

Study on Technology-based Small and Micro Enterprises' Patent Strategy

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Abstract—In order to solve the problem of technology-based small and micro enterprises' intellectual property rights ability and technological ability are not synchronized. This article using literature research method, cases study and related data to analyzes patent's vital role in technology-based small and micro enterprises development, points out problems and the causes existing in patent management of technology-based small and micro enterprises in China, and discusses several specific measures to develop patent strategy from enterprise level. The innovation of this article is based on the perspective of technology-based small and micro enterprises and enriches useful decision-making theory for technology-based small and micro enterprises to establish patent strategy under government's effective guidance. At last for technology-based small and micro enterprises to gain long-term development, measures could be carried out from three aspects: firstly, implementing intellectual property rights development strategy; secondly, improving and perfecting intellectual property management system; thirdly, enhancing the ability of intellectual property rights.

Keywords—technology-based small and micro enterprises; intellectual property; patent; strategy

I. INTRODUCTION

Technology-based small and micro enterprises (SMEs) have played a significant role in creating employment conditions, promoting science and technology innovation and GDP growth although the proportion of it in technology-based SME is not high. However, decline in the competitiveness of technology-based SME is becoming a big obstacle from the worldwide. According to statistics, the average life of technology-based SME is 3.7 years in China. The situation in foreign is similar, in Song's research, the survival rate of 11,239 high-tech start-ups for 4 years is 36%, and for 5 years is only 22.9% in the US [1].

Chinese scholars have focused on technology-based small and micro enterprises since 2012. It is facing many difficulties in management, capital, technology and talent [2]. IP provide technology-based SMEs an important potential option for solving financial difficulties, but there are also multiple financing risks [3]. A Canada-based survey data shows IP is the most valuable assets in the technology-related industries; large enterprises gain more revenue from using IP than small enterprises. The main reason is that the innovation rate of small

enterprises is lower; meanwhile the cost and complexity of IP system for small enterprises are higher [4]. In general relevant researches summarized the main reasons as follow aspects: (1) Low investment and efficiency in innovation. (2) High cost of learning, development, consulting and legal protection of IP. (3) Lack of awareness, knowledge, and expert and appropriate IP strategy. (4) Small enterprises rely on commercial secrets to protect IP mostly; commercial secrets are hard to value so that leads to more financing difficulties. (5) Delay of patent authorization makes uncertainty factors increase, using invention for financial support or partners get more and more difficult. (6) Higher difficulty in operation of internationalization of IP and so on [5].

At present, the number and depth of related research results are obvious inadequate, especially under the China's national condition. The director of SIPO (State Intellectual Property Office), Shen points out that whether government-driven or market-driven, science and technology innovation are contacted with IP closely. Therefore, IP has been paid a lot attention from the micro and macro-economic. Further research need to be studied urgently at a strategic level.

II. THE ROLE OF PATENT RIGHTS ON TECHNOLOGY-BASED SMES DEVELOPMENT

A. Patent is the Most Important Intangible Assets for Technology-based Enterprises

As intangible assets, intellectual properties have been accounted for two-thirds of the total amount of enterprise asset in today's knowledge economy age, and this situation showing a rising trend. On an international scale, intangible assets of world top 500 enterprises have been accounted for 80% on average of the total assets. Microsoft, for example, intangible assets accounted for almost 90% of the total assets, the mainly value is IP. Google booked \$12.5 billion in acquiring MOTOROLA mobility in 2012, including 24,500 patents. And acquired assets include \$2.9 billion in cash and \$2.5 billion in digital TV set-top box business. So acquisition cost Google is about \$7.1 billion, and the evaluation of patents worth about \$5.5 billion. Google announced that it would sold MOTOROLA to Lenovo at a price of \$2.91 in 2014, but still remains most patents in MOTOROLA's mobile business field. Lenovo only received around 2,000 patents which less than one

over ten of Google's acquisition of MOTOROLA's number of patents. Through this process acquisition, the market value of patents has been paid full attention by technology-based enterprises.

