

From Idea To Impact: IP Management And Application—Problems And Causes Of Technology Transfer In Chinese Universities

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Intellectual property systems, by granting exclusive rights to creators within certain boundary (time, region), play an irreplaceable role in promoting innovation. The exclusive right enables innovators to recover the cost of innovation, to get rewards and invest in subsequent innovation. As a consideration, creators will disclose their technical solutions, which allows the follow-up researchers to conduct innovative research “on the shoulders of giants.” By granting “protection” to creators in exchange for the “disclosure” of their innovation, intellectual property systems properly solve the problem of appropriation of innovation resources. This rationale is embedded in China’s patent law and copyright law.

Through the years, the Chinese government has attached great importance to the role of intellectual property to promote innovation. Recently, President Xi Jinping pointed out in the report of the 19th Party Congress that “we should advocate a culture of innovation and enhance the creation, protection and application of intellectual property.” In which, it signifies that innovation is the source, protection is the means, and application is the purpose. Thus, the top decision puts great emphasis on the application of innovation. Viewed against this background, the intellectual property management of Chinese universities is far from satisfactory. This paper will focus on technology transfer in Chinese universities and examine the application problem in the three stages: when research results are disclosed, when technology is patented and when invention is commercialized. This paper further researches the causes behind these problems in the management and application of intellectual property rights in Chinese universities.

I. Status Quo of the Technology Transfer in Chinese Universities—Rembrandts in the Attic

It is widely believed that technology transfer is the only way to turn university research results into full productivity. Without technology transfer, innovation cannot create value or drive economic development. Investment in innovation is considered to be wasted. In recent years, the R&D investment of Chinese universities has grown at a staggering rate. According to the statistics of the Science and Technology Department of the Ministry of Education, the total amount of scientific and technological funds allocated to universities in 2017 was 153.7 billion yuan. In the meanwhile, the number of patents owned by Chinese universities has seen substantial growth. According to the statistics from the Science and Technology Department of the Ministry of Education, the number of patents granted to universities nationwide in 2017 was 144,375.¹ By contrast,

this number was only 14,111² in 2008, in which year “*National Intellectual Property Strategy*” was released. This means, in less than a decade, the number of granted patents from Chinese universities has increased more than nine-fold. However, the technology transfer rates of Chinese universities are fairly low. The poor application of scientific research achievements has been the target of strong criticism in China. For instance, in 2017, the number of patents granted to universities is 144,375, among which only 4,803 patents are transferred by contract. Then the overall technology transfer rate of Chinese universities was only 3.32 percent. Alternatively, put in the ratio of R&D investment against the income of technology transfer, the picture is even more bleak. In 2017, the actual income of selling patents by Chinese universities is about 1.214 billion RMB, and the actual income of technology transfer in other ways is about 2.67 billion RMB. The above two incomes accounted for about 2.5 percent of the total investment in science and technology in Chinese universities.³ According to the “2017 China Patent Investigation Report” published by the State Intellectual Property Office, the application rate of patents in Chinese universities was only 12.7 percent, which is significantly lower than that of patents owned by enterprises, 59.0 percent. Assessed by the industrialization rate and licensing rate of Chinese university patents, the number is also considerably lower than that of enterprise patents. According to the well-cited report released by the SIPO, 76.1 percent Chinese universities have the problem of “Rembrandts in the Attic,” which means “let patents with market prospects stay idle.”⁴

II. The Main Problems and Causes of Inadequate Intellectual Property Management in Chinese Universities

In a nutshell, an ideal intellectual property management system should cover the whole process of innovation and its application, mainly, the three stages: when intellectual property rights are created, intellectual property rights are protected and intellectual property is used. This paper focuses on the three key stages of university technology transfer—research results being disclosed, technology being patented and invention being commercialized, and investigates the problems and causes of the poor management of intellectual property rights at the three stages respectively.

2.1 The Disclosure Stage

2.1.1 The Problems

On the stage of disclosing research results, there exist two

2. Ibid, 2008.

3. Ibid, 2008.

4. The Planning and Development Department of the State Intellectual Property Office commissioned the Intellectual Property Development Research Center of the State Intellectual Property Office to investigate and study. 2017 China Patent Investigation Report.

