The Role of Patent System in Hi-Tech Entrepreneurship-An Empirical Study from Shanghai

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Abstract: “Mass entrepreneurship and innovation” is an effective way to stimulate social innovation potential and entrepreneurial vigor. The role of intellectual property in entrepreneurial activities has attracted much attention. The paper examines the complex relationship between entrepreneurial activities and the application and use of patent through questionnaire surveys and field interviews of nearly 200 technology startups in Shanghai. The survey found that patents have a weaker incentive for startups’ innovation, but they play an important role in helping companies to gain competitive advantages, by means of preventing technology from copying, obtaining government support, and improving corporate image etc. Startups are reluctant to apply for patents because of the insufficient legal protection and the fear of competitors’ follow-up R&D. The commercialization of the patent in entrepreneurship needs to be further strengthened besides the defensive purposes, and suggestions for improving the application of comprehensive patent strategies and raising the level of judicial protection are proposed.

Keywords: innovation and entrepreneurship, patent system, incentive, competitive advantage, policies, suggestions.

1. Introduction
Entrepreneurship contribute significantly to economic growth in the global economy (Audretsch et al., 2006; Van Stel, 2018). Entrepreneurship, in nature, is a process of finding, evaluating and exploiting the opportunity to make the commodity or services (Shane and Venkataraman, 2000). They create new organizations, products, services, jobs, and chances for complementary economy (Verheul et al., 2002). Intellectual property (IP) law is an important policy lever that affects not only the opportunities for engaging in entrepreneurship but also the success or failure of many entrepreneurial efforts (Sichelman and Graham, 2010). Intellectual property law, as the legal basis of knowledge and technology, has important functions of “innovative law” and “industry law” (Wu, 2016). Its
core research is innovation (Zhang, 2017). It not only becomes a competitive weapon for companies to protect innovation, gain benefits and leading position, but also an important part of corporate value (Granstrand, 1999), and gradually surpasses tangible assets to dominate the development of contemporary enterprises (Reitzig, 2007). Especially for high-tech startup companies, the disadvantages of tangible assets are difficult to change in the short term, but effective management and application of intellectual property rights can create new competitive advantages for enterprises and promote the rapid growth of enterprises (Hanni et al., 2012; Marcus, 2013). Although a considerable body of previous work has explored the relationship between IP rights and innovation (Gallini and Scotchmer, 2002; Lee et al., 2006; Jiang and Dan, 2014; Fang et al., 2017), far less scholarship has focused on the more particular relationship between IP rights and entrepreneurship (Burstein, 2016).

At present, China is vigorously advocating innovation and entrepreneurship. From 2015 to 2017, the “Government Work Report” has elevated innovation and entrepreneurship (mass entrepreneurship and innovation) to the strategic height of the new engine of national economic development. Innovation and entrepreneurship have attracted unprecedented attention. From January 2015 to December 2017, as many as 45 policies related to innovation and entrepreneurship have been issued by the State Council of P.R.C. only, and hundreds of documents have been issued by various ministries and local governments. The study of the interactive relationship between intellectual property rights and innovation and entrepreneurship has a strong practical significance for a correct understanding of the promotion role of intellectual property rights in entrepreneurship. However, the current theoretical researches, policy analysis or empirical researches have not yet clarified how a specific intellectual property (e.g., patent) affects the innovative development of startup companies (Graham, 2010).

This article will employ an empirical research to discuss the role of the patent system in entrepreneurship. The paper is organized as follows: The second part reviews the literature on the relationship between intellectual property and entrepreneurship. The third part explains the research methods and survey data collection. The fourth part analyzes the impact of patents on innovation activities. The fifth part analyzes the ways in which patents help companies gain competitive advantage, and summarizes the significance, enlightenment and further problems to be discussed in the last part.

