An empirical analysis of the factors affecting patent pledge financing

Abstract: With the improvement and development of Chinese intellectual property rights environment protection, patent pledge is an important financial product for financing small and medium-sized enterprises. The State Intellectual Property Bureau, local governments, banks and the Guarantee Corporation cooperate with each other to carry out these works. Patent pledge financing developed rapidly in China from 2013 to 2015. The State Intellectual Property Bureau officially issued in 2016: “on submission of IPR pledge financing and patent insurance pilot demonstration, the policy will be carried out for a period of 3 years of the patent pledge financing and patent insurance pilot work in many parts of the country”. This paper makes a detailed analysis of the research from 2013 to 2015, there were significant areas of patent pledge financing. The results showed the relationship between patent pledge and the degree of attention and economic degree of the local work carried out. Patent pledges and patent systems are closely related. To achieve a patent pledge, you need a patent system to promote patent pledges on enterprise innovation. The introduction of the right financial products to help SMEs grow is an important issue in China. Patent pledges operate mainly by corporate patent pledges for loans to financial institutions. Since 2008, patent pledges in China have developed rapidly. The patent pledge system is the core of the patent application system and one of the important mechanisms for technological innovation. Based on the patent pledge system, China needs a patent pledge registration system, patent valuation,
patent insurance system, patent system transfer, a patent auction system, and patent reform of the security system.

**Key words:** Patent pledge, Patent institution, patent measures

1. Introduction

SMEs (covering small, micro and medium-sized enterprises) are the force of the Chinese economy, accounting for about 90% of the number of enterprises in China. They constitute 60% of GNP and 50% of total national taxes, and contribute 85% to job creation. The financial system is still not perfect in China. Introducing appropriate financial policies to create the right financial products to help SMEs grow is an important issue faced by our country. Patents to finance new innovative financial products, combined with traditional tangible financial products such as mortgage, equipment, housing products and other tangible assets, have made a big difference. Patent pledges operate mainly by corporate patent pledges for loans to financial institutions. In recent years, patent pledges in China have developed rapidly, starting from 2008. In 2012 they were 14.1 billion Yuan. In 2013, they were 25.4 billion Yuan, and in 2015, 56 billion Yuan. They are expected to exceed 100 billion Yuan by 2020. Given that patent pledges are a very good development, financial products in the future have greater universality. Therefore, based on patent pledges, a development-oriented patent system becomes inevitable. To analyze the patent pledge system, based on patent pledge requirements, the development of a patent pledge program is proposed.
2. Conceptual background and methodology

Here we analysis the relationship between patent pledge and patent characteristics. We conclude that patent quality and patent value lie at the core of patent pledge pledge. Patent evaluation (Matthis de Saint-Georges, Bruno van Pottelsberghe de la Potterie, 2013 and D. Guellec, B. van Pottelsberghe de la Potterie, 2000) and patent transfer (Asheim, B. T, Coenen, L, 2006) and patent auction are based on patent pledge. Patent insurance and patent securitization (R. L. Parr, G. V. Smith) are protections of patent pledge. (Y. Meng, 2013 and Justus Barona, 2016)

We performed a systematic review of the available evidence on big data from the State Intellectual Property Bureau from 2013 to 2015. Our objective was to establish what is known about (a) the patent pledge objects, (b) the pledgors, and (c) the pledgees. Because the decision to engage the city context is primarily taken on an enterprise level, we focused our analysis on these three aspects. We applied big patent data from 2013 to 2015 to analysis this problem and we found concrete data of patent pledge. Based on research of these big data, we analyzed the institutions that influence patent pledge and give some advice on policy design.

