

# Research on the Innovation Capability of Applicants Based on the Profitable Patents

Rui Liu, Yongzhong Qiao\*

Intellectual Property Research Institute, Xiamen University, Xiamen, Fujian 361005, China

\*Corresponding author. Email: qyzh1@qq.com

## ABSTRACT

Innovation promotes social and economic development. Conducting an innovation measurement to clarify innovation gap is a prerequisite for developing innovation policies and improving innovation systems. In this study, the patents whose maintenance time was about 20 years were defined as profitable patents. Based on the data of China's granted patents in the 1990s, we analysed the proportion of profitable patents to compare the innovation capability of different patents applicants. The results suggested that among the China's granted patents, Japanese applicants had the strongest innovation capability. Enterprise had the best performance on innovation capability among the domestic applicants. From a regional perspective, China's innovation driving force was mainly distributed in economically developed regions such as Beijing, Taiwan and Guangdong.

**Keywords:** Innovation capability, profitable patent, domestic applicants

## 1. INTRODUCTION

Innovation has been regarded as an important influence factor of economic growth since it was first promoted by Joseph in 1911 [1]. Innovation capability measurement contributes a lot to national innovation policy formulation and firm management. Patent, as a comprehensive carrier that integrates legal attributes and technical content, includes related information of existing technology and its rights holders [2], and the acquisition of its monopoly power is based on the disclosure of technical details [3]. Patent documents contain rich technical details [4] and R&D-related comprehensive information. Patent is closely related to technology innovation, and its information and statistics have been regarded as the key indicators for evaluating technological innovation capability [5]. For instance, the evaluating indicators system of patent output constructed by the Organization for Economic Co-operation and Development has been used to evaluate global technological innovation capability [6]. And the number of patents was found out an important indicator for measuring the technological innovation capability [7]. In previous work, we analysed the maintenance status of the patents which were granted by the National Intellectual Property Administration of P.R.China in 1994, and found that the technological innovation capability of patents owners received from home are obviously weaker than that of counterparts received from abroad [8].

Patent system protects right holders' profit by giving them a monopoly time. Because of the huge costs from patent annual fee system, there are the continuous profits that right holders retain according to their monopoly right behind patent maintenance. That means patent maintenance is the result of patent right holders' balance of costs and benefits. Therefore, based on the perspective

of rational patent holders, patent maintenance time can also be regarded as profit time. For a particular patent, the longer the profit time, the higher the total profit it brings to the right holders. We believe that profit time can reflect the total value of innovation achievements and their contributions in promoting the competitiveness of a country, a region or an enterprise. In conclusion, profit time can reflect the innovation capability of the applicants. In this study, the patents whose profit time was over 20 years were defined as profitable patents. Based on the data of China's granted patents from 1990 to 1999, we analysed the number and proportion of profitable patents to compare the innovation capability of the applicants.

## 2. METHODOLOGY

Patent data of the China National Intellectual Property Administration (CNIPA) from 1990 to 1999 was selected as the research object. The selection of research data was based on the following factors. The general protection period for patents was within 20 years from the date of application. The patent data in the 1990s could meet the requirements of profitable patents in this study. And the selection of patent data in the 1990s could reflect the changing characteristics of an era, and it was expected to form a comparison of patent characteristics between different eras with subsequent researches. The data came from the patent database of Patsnap (Suzhou) Co., Ltd. (<https://www.analytics.zhishuiya.com/>). The retrieval time of the profitable patents data of China was November 30, 2018, and the key words of retrieval were granted by China, patent application time (1990 to 1999), legal status (expiration or validity). The 'expiration' refers to the patents whose protection period has reached 20 years. The 'validity' refers to the patents that were applied in 1999 but is still valid. These patents have reached the last year

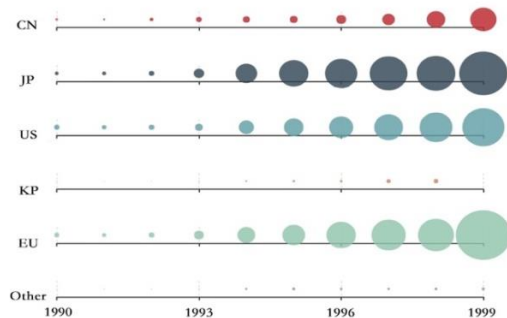
of the statutory protection period. Unless they are invalidated in the last year, they naturally belong to the profitable patents described in this study.

### 3. RESULTS AND DISCUSSION

#### 3.1. Comparison of the Innovation Capability of China's Granted Profitable Patents from the Perspective of Applicant's Country or Region

Patent office authorizes patents applied by applicants from different countries or regions. In order to explore the sources of profitable patents granted by the CNIPA and further analyse the innovation capability of the patent applicants from different countries/regions, the number of profitable patents with the applicants from different countries/region in the 1990s is shown in Figure 1.