1Source: China Government website, "Public entrepreneurship, and innovation" policy compilation analysis platform, search URL: http://www.gov.cn/zhengce/zhuti/shuangchuang/, Retrieved on February 1, 2017
2. Literature Review

Most existing studies of the relationship between intellectual property and entrepreneurship focus on the effects of various IP laws on entrepreneurial behavior (Autio and Acs, 2010; Kirzner, 2015; Liu, 2017). They focus, in other words, on how startups utilize and encounter the existing arrangement of IP laws. To be sure, this approach offers some valuable insights, but it does not provide a complete picture of the ways in which intellectual property and entrepreneurship interact because intellectual property is not just a legal or operational issue in entrepreneurship (Smith and Barclay, 1997), it is also a strategic issue in the entrepreneurial process (Gallié and Legros, 2012).

What is the role of patents in the development of startup companies? Jurists believe that patents can provide exclusive rights to technology to thus effectively protect technology; economists believe that granting inventions exclusive rights to remunerate their investment and prevent their R&D results from being copied without compensation (Polinsky and Shavell, 2007).

The most comprehensive empirical study of the relationship between intellectual property and entrepreneurship is the Berkeley patent survey (Graham et al., 2009). The study examined 1,332 early-stage technology startups in the United States on a series of issues involving the relationship between intellectual property and entrepreneurship. Many meaningful discoveries have been made, For example, patents generally have weaker incentives for innovation activities; the motives of patent applications for startups vary greatly according to the nature of industry and technology; the main purpose of startups to obtain patents includes seeking commercial financing, to prevent copying, and to improve company reputation and so on.

Some scholars have emphasized that the relationship between patents and entrepreneurship is closely related to the entire ecological innovation environment and the background of the entrepreneurship (Burstein, 2016). It depends on the relative competitiveness of startups and existing companies, on the characteristics of technology that startups want to commercialize, and on the social, political and legal environment in which they are located (Nelson, 2014).

First, patent protection affects entrepreneurial activity. Liang Cui and Wang Zhixin (2017) believe that the strength of patent protection affects the activity of entrepreneurship and demonstrates the inverse U-shaped relationship of patent protection on the level of entrepreneurial activity. Startups are often affected by patent troll during the licensing and implementation of patents (Karakashian, 2015). Research has found that start-ups are more likely to pay a small sum to
settle their troubles rather than pay a lot of money to participate in litigation (Chien, 2013).

Second, startups applied for patents to obtain venture financing. An econometric study shows that there is a positive correlation between patents obtained by startups and the number of financings (Sichelman and Graham, 2010) because patents indicate the quality of the technology owned by the company, the superiority of the management team, and the strategic positioning of the company. These are important investment decision-making basis for investments of venture capital (Hsu and Ziedonis, 2013). Another explanation is that patents can help startups to operate freely, making their flexible business models more attractive to investors (Graham et al., 2009). Third, the patent licensing system has promoted the development of startups. In addition to applying patents themselves, startups also obtain and use patents through a patent licensing system.

The survey data shows that the implementation of licensing in startups is increasingly becoming the main means of technology transfer (Feldman and Lemley, 2015). The “technology-for-market” theory emphasizes the importance of patents in expanding the exchange of technical information between partners (Arora et al., 2001), and believes that small businesses are more likely to license their patents and import technologies into the downstream product markets of the industry chain, and thus patents strengthen technology licensing as a kind of particular business model (Arora and Merges, 2004).

The existing literature on patent activity and entrepreneurship described above produces two important conclusions. The first is that the relationship between the patent system and entrepreneurial activity is complex and multifaceted. Patents affect entrepreneurial activities in many aspects in different ways. The second is that the role of the patent system is highly dependent on the environment and the industry, company structure and technical characteristics. So, in the current stage of social development and the environment of incentive entrepreneurship policies in our country, how does the patent system affect or promote entrepreneurial activities? This article will illustrate it by empirical study of survey data of startups in Shanghai.

3. Research Methods and Data Collection
3.1 Research Methods and the selection of company, respondents, industrial sectors
Based on the purpose of our research and related literature review, we have proposed a series of questions on the relationship between the patent system and entrepreneurship. For example, how does a patent play a role in a company's
innovation activities? What is the purpose of patent application of startup companies? What role does a patent play in startup financing? How do startups treat patent infringement? Given these issues are more general, we have designed a questionnaire that can provide more data. In order to better translate these issues into questionnaire surveys, we visited experts in the areas of intellectual property, innovation and entrepreneurship, technology transfer managers, managers of science and technology parks, and some active entrepreneurs. We examined the literatures of economics, law, management, and other social science and empirical literatures (Edwin, 1986; Thursby and Marie, 2002). With reference to the previous survey on intellectual property and innovation, some hypotheses have been formed. Through the above research and exchanges, we have a better understanding of the entrepreneurial environment in our country and have carried out a few rounds of amendments to the questionnaire.