1. Compiled by the Science and Technology Department of the Education Ministry of the People’s Republic of China. “Compilation of Scientific and Technological Statistics of Higher Education Institutions in 2017.” 2017 (Beijing: Higher Education Press, 2018).

main problems in Chinese universities: (1) the scientific research work is not oriented towards market demand; (2) the university researchers do not fully disclose the scientific research results to the IP management departments of universities, instead, they select to disclose partially.

2.1.1.1 Problem of Lacking Market Orientation

University researchers are usually not guided by market demand when they choose research topics and establish the projects. More often than not, cooperation between universities and enterprises has taken place after a research result has been achieved. Most research projects are set without adequate market analysis, and this may lead to difficulties in subsequent technology transfer. To improve the technology transfers in universities, it is advisable to adopt a “Tailored for Customer” model, which is developed in some well-known universities. Under this model, commercial enterprises get involved in the research project from the beginning of project selection to patent applications. This pattern is likely to be more conducive to universities’ technology transfer.

2.1.1.2 Problem of Selective Disclosure of Research Results by Researchers

As researchers play a leading role in the innovation process, they are in a strong position in holding important information and usually have a final say about the application modes of the scientific research achievements. The IP management departments of universities can hardly obtain the information of research achievements or control the process of technology transfer, so that IP management departments have little power or influence to drive the application of the research results. Although most universities stipulate that researchers must truthfully disclose (declare) all their service inventions during their employment, yet there exists a very serious selective disclosure phenomenon: it is not a secret that some university researchers disclose high-value service inventions to off-campus organizations and individuals and leave only low-value or “remote from market” inventions to universities. This sneaky practice leads to a serious loss of high-value employee-developed technologies from universities. This is a key factor that makes technology transfer difficult for Chinese universities. Due to the importance and influence of researchers for university employers, few cases come to light.

2.1.2 The Cause Behind the Problems

The scientific research project of university researchers is usually not based on market demand.

The research funding of Chinese universities comes from two categories: vertical funding (usually means funding from governments of different levels) and horizontal funding (usually means funding from non-government organizations including companies or others). Usually, the research funding of Chinese universities is mainly vertical one. Take Xiamen University as an example, the horizontal funding accounts for about 20 percent, and the vertical funding accounts for 80 percent. The vertical funding mainly comes from the following sources: the National Natural Science Foundation, Key Research and Development (R&D) Plans, and so on. These projects are mainly set for basic research, which is more theoretical and usually more remote from market application.

Moreover, under current evaluation system in Chinese universities for researchers, the key indicators are the following: “number of published papers, impact factor and cited quantities.” Usually, it is relatively easier to publish high-level articles and then to win academic reputation by doing basic research, which is the focus of vertical funding. Horizontal funding is given less weight in

evaluation, and the research results of horizontal funding is more difficult to lead to high-level journal articles. In some universities, researchers who conduct horizontal researches are discriminated against and even considered to be inferior. Therefore, under this assessment and evaluation regime, researchers have less incentive to do horizontal research projects, which are usually closer to the market.

2.1.2.1 Cause for Selective Disclosure of Research Results

Researchers in universities are reluctant to disclose high-quality scientific achievements, mainly because they are worried about losing control over their research results. According to the *Regulations on the Protection of Intellectual Property Rights of Colleges and Universities*(1999),⁵ no matter whether a teacher’s invention is a service invention or not, he/she should disclose the invention to the university in time. For non-service patents or non-service technological achievements, when the assignment or licensing takes place, they should be declared to and verified by the competent authority of the university, and the university shall issue corresponding non-service invention certificates. Due to the unequal position of universities and teachers, it is often difficult for teachers to prove that their inventions are non-service inventions in the process of application.

In addition, in terms of the forms of income distribution, cash income and equity income are two main methods of distribution for university teachers. These two forms of distribution are designed to stimulate teachers to disclose inventions. While the former is more appealing

to risk-averse teachers, the latter is more attractive for teachers with strong entrepreneurial spirit. Some studies point out that university teachers in China prefer equity incentives, particularly when individuals can be the equity holders.⁶ After the inventor owns the equity, he/she can exercise the shareholder’s rights instead of simply obtain the dividend; so that, even if the inventor changes jobs or retires, the rights of long-term interests can be guaranteed. What’s more, the ownership of the equity can be inherited by the next generation. Thus, university researchers have strong incentive to control research results.

2.2 The Patenting Stage

2.2.1 The Problems

The main problem at this stage is that many high-value scientific research achievements are not protected by “high-quality”

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5. Issued by the Ministry of Education in China.