As is shown in Figure 1: The number of profitable patents applied by the applicants from various countries or regions in the 1990s was gradually increasing and the disparity among different countries/regions was large. The number of profitable patents with the applicants from China, Japan, the United States, South Korea and Europe was 3,960, 9,669, 7,749, 987 and 9,141, respectively. The sum of them accounted for 97% of the total, which indicated that China's profitable patent sources were highly centralized. Among them, the number of profitable patents from Japanese applicants (9,669) was the largest, accounting for 30% of the total, followed by Europe (9141) and the United States (7749). The number of profitable patents applied by Chinese applicants was 3,960, accounting for 12.3% of the total, lower than the first three countries or region, but still nearly four times as many as the applicants from South Korea. The number of profitable patents originating from the rest of the countries/regions was only 720, accounting for 2.2% of the total. In 1990, the number of profitable patents applied from American applicants ranked first with 222, accounting for 31.5% in the year, followed by Europe (202) and Japan (153). However, the number of profitable patents of Japanese applicants reached 2,026 in 1999, which was higher than that of American applicants (1,763) and slightly lower than that of European applicants (2,298).



**Figure 1** The yearly distribution of the number of profitable patents with the applicants from different countries/region in the 1990s

Based on the number of profitable patents with applicants from different countries/region, the innovation capability of the applicants from various countries was compared. Firstly, from the perspective of profit time, the source of patents with high innovation capability in China's granted patents in the 1990s was concentrated, mainly in Japan, Europe, the United States and China. On the one hand, that was the embodiment of the world's innovation-driven regionalization. On the other hand, it also showed that China had gradually become a worldwide market after the reform and opening up, attracting a large influx of emerging technologies. Secondly, the patent applicants from Japan and Europe had the strongest innovation capability, followed by the United States and China. Thirdly, in the early 1990s, American applicants had the strongest innovation capability, but then gradually weakened. In the late 1990s, they had relegated to third place, lower than the applicants from Japan and Europe. Finally, in the context of rapid improvement in innovation capability all over the world, Chinese applicants remained relatively stable in terms of innovation capability.

#### 3.2. Comparison of the Innovation Capability of China's Granted Profitable Patents from the Perspective of the Type of Domestic Right Holders

To further explore the composition of domestic applicants' type of the profitable patents granted by CNIPA in the 1990s, the number and proportion of profitable patents with different types of applicants are shown in Table 1.

It could be found from Table 1 that: The types of profitable patent holders in China were centralized. Enterprise holders had the largest number of profitable patents (2,138), accounting for 54.0% of the total. There were 2381 profitable patents whose right holders contained enterprise, accounting for 71.5% of the total. Enterprises, as the direct correlators of economic interests, often need to improve their innovation capability to ensure their own economic interests and seek development. The number of profitable patents with a single individual, scientific research institution, university or institution group right holder was 519, 462, 110 and 10 respectively. Those were far lower than the number of enterprises' profitable patents. The number of the profitable patents of enterprises and scientific research institutions in the mixed-rights type was the highest, reaching 632, accounting for 16% of the total, which reflected the relatively close technical cooperation between enterprises and scientific research institutions.

The domestic sources of profitable patents in China were mainly enterprises, indicating that Chinese domestic enterprises had a fairly high level of innovation capability. As an intangible intellectual achievement, patents require enterprises to actively transform their results to ensure

patent profit, reflecting the close relationship between economic interests and innovation. Enterprises and scientific research institutions, as co-owners of profitable patents, embodies the cooperation between economic power and cutting-edge technology. This kind of cooperation mode is becoming more and more important nowadays when technology is rapidly developing. Since the research sample of this paper is the patent data from the CNIPA in the 1990s, the cooperation between enterprises and scientific research institutions or universities was not prominent enough, but there was still a desirable development prospect. It is worth noting that the relative low proportion of the profitable patents of Chinese research institutions and universities was not the embodiment of their low innovation capability. Because the right holder type was the latest state of the patent, and the research institutions and universities are the producers of innovative technology rather than the converters. In order to transform innovative technological achievements to actual economic benefits, the right holders of the patents often need to be transferred to enterprises.

### ***3.3. Comparison of the Innovation Capability of China's granted Profitable Patents from the Perspective of the Origin Provinces or Regions of Domestic Applicants***

There are often regional differences in innovation capability [9]. To further explore the innovation capability of China's provinces/regions from the perspective of profit time, the number and proportion of profitable patents from different provinces or regions are shown in Table 2.

As can be seen from Table 2: The provincial/regional distribution of profitable patents applicants in China is roughly consistent with the level of economic development in the 1990s. Among them, the largest number of profitable patents held by applicants from Beijing was 1195, accounting for 30.2%, followed by Taiwan (582), Guangdong (282) and Shanghai (241). The three provinces with the lowest number of profitable patents were Hainan (9), Qinghai (9), and Ningxia (9). In the 1990s, the number of profitable patents from different provinces in China was quite different.

The above data reflects Beijing, Guangdong and Shanghai as the national technology industry centres, gathered the best high-tech enterprises and technical talents in the country, driving the country's economic and technological development. The economic level of Taiwan Province in the 1990s was still considerable, which was also reflected in the level of innovation capability. The difference in the number of 1193 profitable patents between Beijing and Ningxia also reflects to the imbalanced development of applicants' innovation capability between regions in China, which puts new demands on the Chinese government's strategy of formulating innovation and development balance.