With the help of the Shanghai Science and Technology Commission, 198 startup companies established in the past 10 years (from 2007) were selected. These startups are mainly scientific and technological small and medium-sized enterprises. The respondents were mainly the CEO and senior technicians of the company. Because we mainly want to understand how patents affect the entrepreneurial process of entrepreneurs, we target the selected companies to some industries with high degree of concern.

Reference is also made to the "Guiding Catalogue of Key National Strategic Emerging Industries Products and Services", "Statistical Catalogue of National High-tech Industries" and "National Catalogue of Patent-Intensive Industries". Based on the literature, previous survey data and understanding of entrepreneurial characteristics in interviews, we have overlooked some high-tech industries that are not suitable for entrepreneurship, such as the research of wind, electricity, and

2 Technology-based SMEs refer to the companies that conduct S&T research and development activities, obtaining independent IP rights and converting them into high-tech products or services. The total number of employees shall not exceed 500, the annual sales income shall not exceed 200 million yuan, and the total assets shall not exceed 200 million yuan. Source: "Measures for the Evaluation of Science and Technology SMEs (Guokefazheng [2017] No.115) ". Ministry of Science and Technology.


nuclear new energy industries and the high equipment manufacturing of satellites, ocean engineering, and aviation industries. In the end, we chose companies in the five major fields for investigation, namely biomedicine, information technology, smart manufacturing, environmental protection, and new materials (see Table 1).

Table 1. Summary of Industry Distribution of Enterprises

<table>
<thead>
<tr>
<th>No.</th>
<th>Industry field</th>
<th>Company count</th>
<th>Proportion</th>
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<tbody>
<tr>
<td>1</td>
<td>biomedicine</td>
<td>54</td>
<td>27.2%</td>
</tr>
<tr>
<td>2</td>
<td>information tech</td>
<td>47</td>
<td>23.7%</td>
</tr>
<tr>
<td>3</td>
<td>Smart manufacturing</td>
<td>43</td>
<td>21.7%</td>
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<tr>
<td>4</td>
<td>Environment protection</td>
<td>33</td>
<td>16.7%</td>
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<tr>
<td>5</td>
<td>new materials</td>
<td>21</td>
<td>10.7%</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>198</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Resource: Designed by author from the survey.

3.2 Data collection
We distributed questionnaires to 450 SMEs and took back 251. After sorting and analyzing, 198 questionnaires were confirmed as valid questionnaires. Most of the establishment of the company was concentrated in 3-6 years. 40 companies have been set up for 1-3 years, 69 companies for 3-5 years, 56 companies for 5-8 years, and 33 companies for 8-10 years. Meantime, we interviewed CEO and senior managers of 30 small and medium-sized startups.

Table 2. Patent data of Startups in the survey

<table>
<thead>
<tr>
<th></th>
<th>all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patents holding rate</td>
<td>60.4%</td>
<td>75%</td>
<td>57%</td>
<td>55%</td>
<td>62%</td>
<td>53%</td>
</tr>
<tr>
<td>Average</td>
<td>7.52</td>
<td>8.5</td>
<td>7.6</td>
<td>6.4</td>
<td>7.9</td>
<td>7.2</td>
</tr>
<tr>
<td>Application</td>
<td>3.6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Transfer</td>
<td>2.4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Self-transfer</td>
<td>2.8</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

1= biomedicine; 2=information technology; 3=smart manufacturing; 4=new materials; 5= environmental protection.

Resource: Designed by author from the survey.