6. Chang Xuhua, Zhan Zehui, Chen Qiang and FONG PSW, “The Issue of Invention Disclosure of College Teachers in China—Current Situation, Institutional Reasons and CounterMeasures,” *Research and Development Management*, 28(3), (June 2016), 126.

patents; and this flaw leads to the difficulty in technology transfer, since it may put off potential buyers. The “high-quality” patent protection here means that the patent is strong from technical, legal and commercial perspectives, and it would provide the patent holder an edge in market competition or even dominate in an innovation market.

At present, there is no uniform standard in China for high-quality patents. Usually, international patents, especially PCT patents, are considered to be high-quality patents. From this point of view, the number of high-quality patents from Chinese universities is rather low. According to the data of the World Intellectual Property Organization, the top 10 educational institutions in the 2017 PCT are almost all from the U.S. (seven in the U.S. and three in Korea). Among the top 20 educational institutions, there are only three Chinese universities, which are Shenzhen University, Mining University and Tsinghua University.⁷ Shenzhen University has 265 PCT applications and 108 published PCT applications, ranking 11th in the global educational institutions and ranking first in Chinese universities.

2.2.2 The Causes Behind the Problems

2.2.2.1 “Impure” Motives of University Researcher in Patent Application

Surprisingly, it is said that researchers do not aim to truly protect the technology or to put their innovation into industrialization when they apply for patents. According to a survey, there are nine factors affecting the quality of patents in China, and the highest proportion, 22.03 percent, of referees put “impure motive” of patent application as the affecting factor.⁸ Behind this distorted phenomenon lies the policies of the government and universities: the Ministry of Education in China requires universities submit the data about their patent applications and patent grants each year, and also uses the patent number as an important indicator of university ranking. In many universities, the number of patents is used as an assessment index for career promotion, and distribution of funding. With little consideration about patent quality, teachers and students in universities can simply pursue the number of patents to enhance their position. Some teachers and students apply for patents for their trivial innovation, or manipulate patent numbers by dividing one patent into multiple patents.

2.2.2.2 The Insufficient Awareness of Intellectual Property Protection in Universities

The limited awareness of researchers about patent protection also contributes to the poor quality of university patents. For many researchers, as long as the patents are granted, they are high-quality patents, and their technological achievements will be well protected. When choosing a patent agency, many researchers often choose one with a record of high patent grant rate. This perception is rather ill-informed. In reality, the agency charges fees according to the number of patent applications. For agencies, the shorter the application cycle and the greater the number of applications, the more they earn. It is not their concern whether the patents can ultimately realize technology transfer. Nor will the agencies put much emphasis on the quality of the patents. Moreover, in order to increase the patent grant

7. “China Drives International Patent Applications to Record Heights; Demand Rising for Trademark and Industrial Design Protection,” WIPO, accessed March 21, 2018, http://www.wipo.int/pressroom/en/articles/2018/article_0002.html.

8. Liu Yang, Wen Ke and Guo Jian, “Analysis of Quality Influencing Factors in China Based on Process Management,” *Science Research Management* 12(2012) 105-109.

rate, patent attorneys often tend to narrow down the scope of patent claims and this would sacrifice the quality of the patent and would reduce the market value of an innovation.

2.2.2.3 Weak Intellectual Property Management in Universities

As explained above, the IP management in many universities is in a “stamp-style” and is inadequate. In theory and policy, the intellectual property management department of universities should be empowered and equipped to improve the quality of patent applications, to evaluate the disclosed technical solutions, and to generate patent portfolios by making use of patent mining techniques. A good patent portfolio should be composed of core patents and peripheral patents at different protection points. However, IP management departments of Chinese universities are usually inadequate in terms of institutional setup and the number and quality of management personnel. Among which, competent management personnel are especially scarce. Due to this weakness, the IP management department can hardly perform its purported functions.