B. Patents Status Reflects the Enterprises' Market Value

Through using patent rights, enterprises could have exclusive rights of the technology invention, display technical strength of enterprises, prevent others from copying or imitating the invention or products, and promote technological advantages into market advantages constantly. A research shows that a company's patent ownership number and the technology quality level of patents are positive correlation with the corporate market value. Chen et al. (2010) have a research on the pharmaceutical industry in the US. Pharmaceutical companies with more patents have higher market value than the companies with fewer patents. As a result, company with less patents in a relatively low patent position, it should raise the level of patent status in the field of science and technology, then increase its market value [6].

C. Patent Cooperation Could Increase the Practice Effect of Enterprise Knowledge Innovation

Through the way of knowledge property cooperation and sharing technical knowledge could make the practical effect of knowledge innovation maximum. Google announced a patent alliance with Canon, Newegg, Dropbox, Anasa and other technology-based enterprises, which has totally 300,000 patents to protect them from abusing and "patent trolls". Restricted by its size, technology-based SMEs are difficult to compete with large enterprises. Using the patent rights transfer, licensing, in the form of cross licensing to collaborate with other enterprises. It could strengthen the result of knowledge innovation practice, promote enterprises value and core competitiveness.

D. Effective Patent Management Could Improve Enterprises Competitive Advantage

The vice president of IP affairs of AT&T said "The stand or fall of IP management has a direct relationship with the value of a company in the competition". IP management has become an important part of modern enterprise management. Vidrascu (2014) have shown that effective IP management could reduce cost, improve labor productivity, create and maintain a good image of enterprises in market competition [7]. Enterprise patent management has the characteristics of intangible assets management, knowledge management, and innovative management. From the angle of law, economic and technology development to do series of development, protection, operation, cooperation, organizing activities. It is not only protect IP rights from potential infringement, but also raise the ability of using patents and improving the strategic advantages and competitiveness by business operation, market development, technology utilization and value-added of IP.

III. PATENT MANAGEMENT PROBLEMS AND CAUSES OF TECHNOLOGY-BASED SMEs IN CHINA

A. Lack of Creative Consciousness and Ability of High Quality Patents

After Chinese government reform and opening up, Chinese enterprises have a certain economic strength. Now they are lack of interest in long-term technology research and development. The average time of a patent survival in China is shorter than that in the other countries. The consequence is that in order to produce the products, the Chinese enterprises have to pay for the patents that the multinational companies have already applied for in China 10 years ago. According to ZongGang, the director of the IP and technology transfer center of Shanghai life science institute. Chinese enterprises pay attention to the traditional business modal generally; we still stay in "What products can we sell how much profit we will get right now" stage. Driven by short-term interests, most technology-based SMEs are eager to use new technology to produce products before applying for patent protection. They often focused on the utility model and industrial design patent which has low creative requirement; however invention patents are not always the emphasis. Base on "Chinese Effective Patent Annual Report in 2012", there is only 15.7% of the total invention patents with higher creation level and technology content. And the most of patents is utility models and industrial design in China. On the contrary, utility models and industrial design patents are almost disappear in Japan and the US. According to the SIPO's data, the rate of apply for authorization in domestic is 27.2%, and apply for foreign patent authorization in China at a rate of 56.4%. From the quality of the authorized patents, less than 20% of the patents the Chinese enterprises applied for have high quality, and this data in foreign enterprises is more than 80%. That means there are lots of "bubble" and "junk" patents spreading in China [8]. The consequences caused by lack of awareness and ability of create high quality patent.

B. Weakness in Awareness and Ability of Using Patents Efficiently

Patent using ability refers to the patent owner could use, transfer, licensing, cross-licensing patent. The purpose is to turn the value of technology products for the value of enterprises' goods or services, in order to get more profit for enterprises. According to the statistics, China's technology transfer rate is only 10%, far below the 40% in the developed countries. Only pay attention to the number of patent application, ignore the patent application, low patent quality, inadequate protection from infringement, low conversion rate of market, the above issues are the main problems in the field of IP rights in China.