According to the survey questionnaire statistics, 119 startups have at least one patent, accounting for 60.4%; 79 startups have no patent at the moment, accounting for 39.6%. This patent holding rate of companies is much higher than other domestic surveys. It may have a lot to do with the type of the companies, most of which are technology-based companies. There are three main sources of patents for startup companies: company creators’ transfer, others transfer or license, and applying themselves.
From Table 2, 60.4% of the companies own patents. However, there is a slight difference between industries. The industry with the most possessions is the biopharmaceutical industry (75%), followed by the new materials industry (62%), and only 57% in the communication information field which was influenced by the software and Internet companies in which more than 85% of respondents report no patents, but the output of patents in the communications equipment field was extremely strong.

4. The influence of patent on the company's innovation activities

4.1 Patents have a weaker incentive on startups innovation
The general theory holds that patents have a great incentive for the company's innovation activities, which is also the theoretical basis for giving patent monopoly rights. In order to further verify the value of patents for innovation, we set several options in the questionnaire to ask respondents to rank the role of patents in corporate innovation activities in the order from weak to strong. They are: no incentive (0 point), weak incentive (1 points), moderate incentive (2 points), stronger incentive (3 points), very strong incentive (4 points); at the same time, we follow the innovation theories of Schumpeter and divide innovation from "idea" to "invention" to "development" to "commercialization". They are: (1) inventing a new product, method and service, (2) developing a new market, (3) grazing or controlling a new source of supply of raw materials or semi-manufactures, (4) achieving any kind of industrial new organization.

![Figure 1. The role of patents in different stages of corporate innovation. Source: This survey](image)

The results showed (Figure 1) that most of the respondents believed that patents have a weaker incentive in entrepreneurial activities. The best performance was that patents would be a more effective incentive in the process of creating new products and new methods, with the value of 1.95 between the "weak incentive" and the "moderate incentive".

In other areas, the incentive of patents is not satisfactory and basically remains at the level of “weak incentives”. In particular, patents have the least incentive for "initial R&D" and "implementation of products", with a value of 0.8. The evaluation of the incentive of patents also varies according to the industries. In the fields of biomedicine, IT hardware, manufacturing, and new materials, the respondents believe that the incentives of patents are relatively large, and they basically maintain the “weak incentives” and “moderate incentives”, with the value of 1.0-1.5. In the field of Internet and IT software, the incentive of patents is considered to be small and the value is maintained at 0.8-1.3.

There is a certain gap between our findings and legal theory of “patent stimulating incentive innovation”, and it is also quite different from many literatures about the role that patent plays in innovation (Chesbrough, 2003; Jiang and Dan, 2014). What kind of relationship does this have with our entire innovative eco-environment? Are intellectual property rights (patents) playing an innovative role just as some scholars have argued that only those countries with an initial level of development above average can benefit from it (Sweet et al., 2015)? This is a question worthy of our further discussion. What's the role of patents in business startups then?

4.2 Patent Enhancing Enterprise's Competitive Advantage
Existing research has proven that intellectual property plays a key role in the company’s first-mover advantage (Teece, 1986). A social survey of managers of large U.S. companies also reflects that intellectual property is a key means for enterprises to gain competitive advantage (Cohen et al., 2000). The results of this survey show that patents play an important role in the startup companies’ gaining competitive advantage. In the questionnaire, we listed seven factors that enable companies to secure a competitive advantage: first-mover advantage, trade secrets, patents, copyrights, trademarks, reverse engineering, implementation and marketing capabilities. In the same way, we give five evaluation options of “not important” to “very important” for the respondents to choose (multiple choices), with 0 to 4 points respectively.

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7 1.95 is the average value of the sum of all choices from "No incentive" (0 point) to "Strong incentive" (4 point).
0=not important; 1=slight important; 2=important; 3=more important; 4=very important

**Figure 2. Factors in gaining competitive advantage**

Source: The survey

The results show (see Figure 2) that startups will use a variety of strategies to gain competitive advantage. The first-mover advantage was evaluated as the most important means to obtain a competitive advantage. The rating was between “more important” and “very important”, with an average score of 3.3 points. The next level is patents, trade secrets, implementation and marketing, and the degree of importance assessed is not much different. They are all between "important" and "more important", with average scores of 3.1, 2.8 and 2.7 respectively. The remaining three items: copyright, trademark and reverse engineering were rated as “important” with an average score of 2.03. The methods used by startups to gain competitive advantage vary greatly according to industry. For example, software and internet companies basically use copyright as the most important means to gain competitive advantage, while companies in other fields report that patents can help early technology companies to obtain competitive advantage. However, what is the mechanism by which patents gain a competitive advantage? We will answer this question by exploring the motivation of the company to secure the patent.

