategy, Beijing has enhanced intellectual property's creation, usage, protection and management, improved the public service platform to protect intellectual property rights and regulated the IPR market discipline.

(2) Inadequacy of Beijing-based Enterprises Innovation

Lack of support from government to small and micro business: In Beijing, the coverage of government funds in enterprises having R&D activities remains relatively low compared with Tianjin and Shanghai, and the financial support for rapidly growing high-tech small and micro businesses is much lacking. At the same time, the degree of recognition of government support policy among small and micro businesses is general low. Relevant departments should provide more effective and favored policies in the areas of innovation incentive, tax privilege, talent introduction and cultivation.

Stimulating effect from innovation on economic benefit is less than desirable: Setting against TJ and SH, the ratio of income as a percentage of sales and the ratio of high-tech output in overall industrial output of BJ are all placed in the middle, as its R&D per capita main business revenue at information transmission, computer service and software industries trailed Tianjin and Shanghai peers. Therefore, there is lacking of synergy between innovation output and economic benefits, as majority of industrial enterprises are still at the stage of low-value-added manufacturing and processing and software companies are still not saying farewell to the high-investment but low-benefit growing period. It deserves particular attention to raising businesses' innovative technology content and cementing market competitiveness.

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