There are three reasons for the weak patent application ability to technology-based SMEs: Firstly, compared with manage and protect tangible, technology-based SMEs are weak in using, research and protecting the value of intangible assets. Secondly, low quality of patents, and lack of business talents with science research and IP knowledge. That's causes poor market operation ability of patents. Thirdly, under the background of patent thicket, technology-based SMEs owned

few IP right, it is hardly obtain cross-licensing from large enterprise, so that the conversion rate is low.

C. Less Consciousness and Ability of Patent Protection

Patent protection here has two means: one means that the patent prevent or avoid patent infringement in legal ways, and the other means to keep away and deal with the issues and litigation violating others' patent rights. In the globe, invention protection originally began from many small sized enterprises, and 30% of them will apply for the protection of IP rights in the 3 years of operation. Yet the small sized enterprises in China are less willing to participate in the protection of IP rights. So there is a big gap between big enterprises and that of the small in this area [9]. Currently, IP rights disputes referring to SMEs in China cover more than half the number of total cases. On the one hand, SMEs haven't adopted effective measures to protect IP rights, which will give rise to the lost, plagiarism and the abuse of them. Because of the unfamiliar with the law, so it's hard to use legal weapon to fight infringement, so that losses appear. On the other hand, SMEs start late with small size and it's difficult to invest huge amount of manpower, material and financial resources to form their own patented technology. Under the driven force of short term economic profits and taking the chance, they violate others' IP rights. However, after the infringement lawsuits happened, most of the cases lead to failure for the weak consciousness of law plus the less initiative to lawsuit response. According to the statistic released by SIPO, in the past 27 years since 1986, the number of IP disputes between Chinese and overseas enterprises is increasing gradually, and the controversy over patent infringement covers the majority reaching to 93%. In the disputes with the overseas enterprises, 65% of Chinese enterprises chose to response to the lawsuit forwardly. 35% of enterprises gave up forwardly. But the winning rate is only 40% in the 65% enterprises which chose to pick up the lawsuit forwardly. Obviously, the weak consciousness of rights protection, inadequate experience, and the weak protection ability are the main problems.

D. Poor Patent Organization and Management Ability

Patent organization and management ability is composed of the enterprise patent management system, management agencies, staffing and management behavior. Enterprise patent management involves many links in the whole enterprises. It is difficult to guarantee the smooth coordination of all departments if there are no specific management departments and staffing. The world top 500 enterprises have attached great importance to establish a scientific system of IP management system, especially in Japan, the US, German and other developed countries. Japan's Hitachi set up the IP department, its priority is to manage the patent information. Canon Company has 11 IP management departments to deal with all kinds of IP rights problems efficiently. At present, most of technology-based SMEs hire lawyer to manage enterprise's IP issues in China. There are no special IP management departments and staffing. This situation leads to an "empty" state of IP management, and causes low efficiency

of using IP rights. Besides, there are many serious IP loss incidents.

IV. COUNTERMEASURES FOR BUILDING AND IMPLEMENTATION OF THE PATENT STRATEGY FOR TECHNOLOGY-BASED SMES IN CHINA

A. Clear the Basic Issues of the Patent Strategy

In order to formulate and implement of patent strategy, some basic issues should be clear:

1) What is patent strategy?

First of all, enterprises patent strategy is an overall and long-term planning to solve patent issues and improve patent comprehensive ability for enterprises. It is not a temporary solution when in trouble. Technology patent invention is not the whole patent strategy. The purpose of patent strategy is to maximize the commercial value of patent and plan the serious of management actions to create, protect, use, and organize patents. Patent strategy is not only to ensure the technology patents to be obtained and used, but also to serve the enterprises' overall strategic intentions and motives. It should be included in the entire enterprise development strategies. Japanese scholar Hasegawa notes, patent strategy is to achieve the success of economic activity. Enterprises should predict the future competition situation before technology commercialization and set in a perfect patent defense system in advance to win the competition. That actions will help enterprises make the competitors (including potential rivals) give up or delay entering the business [10]. In fact, patent strategy should not only play a defensive role, moreover, it should be more flexible in offensive and defensive.