5. Startups’ motivation for holding patents

5.1 The Investigation of startups’ Patent Motivation

5.1.1 “Preventing copying” and “acquiring government support” are the main motives to hold patents.

To investigate how startups use patents to gain a competitive advantage, we investigated the motives of securing patents. Based on the literature reviews and
interview results, the questionnaire gave seven motives such as preventing technology from copying and obtaining commercial investment etc. From statistical analysis of the questionnaires (see Figure 3), most of the respondents took preventing from copying as the most important reason for holding patents, with an average score of 3.8. This means that almost all companies believe that “preventing from copying” are the main motive of them.

![Motives in securing patents](image)

**Figure 3. Motives in securing patents**

**Source: The survey**

In our survey, “acquiring government support” is almost as important as preventing copying. There are obvious differences with past survey which reported the cost of application and implementation is the crucial factor. Most of the interviewed companies ranked “acquiring government support” at an important position, with an average score of 3.7. In this regard, we conducted in-depth interviews and found that holding more patents can enable startups to receive the nominal and financial support from government. After China put forward the "Outline of the National Intellectual Property Development Strategy" and the "National Innovation Driven Development Program", governments at all

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8 See note 23.
10 The 18th Congress of the Communist Party of China put forward “innovation-driven
levels have begun to set up a large number of funding for small and medium-sized science and technology enterprises to promote economic improvement and efficiency. According to incomplete statistics, the special funds or program that Shanghai's science and technology innovation enterprises can apply for reach more than 20 at the municipal level only⑪. Many district governments have carried out supporting work for these funds and program. These programs provide technology-based companies with funds ranging from hundreds of thousands to millions of RMB. Therefore, obtaining government support has become the reason for many startup companies to secure patents.

5.1.2 Financing and attracting investment considerations

The next group of important reasons for patenting include obtaining investment opportunities, promoting acquisition quality and opportunities, and improving company reputation and image. Respondents rated the improvement of the image of small companies very high with an average score of 3.2. When entrepreneurs and startup companies try to get business finance to support their growth, they may face great difficulties because of their small size, low assets and limited experience (Tyebjee and Bruno, 1984). This kind of uncertainty caused by limited information makes it difficult for potential investors to evaluate the quality of startups and their potential benefits. As a result, investors can only evaluate their value based on their existing tangible assets.

The questionnaire also investigated the importance of venture capital source. We have proposed six sources: family and friends, angel funds, venture capital, other company investments, investment banks, and commercial banks. The question is: When the startups negotiate with these sources of funding, how does the other party view the importance of the patent held by the startups? Only 8.8% of respondents in Shanghai believe that patents are important when obtaining financing while average of 47% of respondents in the United States believe that patents are important according to the Berkeley patent survey. Why is there such a big difference? Scholars believe that patents are a symbol of technical quality, and the expertise of patent offices has reduced the information asymmetry between investors and startups (Long, 2002). Further, patent office grants are certainly important. What's more important is that the company patenting activities can show that startup managers have the idea of systematicizing their knowledge, indicating that they have experience in the management of coded knowledge (Chien, 2008). Other explanation is that patents can provide businesses with the opportunity to operate freely and commercialize their specialty products (Gideon,
2007). As for the situation in China, scholars believe that the low quality of Chinese patents is the main reason affecting their application (Zhu, 2013; Cheng, 2014) because there are many institutional factors and non-market factors that play an important role in the acquisition of patents (Hu et al., 2017). Some empirical studies have concluded that China's patent promotion plan has increased patents by 160% (Li, 2012), Patent Subsidy Policy increases patents by 30% (Dang and Motohashi, 2015). The surge in patents has lowered the credibility of patents, which has reduced the value of patents in investment and financing.

