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# Research on the current situation and countermeasures of university - enterprise cooperation based on patent data in China

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## ABSTRACT

In the highly competitive market economy era, science and technology, knowledge, talent is particularly important. In this environment, in order to be able to better development, enterprises and universities to carry out cooperation. University-enterprise cooperation is a model in which enterprises and universities play their respective advantages under the premise of mutual trust so as to achieve mutual benefit and win-win. It can not only improve the efficiency of universities, but also enhance the innovation and output ability of enterprises and strengthen competition weight of enterprises. Therefore, for both enterprises and universities, university-enterprise cooperation has far-reaching significance. This paper expounds the development background and significance of the cooperation between universities and enterprises, introduces the concept of cooperation between universities and enterprises, and analyzes the current situation of the cooperation between universities and enterprises and the existing problems and solutions based on the patent data, to improve patent transfer rate of Chinese universities, promote enterprise innovation, and promote the transformation of patented technology achievements of university-enterprise cooperation in China.

## KEYWORDS

university-enterprise cooperation; patent data; patent transfer; problems and countermeasures

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## INTRODUCTION

With the advent of the new economic era, intellectual property has increasingly become the core of the competitiveness of enterprises and universities. In June 2008, the Chinese government promulgated the Outline of its Intellectual Property Strategy. One of its strategic objectives is to make full use of intellectual property so as to promote the commercialization, industrialization and commercialization of scientific research and innovation achievements, that is, to transform patented technologies into real productive forces in an appropriate way. Colleges and universities have abundant scientific resources and considerable scientific research achievements, so there is a great potential for patent application. Although the number of patent applications and grants in Chinese universities has increased by tens or even hundreds of times, the patent quality is not high and the patent conversion rate is mostly low. The technological cooperation between enterprises and universities can lead the technological innovation by taking the needs of the market as the leading goal, which can not only enhance the innovation level of enterprises, but also give full play to the scientific research advantages of universities, and ultimately promote the industrialization of innovative technological achievements.

This paper combined with the existing patent data, patent, patent analysis and patent transfer, manufacture-learning-research cooperation, cooperation between colleges and other related concepts, based on the analysis of the factors: China's patent application and patent transfer, on the basis of exploring the various factors influencing the university technology transfer, summarizes the successful experience of universities patent transfer, discusses its defects and shortcomings, analysis the reason, So as to provide scientific basis for university patent technology transfer. At the same time, gradually improve the patent application rate and implementation rate of universities, promote the patent transfer work of universities, and provide data support for government departments to issue relevant policies. It is of far-reaching significance to improve the core competitiveness of enterprises, enhance the quantity and quality of university patents, and promote the ability of national independent innovation.

## MAIN MODES OF SCHOOL-ENTERPRISE COOPERATION

School-enterprise cooperation is a powerful form to promote technological innovation of enterprises and realize advanced development of higher education. It not only meets the requirements of economic and times development, but also conforms to the general direction of higher education development. Strengthening school-enterprise cooperation can not only reform the teaching mode of colleges and universities, but also conform to the trend of technological innovation of enterprises. At present, the main modes of cooperation between Chinese universities and enterprises are as follows:

### School-enterprise cooperation led by the government

- (1) Establish strategic alliances of industry-university-research cooperation. The industry-university-research alliance is an advanced system integrating research, development and production formed by enterprises, universities and scientific research institutions cooperating with each other and giving full play to their respective advantages. It can reflect comprehensive advantages in the operation process. This kind of alliance can introduce scientific and technological resources of scientific research institutions and universities outside the region and promote the regional economic development.
- (2) Establish university science and technology park. University Science park is a service institution for science and technology entrepreneurship approved by the Ministry of Education and the Ministry of Science and Technology. Its purpose is to fully integrate the resources of colleges and universities with the comprehensive resources of the society, and then promote the transformation of scientific and technological achievements in colleges and universities, and serve for the construction of an innovative country and the development of economy and society.