3. Current patent pledge System

Along with the economic development of the patent system, the inventor has certain exclusive rights to the invention. (Acemoglu et al, D. Acemoglu, S. Johnson, J. Robinson, Y. Thaicharoe, 2003) The patent system can promote the
invention to the public, which avoids repetition of the same research and improves innovation through technological development and protection. The patent pledge system is a patent application system,(Bantel and Jackson, K.A. Bantel, S.E. Jackson, 1989) borrowed from the government’s guiding force by formulating a series of laws and regulations to help banks and financing companies and other financial institutions offer loans to develop new products, improve business performance, and increase profits.( Harhoff, F. Narin, F.M. Scherer, K. Vopel, 1999 and Maskus, Private Rights and Public Problems, 2012)

The impact of the patent pledge system is that the government adopts risk compensation and direct incentives and government subsidies to create an environment that prompts financial institutions to effectively promote financial product. Patent Pledges help companies improve efficiency, reduce the cost of innovation, and transfer costs into liquidity, enabling enterprises to enter a new round of research and development and technological innovation.( N. Bloom, J. Van Reenen, 2002 and J.E. Coombs, P.E. Bierly, 2006)

Enterprises can increase their profits through the patent pledge, maintaining effective operations each year. Bank financing and guarantees and other financial institutions can get interest from business income; the community can benefit from the new tax and from employment. The current patent pledge system in China is mainly a patent pledge interest subsidy system, patent and collateral system, and patent pledge direct incentives system. (E. Kitch, 1977, Narin, K. Hamilton, D. Olivastro, 1997 and Galasso, M. Schankerman, 2015)
The patent pledge interest subsidy system means the government uses state macro-control measures to reduce high-risk interest rates for financial products such as patent pledges, which is more than 10% of interest subsidies, to reduce the burden on enterprises. The patent mortgage interest subsidy system helps to reduce the financial cost of the pledgor to improve willingness to use such high-risk financial products. (Pakes, 1986, Arthur Anderson & Co, 1992 and P. Megna, M. Klock, 1993)

Patent pledge means that the risk compensation system (S.W. Bradley, J.S. 2012 and D. Dollar, A, 2003) for the state in the establishment of SMEs’ intellectual property (IP) demands a survey system on the basis of the further development of financial services’ patent value. It encourages small business financing, licensing, and investment for shares, such as funding to expand IP value and channel financial institutions to SMEs to provide IP and financial services. It encourages the establishment of an SME credit risk compensation fund, and provides key factor for IP pledge and loans. Accelerating IP insurance services into SME policy (M. Zhao, Conducting R&D, 2006 and E. Tebaldi, B. Elmslie, 2013) to guide industry improves the SME compensation mechanism. Supportive fiscal policy reasonably reduces loans, guarantees and insurance rates through subsidies and risk compensation or any other means.

The patent pledge system is when government-owned institutions act as intermediary guarantors to banks and financing companies. Financial institutions fund loans to patent enterprises, because patent pledge loans are high risk and
the potential for bad trading is high. (D. Duffie, R. Rahi, 1995 and Raymond Fisman, Inessa Love, 2007) The risk borne by government-affiliated institutions is easily changed into financial risk, and, due to SMEs’ business difficulties, the patent pledge proportion rises yearly. The debt claim rate of government-affiliated institutions also increases. China’s patent applications have increased in recent years, but patent quality is quite a mixed bag. Banks and financing companies and other financial institutions, such as patent value judgments (M. Trajtenberg, 1990, D. R. L. Parr, G. V. Smith, Harhoff, 1994 M. and Reitzig, 2002, D. Harhoff, F. Scherer, K. Vope, 2003), are likely to have deviations and govern-owned institutions’ guarantees in general can increase the value of these financial institutions to judge the patent value that used to be pledged.

4. The relationship between the patent system and the patent pledge system

The patent pledge system is the core of the patent application system and one of the important mechanisms for technological innovation. Patent pledges achieve the innovation and development of enterprises. The cornerstone of the patent system is the main system of patent pledge. The patent pledge system in China needs to be achieved through the patent system. Basically, in the national innovation strategy, reform of the patent system is required from the original value orientation of protection of the patent application. Under this change in value, the research and analysis of the running mechanism of patent pledge to improve the system (D. C. North, 1990, M. Zhao, 2006 and D. Dollar, A.
Kraay, 2003) of patent pledge rights is of significance. In China, the system of patent pledge rights appeared after the emergence of the patent system. Chinese patent law was promulgated in 1983 and patent pledge registration appeared in 2008. Twenty-four provinces had a patent pledge policy in 2012, and there are significant patent guiding policies in 31 provinces. In China, the patent pledge system has emerged. Before the advent of the patent pledge system (E. Tebaldi, B. Elmslie, 2013), pledgors (in order to protect their research results) often had to pay and bear the high cost of patent application and protection, which resulted in a lack of cash to produce new products. After the development and implementation of the patent pledge system, pledgors could make use of this system to produce and transfer patent products. This is a benefit both to the pledgors and to society as a whole.