5.1.3 Legal protection and licensing fees are considered
Another important reason for startups to file patents is the need of protection and profit strategies, namely consideration of infringement litigation and licensing fees. The interviewed companies rated the prevention of infringement litigation as “slight important”.

Judging from previous literature and investigation, we can infer that startup companies generally do not pay much attention on litigation. This is not similar to the fact that large companies have specialized legal affairs departments to formulate and handle infringement cases involving complaints. Practice has proved however that once the startup company rolls up infringement, it will have a serious obstacle to the development of the company because intellectual property cases, especially patent cases, generally take a long time and cost much.

In the end, almost all startup companies rated the importance of licensing income as lower than other factors. This result seems to conflict with the idea of “technology for market” (Arora and Ceccagnoli, 2006). This view holds that small businesses are more likely to license their patented technology and provide downstream companies with technical input. Indeed, the survey of European patent holders by Alfonso (2005) found smaller companies are more likely to license patents than larger companies. Our survey also found that the smallest part of the business community still views licensing revenue as an important incentive to secure patents. 20 out of 25 startups with annual revenues below 3 million yuan rated the licensing fees as “important” factors (accounting for 80%).

5.2 Reasons for not seeking a patent
Although most of the respondents believe that patents are important, many other companies also opt against the patent system. Reasons include: Considering that technology can’t be patented, the high cost of application and implementation, fear of reverse engineering, weakening patent protection, technology disclosure risks, and still other forms of protection. In the questionnaire we designed the question: What cause startups not to obtain a patent (multiple choice)?
What causes startups not to secure patents?

![Bar chart showing reasons for not patenting]

**Figure 4. Response to reasons of not patenting**

*Source: This survey*

Our investigation found that “the protection of trade secrets is sufficient”, “fear of competitors’ follow-up” and “inadequate legal protection” are the main reasons why startups don’t file patents, reaching 65%, 63% and 61% of the respondents respectively (see figure 4). The intrinsic factors of these three options are linked to each other. The inadequate legal protection leads to copying and then enable the startups to turn to trade secret. Therefore, the underlying cause is the problem of inadequate legal protection. Although the protection of intellectual property rights has been increasingly strengthened, there are many problems in the enforcement of intellectual property rights.

The main problems lie in the low cost of infringement, the high cost of rights protection (Kong, 2015), the difficulty in obtaining evidence for litigation, and the low amount of compensation (Zhan and Zhang, 2015). These factors have caused some startup companies to have no time and energy to deal with intellectual property litigation. Therefore, a better way is to choose the protection of trade secrets. Meantime, 38% of respondents believe that the long examine time of patent reviewing is one of the reasons for their opting against patenting. Another 31% believe that it is not necessary for them to protect their technology. Almost all respondents believe that the cost of patent application and implementation is not the most important reason for them to opt against patents.

About 7% and 5% of respondents respectively think that the cost is the most important reason for their reluctance to secure patents. While the cost of
application and implementation in developed countries without exception is the main reason why startups do not secure patents because the patent application and maintenance fee are very expensive, for example, obtaining patents only costs US$ 10,000 to 30,000 in the United States (Lemley, 2000). In China, almost all application fees and maintenance costs for the first three years are funded by governments. Therefore, the application and maintenance costs of patents in China are not the main issue.

6. The role of patent system in startups and its enlightenment

In the questionnaire survey, we also designed a question on the role of the patent system in entrepreneurship. We asked respondents to answer a general subjective question. We asked “How about the role played by patent system for the development of your company?” We gave five options: very good, good, not good not bad, slight bad, bad. The results show that, most of the startup companies (61% of the respondents) believe that the patent system has a "not good not bad" effect on the development of their company. There are some slight differences between industries. For example, 31% of respondents in the bio-industry think that patents play a “good” or “very good” role in their development, but most (63%) respond to their development is “not good not bad”. In the field of software and internet, 55% of the respondents answered that they are still “not good not bad”, but 20% of the respondents think that the patent system does not work well for them. This survey also gives us some enlightenment:

6.1 Patents can help startups gain competitive advantage, but the incentives for innovation activities have not yet been exerted

The survey shows that the interviewed companies believe that patents play an important role in gaining competitive advantage for the company. Of the many elements, the importance of patent is rated second only to the first-mover advantage. At the same time, however, the respondents believe that patents provide a weaker incentive for the company's innovation activities. As mentioned in the previous literature, the theory of “patent enhancing innovation” is demonstrated and approved by many experts. Why did patents not play the role of incentive to innovation in entrepreneurial activities of China?