2) What time to make patent strategy?

Enterprises should make patent strategy proactively before patent application. As the same as other management strategies, in order to maintain the flexibility of patent strategy patent strategy should be regularly (once every six months) organized to revise for discussion when at least a year of filing a patent application, or before application public, or after authorization in the meetings. This is conducive to expand the technological and economic value of patent according to the internal and external conditions changes of the enterprises.

3) Which department should be participated in making patent strategy?

Patent strategy formulation is not just the task of IP department. It need senior leadership, business department, research and development department and IP management department to participate to ensure the collection and communication of information, thus to make a corresponding and operable patent strategy for enterprises.

4) What information is needed to develop patent strategy?

Patent Building patent strategy need carry out a thorough investigation of the market. It is necessary to collect and maintain the following 4 aspects information under the dynamic monitoring control. First, technical scope of the enterprises; Second, similar to the enterprise's technical range. It means that based on the technical scope of existing competitors and potential entrants to establish patent defense

system in similar technical scope, and protect from others enterprises to enter it; Third, technology research and development costs; Forth, the changes of the technology life cycle.

B. Set up Special Patent Management Departments and Officials

Technology-based SMEs should establish a special patent management department to application, organize, coordinate, protect the patent issues and make rules. If the size of enterprises is too small to set up a special department, it must be cooperated with professional patent office or law firm. The important role of patent department is to confirm that enterprise's technology did not conflict with others' patents. If conflict has occurred, negligence of enterprise would result in infringement [11]. Moreover, patent management department should confirm the other enterprises whether infringe patents or not. It keeps monitoring and early warning of possible conflicts to deal with in legal avenues.

At present, the position of CIPO (Chief Intellectual Property Office) of enterprises is getting more and more attention. CIPO is a key leadership role of technology-based enterprises. His duty is contact business and deal with patent strategy related issued. Technology-based SMEs should recruitment of this position base on their owe situation.

C. According to the Internal and External Conditions of Enterprises to Set up Suitable Patent Strategy

Based on the Hsueh & Chen (2015)'s research on 238 innovative small and medium enterprise in Taiwan, using five different dimensions of patent energy, institutionalized patent management, patent creation, patent update, patent utilization to analyze patent strategy. There are 5 categories of patent strategies for SMEs: comprehensive strategy, developmental strategy, defensive strategy, reactive strategy and marginal strategy. Among them, reactive and marginal patent strategies which enterprises adopted tend to spend less spending on R&D and the size of the enterprises are small generally. The enterprises which adopt comprehensive strategy tend to do more fundamental technology innovation, and spend more R&D costs. Thus they pay more attention to the patent value chain; The enterprises which adopt developmental strategy emphasize the use of the cost-benefit analysis to evaluate the risk and profit in the each link of the patent value chain, and tend to focus more on the management and development of patent institutionalization; The enterprises which adopt defensive strategy always pay attention to the patent application and authorization in the present to ensure the core business and technology be fully protected; The enterprises which adopt reactive patent strategy are lack of consistent patent management mechanism and ability to benefit from the patent in the changing market environment; The enterprises which adopt marginal strategy are mostly lack of patent energy and patent management system. They are barely pay attention to patent management problems and have few patent applications. They take other measures, like complementary skills, preposition development time or secret to protect technology.

Strictly speaking, the last two strategies mentioned have not strategic significance and not enter the strategic category. For technology-based SMEs, it is suggested that according to the purpose of economic activity, enterprise scale, the intensity of competition, competitors (including potential rivals), development expenses internal and external environment of enterprises to choose comprehensive, developmental, defensive patent strategy. Passive reactive and marginal patent strategy should be abandoned.