5. Funding

5.1 Analysis of the International Patent Classification (IPC) system

The patent technology field accurately reflects the nature of patent technology, industry characteristics and future trends in technology development. This paper is based on the statistics and analysis of data on behalf of the pledge of patent rights in China. It analyzes 8 categories of statistics:

- A represents the human necessities of life
- B represents operation and transportation
- C represents chemicals and metallurgy
- D represents textiles and paper
- E represents fixed buildings
- F represents mechanical engineering, lighting, heating, weapons and blasting
- G represents physics, and
- H represents a class of necessities of life.

The electrical domain in the A class, A 61k, belongs to medical, dental or toilet preparation and consists of 329 patents. The B class (to separate solid from wet solid), B 29C has 228 patents; the C class belongs to water, waste water treatment, sewage or sludge and C08L has 286 patents; D class belongs to D21H pulp or pulp composition and has 62 patents. E class is a common building construction. All areas have 129 patents. F class, belonging to F16K valves, taps, actuating floats, ventilating or inflating devices and have 215 patents. G class is based on the determination of physical or chemical properties testing or analysis of materials, except those belonging to immunology including measurement or test field of enzymes or microorganisms, and G 104B has 301 patents. The H class, H01L is the largest in the field of direct conversion of chemical energy to electrical energy in the field of methods or devices and has 279 patents.
Figure 1: Technical classification of International Patent Classification

A – Life Necessities

Figure 2: Life Necessities

B – Spin paper-making

Figure 3: Spin and paper-making
C – Work transportation

Figure 4: Work transportation

D – Fixed buildings

Figure 5: Work transportation

F – Mechanical engineering, lighting, heating, weapons, blasting

Figure 6: Mechanical engineering, lighting, heating, weapons, blasting

G – Physics
we can see more than 600 pledgors use patent pledge. This financial product has been concentrated in Beijing, Zhejiang, Tianjin and Shanghai from 2013 to 2015.

The rapid development of the patent pledge has a close relationship with local innovation and high-tech small and medium-sized enterprises (SMEs). The cities Anhui, Fujian, Henan, Shandong and Chongqing, in the coastal areas and the western region, come next with about 300 pledges. The central region of the patent pledgors is in close distance, indicating that the economic conditions in the unbalanced development of the provinces can be adopted by state and local government patent pledge policy. It can help some patent technology to achieve high-quality SMEs through using patent pledges to obtain loans to improve financing capacity. The cities
of Hunan, Shaanxi, Guizhou, Hubei, Guangxi, Hebei, and Shanxi provinces have patent pledgors between 80 and 180. This shows that, compared with the eastern region, the number of patent pledges in the central and western regions is still relatively small but has strong developmental potential. The northeast three provinces of Heilongjiang, Jilin and Liaoning are obviously lagging behind the rest, at about 50 and below. Numbers fell in Northeast China in the three years of slow economic development; the banks’ bad debt rate certainly influenced this. The pledge of the State Intellectual Property Office ranked the top 10 patent pledges as more than 1000 in Shenzhen city; more than 600 in Wuzi; more than 300 in Qingdao, Guangdong, and Dongguan; and more than 100 in Chengdu, Changzhou, Nanjing, Jiaxing, and Bengbu. The top 20 in Shunde, Huzhou is more than 50; Xiangyang, Zhongshan more than 40; Kunming, Weifang, and Huizhou, more than 30; Zhenjiang, Shenyang, and Foshan more than 20 pledgors, Patent pledges for the top 20 city and local city economic developments and the local innovation ability of the enterprise and the pledgors inseparable. For example, in Shenzhen, the national innovation capability ranked the Wuxi branch of the Agricultural Bank of China as having great importance to the local patent pledge, so the local patent pledge number reached second ranking. Qingdao, Guangzhou, Dongguan, Chengdu, Changzhou, Nanjing, Jiaxing, and Bengbu ranked second to tenth place. Shunde, Huzhou, Xiangyang, Zhongshan, Kunming, Weifang, Huizhou, Zhenjiang, Shenyang, and Foshan ranked 11th to 20th. The relevant local government and local state-owned and joint-stock banks and local banks are inseparable.
Through the patent pledge of data of this group, the Chinese Intellectual Property Office of the representatives of patent rights, we can analyze these Four lines: policy banks, joint-stock banks, city commercial banks and Financing Guarantee Corporation. The main business of the Agricultural Bank of Chinese pledge is 1313; Chinese Bank is 1073; ICBC is 521; Construction Bank, Bank of Communications China is 602; Bank of China is 932. Policy banks such as China Development Bank is 304; China Import and Export Bank is 276; a representative of the significance of the joint-stock banks in Shanghai Pudong Development Bank is 437; China Merchants Bank is 237 pieces; Guangdong Development Bank is 117 pieces; and China CITIC Bank 202; China Everbright Bank and Huaxia Bank is 28. The City Commercial Bank, which has significance on behalf of the Bank of Shanghai, is 147; the Bank of Beijing is 383; Hankou Bank is 150 and the Bank of Tianjin is 95. The Financing Guarantee Corporation has significance on behalf of Zhongguancun Science and Technology Financing Company Limited by guarantee 327 guarantees and Beijing Technology Intellectual Property Financing Company Limited by guaranteeing 126.