### Direct cooperation between universities and enterprises

- (1) Project cooperation between universities and enterprises. There are two ways of project cooperation: first, the state or government provides the project, and universities and enterprises jointly undertake the research and development plan; Second, enterprises entrust projects to colleges and universities, which provide technical services or carry out technological development according to the needs of enterprises. Project cooperation can effectively bring into play the advantages of both enterprises and universities.
- (2) Science and technology enterprises run by colleges and universities. Colleges and universities have rich talents, intelligence and scientific and technological resources, so they have strong research ability and technological innovation ability, and many scientific research achievements. In recent years, some universities have established a number of successful technology enterprises, such as Tsinghua Tongfang and Peking Founder. These enterprises not only develop well themselves, but also have a great effect on the government, universities and enterprises.
- (3) Universities and enterprises jointly establish research and development centers. Enterprises invest funds to set up research and development centers in colleges and universities to carry out research and development centering on the needs of enterprises, thus becoming strong technical backing for enterprises.

## ANALYSIS OF SCHOOL-ENTERPRISE COOPERATION IN CHINA BASED ON PATENT DATA

### Data Sources

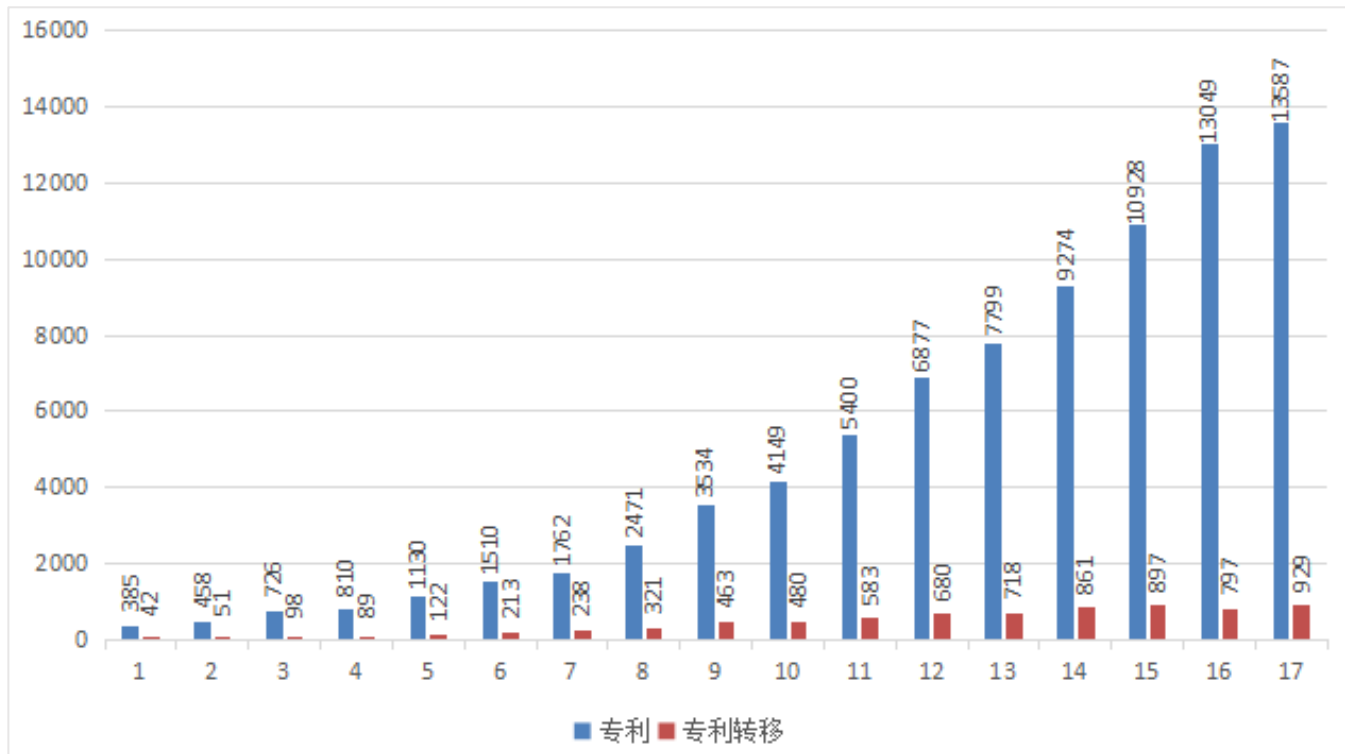
The patent literature data collected in the patent database of China Intellectual Property Office is large, comprehensive, reliable, timely updated and accurate, and the patent information is mined and analyzed in multiple dimensions. In view of the advantages of SIPO, this paper uses the Patent database of SIPO as the data source to mine and analyze school-enterprise cooperation patents and their transfer in China from multiple perspectives

### Patent Retrieval

This paper uses the advanced search of patent database of State Intellectual Property Office to construct the patent search formula, so as to obtain the required patent data. Among them, the patent retrieval formula of university-enterprise cooperation is: AP-type =(C) AND AP-type =(U), AND the total number of patents is 105,091. The retrieval formula of patent transfer in school-enterprise cooperation is :(ap-type=(C) AND ap-type=(U)) AND ((license-flag =1) OR (assign-flag= 1)), AND the total number of patents is 61281. China's patent transfer search formula is :(license-flag =1) OR (assign-flag= 1), and the total number of patents is 824,637.