**Table 1** The patents owned by different types of Chinese applicants in the 1990s.

<b>Applicant Type</b>	<b>Frequency</b>	<b>Proportion</b>
Enterprise	2138	54.0
Enterprise and Scientific Research Institute	632	16.0
Individual	519	13.1
Scientific Research Institute	462	11.7
University	110	2.8
Enterprise and University	45	1.1
Enterprise and Individual	16	0.4
Government Organization	10	0.2
Other	28	0.7
Total	3960	100.0

**Table 2** The number and proportion of the profitable patents from different provinces or regions.

Province/Region	Beijing	Taiwan	Guangdong	Shanghai	Jiangsu	Liaoning	Zhejiang	Sichuan	Shandong	Hongkong	Hubei
<b>Frequency</b>	1195	582	282	241	173	143	140	126	124	112	90
<b>Proportion</b>	0.302	0.147	0.071	0.061	0.044	0.036	0.035	0.032	0.031	0.028	0.023
	Hunan	Shanxi	Yunnan	Tianjin	Heilongjiang	Jilin	Anhui	Gansu	Hebei	Chongqing	Fujian
	79	63	57	57	56	48	48	46	45	42	38
	0.02	0.016	0.014	0.014	0.014	0.012	0.012	0.012	0.011	0.011	0.01
	Henan	Guizhou	Shanxi	Nei Monggol	Guangxi	Jiangxi	Xizang	Xinjiang	Hainan	Qinghai	Ningxia
	31	29	22	20	15	14	11	11	9	9	2
	0.008	0.007	0.006	0.005	0.004	0.004	0.003	0.002	0.002	0.002	0.001

#### 4. CONCLUSION

Patent profits that the sum of the benefits obtained by patent owners and related stakeholders is the basic issue of the regulation of patent system and policies. The measurement of applicants' innovation capability based on the proportion of profitable patents contributes to innovation policy formulation and firm management. In this study, the research on the characteristics of China's granted profitable patents was conducted to measure the innovation capability of different patent applicants.

Chinese profitable patents' applicants were mainly from Europe, Japan and the United States. That shows that there was a certain gap of applicants' innovation capability between China and other developed regions in the world. The domestic rights holders of China's profitable patents were mainly enterprises, and the source of applicants was mainly concentrated in the domestic economic and technological development centres such as Beijing, Taiwan, Guangdong and Shanghai. That shows economic interests would maximize the protection level of patents by the direct stakeholders, and the centralization of the provinces/regions of profitable patentee also reflects the high correlation between patent innovation and economic development.

In conclusion, Japanese applicants had the strongest innovation capability. Enterprise had the best performance on innovation capability among the domestic applicants. From a regional perspective, China's innovation driving force was mainly distributed in economically developed regions such as Beijing, Taiwan and Guangdong. The Chinese government might formulate relevant policies to promote the balanced development of innovation capability across the country, improving and balancing the sources of innovation driving force at the level of the national innovation system.

#### ACKNOWLEDGMENT

This work was supported by National Natural Science Foundation of China (71874148).

#### REFERENCES

- [1] Schumpeter, J.A., The theory of economic development: an inquiry into profits, capital, credit, interest and the business cycle, translated from the German by Redvers Opie, New Brunswick (U.S.A) and London (U.K.): Transaction Publishers, [1911] 2008.
- [2] Park Y, Yoon B, Lee S, et al., The idiosyncrasy and dynamism of technological innovation across industries: patent citation analysis, *Technology in Society* 27(4) (2005) 471-485. DOI: 10.1016/j.techsoc.2005.08.003
- [3] Trappey C V, Wu H, Taghabonidutta F, et al., Using patent data for technology forecasting: China RFID patent analysis, *Advanced Engineering Informatics* 25(1) (2011) 53-64. DOI: 10.1016/j.aei.2010.05.007
- [4] Chang P, Wu C, Leu H, et al., Investigation of technological trends in flexible display fabrication through patent analysis, *Displays* 33(2) (2012) 68-73. DOI: 10.1016/j.displa.2012.03.003
- [5] Nagaoka, S., Motohashi, K., Goto, A., Patent statistics as an innovation indicator, *Handbook of the Economics of Innovation*, North-Holland, 2010, pp. 1083-1127. DOI: 10.1016/S0169-7218(10)02009-5.

[6] Gault, F., Srinivas, K. R., Handbook of innovation indicators and measurement. Edward Elgar Publishing, 2013.

[7] Acs, Z. J., Anselin, L., Varga, A., Patents and innovation counts as measures of regional production of new knowledge, *Research policy* 31 (2002) 1069-1085. DOI: 10.1016/S0048-7333(01)00184-6.

[8] Qiao, Y., Research on the capability of technological innovation based on the maintenance time of patent, maintenance time and the industry development of patents, 1-10: Springer Singapore, 2017. DOI: 10.1007/978-981-10-1621-9\_1.

[9] Evangelista, R. et al., Measuring the regional dimension of innovation, Lessons from the Italian Innovation Survey, *Technovation*, 21 (2001) 733-745. DOI: 10.1016/S0166-4972(00)00084-5.