In further analyzing the quality of the detailed information, we can draw the following conclusions:

- The five major state-owned commercial banks – (in order of size), the Industrial and Commercial Bank of China (ICBC), the China Construction Bank, the Bank of China, the Agricultural Bank of China, and the Bank of Communications-combine with the local legislation of patent pledge policy, such as patent pledge and risk compensation, the risk-sharing policy
pledge to local enterprises, such as the Agricultural Bank of Wuxi branch Chinese respectively is 622, Tianjin is 59 and Chendu branch 101, such as the Agriculture Bank of Wuxi branch of Agricultural Bank China technology is largest.

- the Industrial and Commercial Bank of China (ICBC) Beijing 119
- Beijing branch bank Changsha 175
- Beijing Bank Shanghai branch 47
- Shanghai Pudong Development Bank Tianjin branch 87
- Shanghai Pudong Development Bank Jiaxing branch 62
- Shanghai branch of Pudong Development Bank Changsha 43
- Shanghai Pudong Development Bank Nantong branch 32
- Shanghai Pudong Development Bank Minhang branch 75
- China Merchants Bank Guangzhou Branch Ocean Building 16
- China Merchants Bank Dalang branch, Dongguan 9
- China Merchants Bank Zhongshan branch 28
- China Merchants Bank Shanghai branch Minhang 14
- Everbright Bank Suzhou branch 40
- China Everbright Bank Shenzhen Branch 165.

Rural commercial bank patent pledges are nearly 1397. Agricultural credit cooperatives’ restructuring of rural commercial banks and rural SMEs for patent pledge is a demand. The future offers opportunity for more SME to grow up development. (D. Duffie, R. Rahi, 1995, Raymond Fisman, Inessa Love, and FrameW.
6. System of patents based on patent pledge orientation

As a kind of intangible asset (Arthur Anderson & Co, 1992 and P. Megna, M. Klock, 1993), patents offer novelty, creativity and practicality. Enterprise use patent pledge to obtain loans. The core factors that affect patent pledges are patent evaluation (R.L. Parr, G.V. Smith, 1994, and M. Hirschey, 2001), patent insurance, patent auction, patent transfer, and patent securitization. We focus on these factors to design patent pledge system-oriented research.