A. Management Organizations

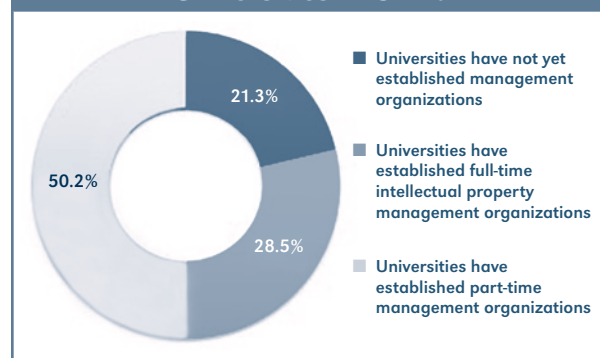
According to the “2017 China Patent Investigation Report” published by the State Intellectual Property Office, only 28.5 percent universities have established full-time intellectual property management organizations; 50.2 percent universities, part-time management organizations; and 21.3 percent of universities have not yet established management organizations.⁹ See Figure 1.

In our research, we find that most intellectual property management offices of universities are affiliated with the scientific research institutes or science and technology departments. The position of intellectual property management office is low, and the professional qualification of intellectual property management is rarely considered. Only a small number of universities set up independent intellectual property offices to manage intellectual property affairs. Many universities simply have no intellectual property management offices.

B. Management Team

According to the “2017 China Patent Investigation Report” issued by the State Intellectual Property Office, 87 percent intellectual property management organizations have only two or

Figure 1: The Establishment Of Intellectual Property Management Organizations Of Universities In China



9. The Planning and Development Department of the State Intellectual Property Office commissioned the Intellectual Property Development Research Center of the State Intellectual Property Office to investigate and study. 2017 China Patent Investigation Report.

fewer staff, and most of these staffs are actually part-time engaged in IP management. Take Xiamen University as an example, the intellectual property management office is a sub-division of the science and technology department. The two staff members are also in charge of managing the horizontal research projects and the university-industry cooperation affairs, in addition to intellectual property affairs.

Therefore, at present, there are very few professionals who specialize in intellectual property management in Chinese universities. The workload of administrative staffs, including IP management staffs, in Chinese universities is quite heavy, so that they do not have sufficient time and energy to “manage” IP affairs. For example, a comparison between Xiamen University and Stanford University may shed some light on this matter. The annual research funding of Xiamen University is about 1.3 billion RMB, and the average annual patent application is about 700. By contrast, the annual research funding of Stanford University is about \$1.3 billion, and there are 500 inventions disclosures each year, among which about 300 patent application are filed.¹⁰ In Stanford, the technology transfer office will firstly evaluate new invention disclosures, and select inventions with commercial value to file for patent application. There are about 50 people working on intellectual property management and technology transfer office. Thus, on average, every staff person is in charge of 5-10 new patents and new inventions per year. However, in Xiamen University, every staff person is in charge of about 350 new patents every year. By number, the workload of Xiamen University’s IP staff is 35-70 times of that of their counterparts in the U.S.A.

In addition to the shortage of personnel, the quality of IP management staffs in Chinese university is far from satisfactory. Ideally, IP management staffs should have inter-disciplinary education background, especially science, economics and law. For instance, in Oxford University, there are about 320 inventions and 100 patents each year. There are 92 staffs in the intellectual property management department, 13 of who have a master’s degree in business administration and 45 of whom have doctorate in science or engineering. Such high-quality versatile professionals are lacking in China. Most intellectual property management staffs in Chinese universities have a single education background. Very few have education background on intellectual property law. Accordingly, their salaries and remuneration, which are mainly based on their administrative rankings in a public institution, are much lower than their counterparts in developed countries.

2.3 The Commercializing Stage

2.3.1 The Problems

The striking problems at this stage are that many universities do not have specialized technology transfer institutions, Table 1, and the dysfunctional management system. At present, the technology transfer staffs are treated as administrative personnel, instead of specialized experts.

As shown in Table 2, in many universities (33.89 percent), there are more than two divisions having the power to intervene in technology transfer affairs; such a structure may pose a threat to efficient decision-making.

2.3.2 The Causes Behind the Problems

The causes of the above problems lie in the lack of clear per-

10. “Stanford University OTL Annual Report,” Stanford University, accessed December 21, 2018, <http://otl.stanford.edu/documents/otl-lar16.pdf>

Table 1. Universities With Technology Transfer Institutions Or Not¹¹

	Universities Nationwide %	985 Project Universities %	211 Project Universities %
Yes	55.24	100	81.5
No	42.19		14.58
N/A	2.73		4.17

Table 2. Structure Of Technology Transfer Institutions In Chinese Universities¹²

	Universities Nationwide %	985 Project Universities ¹³ %	211 Project Universities ¹⁴ %
Multi-Institutional Structure ¹⁵	33.89	76.92	51.28
Single-Institutional Structure ¹⁶	62.78	19.23	46.15
N/A	3.33	3.85	2.56

ception about the role of technology transfer in universities and the lack of comprehensive planning. Meanwhile, the income policy for technology transfer personnel, which follows the salary standard of public institutions, fails to create a market-oriented incentive. As long as the incentive problem is not solved, it is hard to attract qualified candidates to build a specialized team.

