

Research on Tianjin Patent Development Based on Cluster Analysis

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ABSTRACT

This paper uses the method of cluster analysis to analyze the patent development in Tianjin. Based on the relevant data from 2006 to 2019, this paper analyzes the patent application and patent structure in Tianjin, and analyzes the development trend of the proportion of invention patents, job patents and development subjects in Tianjin. The growth rate of patent licensing in Tianjin is generally higher than the overall growth level of patent licensing in China. The proportion of invention patent applications in Tianjin has been lower than the overall proportion of the country, and is in a continuous decline. The proportion of service invention patent applications in Tianjin also showed steady growth. The results of cluster analysis showed that the patent development of Tianjin ranks fifth in the country, indicating that the overall patent application and technological innovation ability of Tianjin is in a medium position in the country.

Keywords: patent; patent structure; cluster analysis

1. INTRODUCTION

At present, China is transforming from a big country in the introduction of intellectual property rights to a big country in intellectual property creation, and intellectual property work is shifting from the pursuit of quantity to the improvement of quality[1]. The Tianjin Municipal Intellectual Property Office issued the "Work Measures for Comprehensively Strengthening the Innovation and Vitality of Intellectual Property Protection in Tianjin" in March 2021. Since the implementation of Tianjin's mid- and long-term science and technology plan in 2006, Tianjin has continuously increased its investment in research and development for the whole society, which has ushered in an outbreak of patent innovation activities. The average annual growth rate of patent applications reached 17.81%, and the average annual growth rate of patent grants reached 23.43%, both higher than the national average. As an important part of intellectual property rights, the improvement of patent level is of great significance for stimulating the vitality of scientific and technological innovation in Tianjin, promoting high-quality economic development, and accelerating the construction of a city with strict protection of intellectual property rights[2].

2. ANALYSIS OF PATENT DEVELOPMENT IN TIANJIN

2.1. Analysis of patent applications

In 2006, the number of patent applications in China was only 573,178 and in 2019, the number of patent applications was as high as 4,380,468, with an average annual growth rate of 17.32%. The number of patent applications in Tianjin increased from 13,299 in 2006 to 96,045 in 2019, with an average annual growth rate of 17.81%. In terms of the average annual growth rate, the growth trend of patent applications in Tianjin and the whole country has been the same in recent years. It can be seen from Figure 1 that the national patent application growth rate is relatively stable, while the Tianjin region's patent application growth rate fluctuates greatly. Tianjin had the highest growth rate in 2013, reaching 46.78%, while in 2017, there was a negative growth rate of -18.32%. The growth rate of patent applications in Tianjin has accelerated, so 2010-2017 has basically maintained a growth rate higher than the national level. In 2017, affected by the decline in R&D investment, the growth rate of patent applications in Tianjin plummeted or even reached negative growth. In 2018-2019, although the growth rate of patent applications in Tianjin was close to the national growth rate, it was still lower than the overall national level.

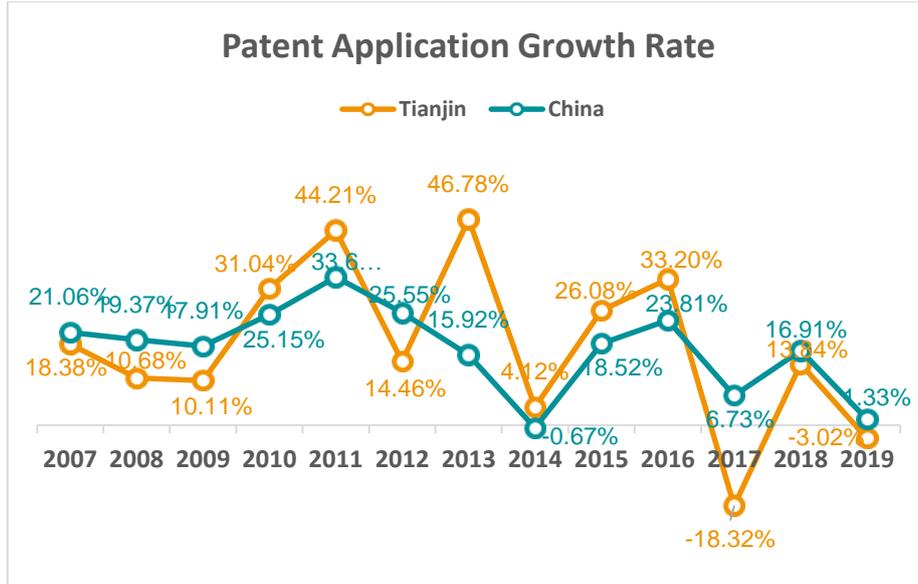


Figure 1. Growth of Patent Applications in Tianjin and China

2.2. Analysis of patent authorization

The number of patent authorizations in Tianjin has maintained a continuous growth since 2006. In 2006, the number of patent authorizations in Tianjin was only 4,159, and the number of patent authorizations in all regions of the China was 268,002. However, in 2019, the number of patent authorizations in Tianjin reached 57,799, with an

average annual growth rate of 23.43%, and the number of patent authorizations nationwide reached 2,591,607, with an average growth rate of 19.99%. Figure 2 shows that, with the exception of 2009, Tianjin's patent authorization growth rate was generally higher than the national overall patent authorization growth rate during 2007-2017, while the Tianjin patent authorization growth rate in the past two years was approximately equal to but slightly lower than the national overall level.