Through patent evaluation and implementation of geographic and a higher degree of patent technology leadership and of industrialization with much better corporate management performance and higher profitability, patents create wealth – the more patent pledge, the greater patent value. Patent is a special intangible asset. When we assess a patent, we consider the legal life, the technology life, and the economic life (R. Razgaitis, 1999 and J.T. Cromley, 2004). When we assess a patent, we should be aware that when pledged it still can be used by the enterprise. But if this patent passes the patent legal protection period it will be a public product and cannot belong to funded people. Patent pledge evaluation is a core part of patent pledge. Using the appropriate method for effective evaluation of patent value, improving the patent evaluation system and strengthening the establishment of a third-party review mechanism and establishing a good patent evaluation system will facilitate patent pledge regulators.
Patent insurance is according to contracts to insurance companies with pledgors meeting survey costs for compensation. Patent insurance is a good way to protect patents now and in the future. Infringements, reduced bank risk, financial institutions for patent pledge loan risk, and Zoom financial institutions loan lines make financial institutions more willing to engage in patent pledge business. But patent insurance over the patent pledge amount is lower. Lower insurance rates make it difficult to share the patent pledge lending risks of banks and other financial institutions.

Patent transfer refers to the higher annual fees to maintain the patent rights system. Patent assignees consider patents in advance of detailed market research and patent transfer market analysis. Patents arise after the transfer of the benefits and possible risks of failure measures. Patent auction technology through patent rights is a way of implementing the transfer of market transactions. Patent auctions have wide, open, transparent and competitive characteristics. Patent auctions can help mutual understanding so as to improve the effectiveness of patent transactions. Patent auction public modes of operation, market-oriented pricing mechanism( M.Reitzig,2003andHall, A. Jaffe,2005) and standardized transaction processes(M.Reitzig, 2015) contribute to the patent pledge to carry out the business. Patent auctions as an effective complement to conventional patterns of technology transfer can efficiently promote bulk stock of patent rights to businesses and land. Patent transfers enable patentees to reduce the burden of patent maintenance fees. Patent transfer is mainly patent research and development investments of time, energy and labor costs. Patent assignees
consider franchise value and risk in the market. Establishing an effective patent and market security system can help financial institutions recover the principal patent pledge.

Patent securitization (Deng, B. Lev, F. Narin, 1999) can help asset-light SMEs create future cash flow, reducing patent difficulties characteristic of high-risk assets and transactions. SMEs can use patent securitization for currency and capital transactions and evaluate patent assets and reduce patent asset risk, helping patents result quickly. Patent securitization is the essence of patent assets structured financing. The duration of expected income in the future becomes a lot of cash flow. Patent securitization operates on the premise that SMEs have less risk of patent technology. Technology is relatively mature. Patents are expected to be clear and stable. Patent securitization can help SMEs get more cash in a short period of time. As patent investors can’t withdraw investments in securities, this insures the future value of the franchise. SMEs can use patent securitization to advance modern management and promote technological innovation, with full use of the industrialization of patent technology, enabling access to good economic returns and social value. Through the franchise securitization system, SMEs can better increase their credit rating, enhance the enterprise’s financing efficiency, reduce the cost of financing, transfer liquid assets into liquid assets to enhance the liquidity of the assets and short-term debt-paying ability, realize financial value, and improve the competitiveness of enterprises.
7. Patent pledge policy recommendations

7.1 To strengthen and improve the national and local intellectual property offices and national and local CBRC cooperation.

Patent pledges involve many aspects of intellectual property rights and finance. It is a kind of comprehensive financial product. Each area of China pledges patents because local economic conditions are different and unbalanced. With the introduction of patent pledge guidance, patent pledge numbers will increase significantly. National and local CBRC supervision is not only Department of Bank of China, China's banking sector. The bank is the main guidance of loans. CBRC can help and guide commercial banks and policy banks to carry out patent pledge activities throughout the country. To strengthen and improve patent pledges, the national and local intellectual property offices and the state and local CBRC together help to promote the development of patent pledge activities.

7.2 Domestic commercial banks to improve the subject matter of patents and dynamic supervision and evaluation of patent values because patent pledge subject matter varies with changes in the market

The dynamic observation and assessment of quality of patent of domestic commercial banks should pay attention to patent rights in patent pledge of the subject matter of pledges to ensure that banks are consider the pledge of patent in the patent value. In general, the value of patent and patent pledge in real estate is not the same, with the increase of open time and alternative technologies and products devalued.
7.3 To improve and adjust domestic commercial banks to the patent, as the quality of the credit requirements further expand the amount of patent pledge.