In fact, technological innovation activities are a complete chain (Schumpeter, 1991). This "innovation chain" specifically includes: scientific and technological achievements, incubators, public R&D platforms, venture capital, industrial

⑫Patent Subsidy Policy begins from Shanghai in 1999 and nearly all provinces adopt the policies until 2003. The government bear the cost of application fee and maintenance fee for first years according to the policies.
chains formed around innovation, property rights transactions, market agencies, and legal services, logistics platform, etc. However, scientific and technological achievements such as patents are only one of several aspects of innovation. The innovation effect also depends on the improvement and mature of other factors. At the same time, it is also related to the quality of patents. When a large number of low-quality patents flood the market, not only does it reduce incentives for innovation, it may also hinder the pace of innovation. The government should further improve the innovation ecology, such as comprehensive consideration in innovation power, innovation risk, innovation ability, and innovation financing etc.

6.2 Strengthen IP commercial operation strategy
Patents are mainly regarded as a defensive tool in current Chinese startups. There are still great deficiencies in the active use of patent strategies for commercial planning and operations. Respondents almost unanimously view preventing competitors from copying and obtaining government support as the main reason for securing a patent. Stronger market elements such as obtaining commercial investment, increasing the quality of mergers and acquisitions, obtaining licensing fees, and improving the company's image are ranked in secondary positions, showing that entrepreneurs have not yet to strengthen their awareness of the commercial strategy of patent. Take the key venture capital for example, only 8.8% of funding sources believe that patents are important in investment decision and pledge financing while nearly half (47%) of venture capital sources believe that patents are important in their investment decisions in U.S.. Therefore, the patent management department should supervise the relationship between patent quality and quantity, enhance the credibility of patents in the technical field, and advocate the commercialization of patents. The government should also guide startups to conduct commercial operations when providing subsidy funding. It needs to provide education and training for startups, and strengthen the implementation of corporate intellectual property rights management and application strategies.

6.3 Shorten patent examination time and strengthen judicial enforcement
The fact that startups do not secure patents for their use and protection is also due to factors such as long time of patent examination and weak legal enforcement. At

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present, the average period of China's invention patent examination cycle is 22 months, while Japan's total examination cycle averages 14.6 months, and the U.S. is 16.2 months\(^\circ\). Therefore, it is possible to shorten the patent examination cycle and further perfect the temporary protection before grant. At the same time, as previously analyzed, China's legal enforcement for intellectual property rights need to be improved, gradually changing the phenomenon of high costs of protection, difficulty in obtaining evidence of infringement, and lengthy court hearings which may prevent startups from seeking patent protection. The management departments of intellectual property rights and the judiciary should pay attention to these problems and employ the combination measures of administrative enforcement and judicial protection of intellectual property rights to change this phenomenon.

**Conclusions and Problems**

Through investigation and research, we tried to reveal the delicate relationship between China's patent system and technological entrepreneurship. Our specific findings can't fully answer these questions. Technology startup companies tend to file and hold more patents, but they think that patents are less incentive for major innovation activities. We have then studied the reason why startups secure patents since the patent system does not have a strong incentive for innovation and found that patents are used to gain competitive advantage from other perspective such as obtaining government support, enhancing the company reputation and improving the merger and acquisition etc.

There are still significant deficiencies in the commercialization of active patent strategy. The main reason why startups do not file patents is the inadequate legal protection and long examination time. The insufficiency of this survey mainly lies in the limited data. For surveys and researches, the more data you get, the more objective the result is. Although the industries and regions we select are representative of entrepreneurship, the data is slightly thin. Another point is that the findings of the survey are based on the subjective evaluation of respondents. This has a lot to do with the personal values, concepts, and experiences of respondents. Further research can be conducted on the role of the patent system in stimulating innovation, using statistical analysis of data more scientifically.

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