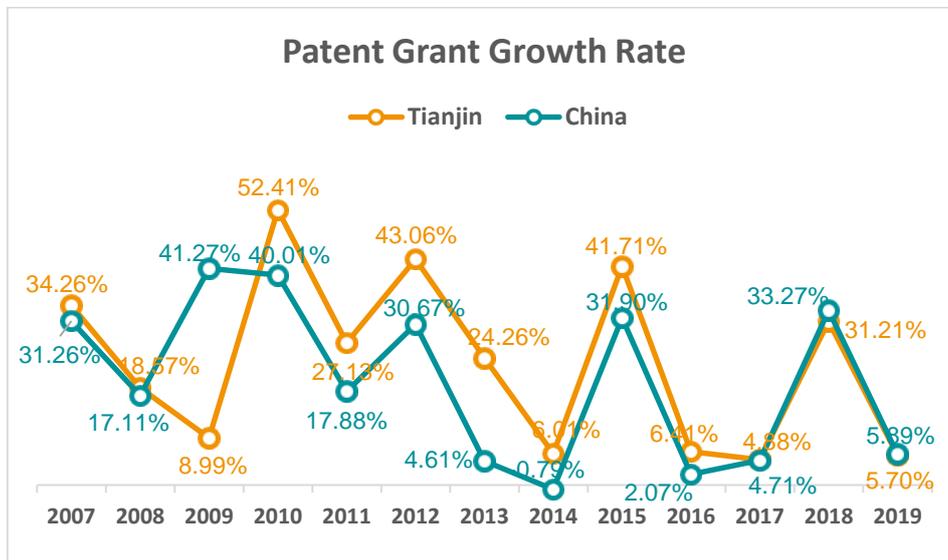


Figure 2. Growth of Patent Applications in Tianjin and China

3. COMPARATIVE ANALYSIS OF PATENT STRUCTURE BETWEEN TIANJIN AND CHINA

3.1. Proportion of invention patent applications

Patent types include invention patents, utility model patents, and design patents. Among them, invention patents have higher requirements for novelty and creativity than utility model patents and design patents and can better reflect the level and ability of technological innovation. In the past ten years, the proportion of invention patents in both Tianjin and the country as a whole has been increasing between 2011 and 2014, and has been in decline in other years. This shows that although the proportion of invention patent applications and authorization ratios in my country has been increasing, but the level and ability of technological innovation are still insufficient. The proportion of Tianjin's invention patent applications has been lower than the overall proportion of the country, and is in a state of continuous decline, indicating that the level and ability of Tianjin's technological innovation still needs to be improved.

3.2. Proportion of service invention patent applications

The proportion of service invention patent applications refers to the proportion of service invention patent applications among all the invention patents applied for. [3] Since the quality of service patents is generally higher than that of non-service patents, the proportion of service invention patent applications is an important indicator of patent quality. The proportion of patent applications for service inventions nationwide has shown a steady growth from 2006 to 2019, and the proportion of patent applications for service inventions nationwide has increased from 38.71% to 81.11%. In Tianjin, the proportion of service invention patent applications in 2006-2008 declined slightly, and from 2008 to 2016, the

proportion of service invention patent applications in Tianjin also showed a steady increase, from 63.54% to 95.38%, and in the following years In a state of volatility.

4. CLUSTER ANALYSIS OF PATENT DEVELOPMENT IN VARIOUS PROVINCES AND CITIES

4.1. Sample material

This section aims to analyze the patent development status of various provinces and cities in China in 2019 to judge and understand the development of patents in Tianjin. The data to be analyzed in this section are mainly the total number of patent applications, the total number of patent authorizations, the number of invention patent applications and the number of invention patent authorizations in China's provinces and cities in 2019.

4.2. Algorithm Description

This article uses the cluster analysis method in statistical analysis. Traditional clustering statistical analysis methods include systematic clustering method, ordered sample clustering method, dynamic clustering method, fuzzy clustering method, graph theory clustering method, cluster forecasting method and so on. Since the amount of data is not too much, the method of systematic clustering is selected and a systematic clustering diagram is drawn[4].

4.3. Cluster analysis

Using the clustering method of inter-group connection, using the square of Euclidean distance as the measurement, the patent data of various provinces and cities are systematically clustered and analyzed, and a dendrogram is made.