III. Conclusion and Prospective Development

As discussed above, there are still many problems in intellectual property management in Chinese universities. One of the heavily criticized problem is the low percentage of applications of patented technology. The cause for this problem is multi-fold. According to a study conducted by a research institute under the SIPO, factors such as low inventiveness, poor management, little incentives for management teams and insufficient funds all contribute to the low application rate of university technology. Among which, some of the factors have affected the quality of patents, and some of them have had negative impacts on the

11. The Ministry of Education commissioned Tsinghua University to investigate and study. “Strategic Research on the Transformation of Scientific and Technological Achievements in Universities.”

12. The State Intellectual Property Office commissioned Tsinghua University to investigate and study. “Strategic Research on the Transformation of Scientific and Technological Achievements in Universities.”

13. In May 1998, Jiang Zemin, then the president, proposed a goal in Peking University’s 100th anniversary that “To realize modernization, we must develop several world-class universities in China.” Since then “985 Project” was launched. Up to now, there are 39 Chinese universities listed in the “985 Project.”

14. “211 Project” was also a project launched by the Chinese government in 1995 to build 100 most elite universities. “21” represents the 21st century, “1” represents 100, and “211 Project” is that “In the 21st century, there have been 116 universities listed in the “211 Project.”

15. “Multi-institutional Structure” means there are many units of a university involved in technology transfer, which leads to decentralization of power and chaos in management.

16. “Single-Institutional Structure” means there is a specialized institution in charge of technology transfer affairs in the university.

enthusiasm of the management team. These problems have significant influence on the technology transfer and application of intellectual property. As a result, substantial innovative resources in Chinese universities generate little or no fruit. See Table 3.

In recent years, Chinese government has laid great emphasis on improving patent quality and promoting technology transfer in universities. For instance, in order to promote technology transfer and accelerate the implementation of innovation-driven development strategy, the Law on Promoting the Transformation of Scientific and Technological Achievements was amended in 2015. The revised law makes it compulsory for universities to reward their employees who made the invention. If there is an agreement between the university and the employees, the agreement will prevail. If there are no agreements, the remuneration to the inventors shall not be less than 50 percent of the net income of technology transfer or licensing. Additionally, in order to regulate the management of intellectual property rights in universities and to improve the quality of patents, “Regulations on the Management of Intellectual Property Rights of Chinese Universities” was promulgated and implemented in 2017. Moreover, in order to form high-value patent portfolios or patent pools in the key industries, “High-value Patent Cultivation Program” was carried out by the government. With these reform measures, which are schemed to tackle the problem in intellectual property management in Chinese universities, we have reasons to expect that technology transfer in Chinese universities will be improved to some extent. ■

Available at Social Science Research Network (SSRN):
<https://ssrn.com/abstract=3380388>

Table 3. Factors Influencing Technology Transfer In Universities (Unit: Percent)¹⁷

Influencing Factors	Universities
Low inventiveness	39.9 ¹⁸
Lack of Professional Team for Technology Transfer	58
Inventors (teachers or employees) Lack Enthusiasm	24.9
Patent Administrators Lack Enthusiasm	2.6
Insufficient Support for Patented Industrialization Funds	38.2
Lack of Patent Income Distribution Mechanism	10.9
Other	0.9
Total	175.3¹⁹

17. The Planning and Development Department of the State Intellectual Property Office commissioned the Intellectual Property Development Research Center of the SIPO to investigate and study. 2017 China Patent Investigation Report. The survey investigates 1293 colleges, universities and research institutions in 23 provinces in China, and 971 valid questionnaires were collected.

18. 39.9 means 39.9% of the respondents (colleges, universities and research institutions) regarded low inventiveness as one of the influencing factors of low technology transfer in Chinese universities.

19. As the questionnaires consisted of multiple-choice questions (That’s to say, the respondents can choose multiple factors as the influencing factors of low technology transfer in Chinese universities), the total percentage exceeds 100%.