The domestic commercial bank patent pledge loan period is generally 1 to 2 years, rarely 3 years. The amount of the loan is mainly concentrated in 2 million, 5 million and less than 10 million Yuan. The loan interest rate is based on an interest rate of not less than 10%, mainly concentrated in the pledge of patent invention patent and utility model patent invention. The patent is generally not more than 30%. The utility model does not exceed 20%. Collateral requirements are generally used in the production of invention patents. Invention patents are on the market generally at least one year. The State Intellectual Property Office and the CBRC can consider the establishment of risk compensation or reward policies to help those who pledge to do better. The bank will consider extending the loan period to 3 years, if appropriate, and increase the loan amount to more than 20 million Yuan.

7.4 To improve the existing system of patent pledge so that interest rates rise about 5% to reduce the burden of patent pledge loans.

The patent industry, profitability and the economic and technical value selection of invention and utility model patent subsidies with high economic value will increase the proportion of loans from 30% to 40%.

8. Research conclusion

Financial investment in China is in a variety of projects in the form of grants or patent application subsidies. The subsidies have caused a significant increase in the amount of patent application but have also caused an explosion in a lot of garbage
patents. Domestic and foreign government officials and experts frequently decry the quality of Chinese patent application. China’s concern about this has made it put pressure on every negotiation. These financial investments have attracted anti-subsidy dues at the time of export. In this case, we propose that having direct financial investment to the patent pledge discount and re-guarantee system is conducive to change. The banks are not willing to carry out patent pledge behavior promotion, but they are willing to expand the patent pledge loan amounts. The enterprise is willing to obtain a patent pledge loan amount to increase research and development (R&D) and R&D strength. We analyze that the main reasons for the innovation performance is that the city has introduced local administrative regulations to guide local patent pledges. These local administrative regulations are the Intellectual Property Rights Bureau of the joint local branch of the People's Bank of China, the local banking regulatory bureau, and the implementation of the local Industrial and Commercial Bureau and local Finance Office released together, so that we can ensure timely and effective performance by the local People's Bank and the support of local government. The local laws and regulations accord to local conditions. They form the loan enterprise patent, including pledge conditions, the use of the loans, the amount of patent pledge, discounts, and other aspects of the specification and guidance of the local patent pledge. The total proportion of patent is still relatively small. How to adopt policies to control and resolve the risks, and bring better conditions for the pledge of patent work is a challenge for our country. Our productivity promotion centers and enterprises are most concerned with financing local administration to
ensure the introduction of more timely and targeted policies to improve enterprise management ability and profitability, and establish assessment, pledge, and transfer transactions. This is part of a complete intellectual property pledge-financing service system to promote the rapid development of the conditions that give rise to the pledge of patents.

9. Research implications

Intellectual power is an important strategy of our national development. Government decision-making has become a key factor in promoting the development of intellectual property. Analysis of the above policy text and content of the results generally reflect the important features of China's patent pledge. The pledge of patent rights dimension and the policy support dimension to the analysis of patent policy and text content is conducive to the future prospects of the government, and is both scientific and reasonable. To carry out the pledge of patent work is not a separate issue. It is the result of the cooperation of many departments. Basically, each of the pledge of patent documents involve intellectual property management departments and financial institutions’ management departments, the management department of securities’ institutions, insurance agencies’ management departments, technology departments and other departments jointly formulated, so it needs good coordination and a cooperation mechanism to carry out the pledge of patent work. The work is the pledge of patent rights and patent quality, related to patent and patent auction transactions, so in the future the policy text will also reflect these important links. This can be very good for promoting the pledge of patent work. Most of the
national-level patent pledge documents are from the macro level to regulate patent right pledges, have relatively clear provisions of the patent pledge of enterprise-specific conditions at the provincial and municipal levels, can pledge patent, risk compensation rate, patent insurance rates, and the reward of patent right pledge rate. The most important innovation is to produce good interaction and enterprise innovation. The enterprise-innovation ability is a financial institution in the patent pledge that studies the key factors. In the past, financial institutions’ often paid attention to the financial situation of enterprises and profitability but rarely considered the innovation ability of the enterprise. But enterprise-innovation ability is one of the most important risk controls of enterprises. To repay bank loans, there must be a good business model, innovation ability and efficiency, all serving to promote enterprises core competitiveness.

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