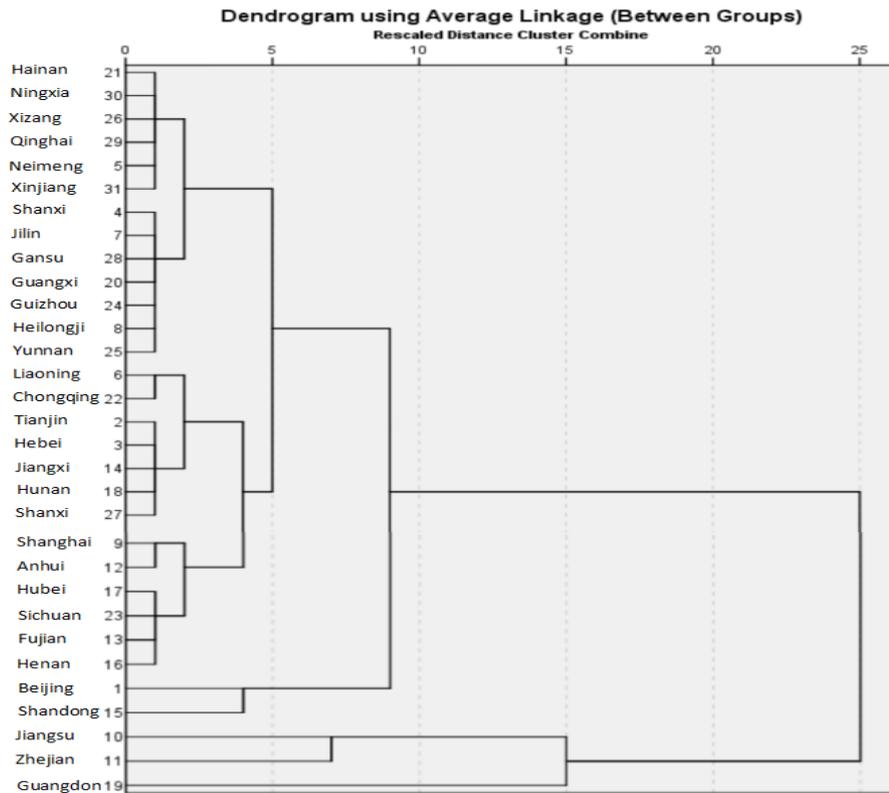


Figure 3. Cluster Analysis Dendrogram

4.4. Result analysis

(1) 31 provinces and cities are divided into five categories:

- The first category: Guangdong
- The second category: Zhejiang
- The third category: Jiangsu

The fourth category: Beijing, Shandong

The fifth category: Shanghai, Anhui, Hubei, Sichuan, Fujian, Henan, Liaoning, Chongqing, Tianjin, Hebei, Jiangxi, Hunan, Shaanxi, Shanxi, Jilin, Gansu, Guangxi, Guizhou, Heilongjiang, Yunnan, Hainan, Ningxia, Tibet, Qinghai, Inner Mongolia, Xinjiang

(2) Divide 31 provinces and cities into six categories:

- The first category: Guangdong
- The second category: Zhejiang
- The third category: Jiangsu
- The fourth category: Beijing, Shandong

The fifth category: Shanghai, Anhui, Hubei, Sichuan, Fujian, Henan, Liaoning, Chongqing, Tianjin, Hebei, Jiangxi, Hunan, Shaanxi

The sixth category: Shanxi, Jilin, Gansu, Guizhou, Guangxi, Heilongjiang, Yunnan, Hainan, Ningxia, Tibet, Qinghai, Inner Mongolia, Xinjiang

According to the classification results, it can be seen that the number of patent applications and authorizations in

Guangdong, Zhejiang, and Jiangsu are relatively high, indicating that technological innovation capabilities are relatively strong and ahead of the national average. When the patent situation of the provinces and cities in the country is divided into six categories, it can be seen that Tianjin is in the fifth category, while the first four categories include fewer provinces and cities, indicating that Tianjin's overall patent application and technological innovation capabilities are in the middle of the country.

5. CONCLUSIONS AND SUGGESTIONS

It is necessary to optimize the structure of patent types and increase the proportion of invention patents. Invention patents are inventions with a higher technical level compared with utility models and design patents, which can better reflect the level of science and technology and development[5]. By 2019, the proportion of invention patents in Tianjin was 25.59%, a drop of nearly 12% compared to 2006. The ratio of invention patents should be gradually increased, and scientific research funding should be tilted towards more innovative invention patents.

It is still necessary to strengthen the protection of the legal rights and interests of service inventors to further promote the increase in the proportion of service invention patents. The proportion of patent applications for service

inventions in Tianjin is generally higher than the national rate by about 20%. The gap is relatively large, indicating that the quality of patents in Tianjin is higher than the national average. However, from a general perspective, the protection of the rights and interests of service inventors still needs to be further improved and strengthened.

The government should give full play to its guiding role, pay attention to the quality of patent applications and authorizations, make policies and funds more inclined to the direction of high-quality patents.[6] At the same time, the government should appropriately reduce the rewards for patent authorization, and then reward inventors through "post-subsidy" methods such as increasing the proportion of conversion income to promote the conversion and application of patents, thereby improving the quality of patents and promoting the development of innovation.

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