Enterprises should also consider the effect of technology life cycle when making patent strategy. During the emerging technology period, creating and protection patent should be focused; During the growth period, enterprises should accelerate the commercialization and propulsion of patent and related leading technology, and promote the establishment of the relevant standards; In the mature period, with the increasing size of technology diffusion, it is an wise option to exploit patent licensing or cross licensing to obtain more technological profits [12]; And in the technical recession, enterprises should start another round of technological innovation, and eliminated the old patent technology through the coordination of external environment.

D. Rational Arrangement for Patent Evaluation

Patent value evaluation is a basic work in patent strategy management. The value of patent embodies in two aspects; one is patent strategy and economic value through the manager of relevant strategic and economic department to make the judgment. The other is the value of patented technology which decided by the claims, citation and market coverage of patents. It mainly embodied in three indexes, the first is patent claims which means the scope of patent protection technology; the second is patent citation which reflects the usefulness and originality of the future patent. Especially forward citation that shows the patent's influence on the existing technology and the application of related research in the future; the third is patent market coverage which means patent protected in which countries and regions. In condition of larger geographical scope of patent protection, the patents will have larger value. Enterprises should update technology and innovation strategy regularly, assess the value of patent timely and extract all the useful strategic information to serve the enterprise strategy management.

E. Do a Good Job in Patent System Integration

Patent system integration means according to a new portfolio or layout to achieve more market value of patent. Transformation of the patent rights to trademark rights should be considered. Monsanto is a successful case in this respect. In 1985, Monsanto Company purchased Searle Company and its aspartame production technology patent. Monsanto gave aspartame a new brand name, Nutrasweet. It used to sell aspartame for soft drinks. The director of marketing, Michelle points out: "The patent will expire someday, but the brand will not". Therefore, using the transfer of value in multiple IP rights to integrate IP rights, profits will increase with the expansion of the existing market. Under the new competition environment, to do a good job in combining market and IP system is a wise option for enterprises in international competition.

F. Training and Development on the Basis of Core Technology with "wide" Range of Patent

After a patent application for public, existing and potential competitors in the same industry would think if there is any similar or better invention patent beyond the scope of this patent. If competitors success means that the enterprise patent defense system failure. Enterprises should apply for patent in a wide range, and focus, forecast, and conquer the existing technologies to form a wider range of safety patent system. And make sure patented technology would not be imitated and beyond.

It is not enough to form a wide scope of patent. Patent strategy has wide radiation focus on the core technology. The technology-based SMEs should improve ability of creating core technology and apply for patent in time. Besides, Enterprises should focus on the development of core technology and their patent application, and insure the re-innovation of self-development and study, so as to form independent IP rights and core technology. For example: Kiel technology in integrated circuit; characters of compression and recovery technology in laser typesetting system; membrane separation technology in chemical. Patent technology controls the application of the technology in market. Enterprises apply for patents to protect their IP rights and bring huge economic benefits.

V. THE CONCLUSION AND PROSPECT

World's economy has entered into Knowledge Economy Age, patent has become a driving force of enterprise development, meanwhile technology-based SMEs are the main carrier of national innovation strategies; therefore, with treating technology-based SMEs as main part, promoting patent strategy is not only beneficial for improving technology-based SMEs' patent creation, management, utilization and protection ability but also related to national innovation ability. Certainly, in terms of external cause favorable environment and conditions are necessary, the government should actively strive to make measures to provide favorable public service and policy environment. Concrete measures include improving IP legislation and law enforcement system, strengthening education of IP rights

protection, learning from the western developed countries experience, actively promoting international cooperation in protection of IP rights, carrying out support projects, supporting technology-based SMEs' preferential access to patent. With the government effective guidance, technology-based SMEs' patent strategy is overall carrying out, which will bring long-term development for enterprises and nation.

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