## Patent trend analysis of university-enterprise cooperation

### • Application Trend



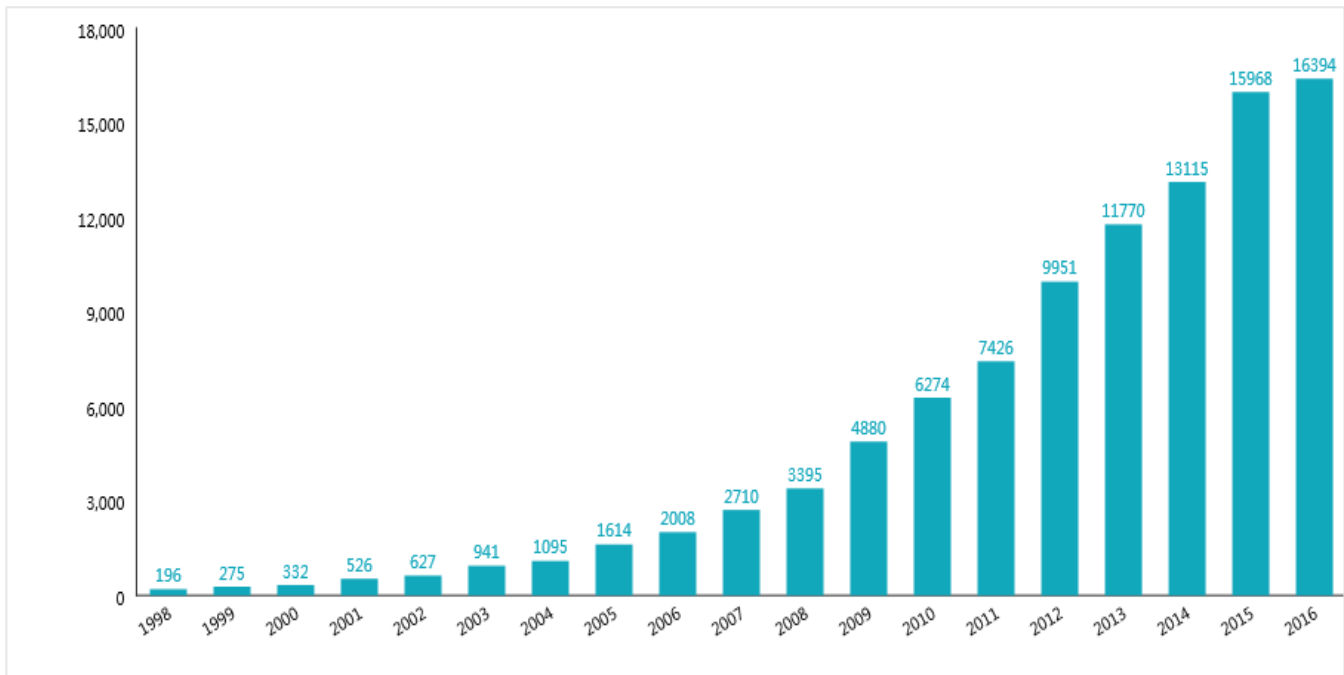
**FIGURE 1:** Patent transfer trend of university-enterprise cooperation

As can be seen from Figure 1, the number of patent applications of school-enterprise cooperation in China increased year by year from 1998 to 2014, among which, the growth was relatively slow from 1998 to 2005. 2005 was a turning point of patent applications of school-enterprise cooperation, and the annual number of patent applications increased significantly from 2005 to 2014. From 2012 to 2013, the number of patent applications increased by a maximum of 2,121. In addition, the number of patent applications for university-enterprise cooperation in China continues to grow rapidly, reflecting the increasing awareness of intellectual property protection among universities and enterprises and the increasing closeness of university-enterprise cooperation.

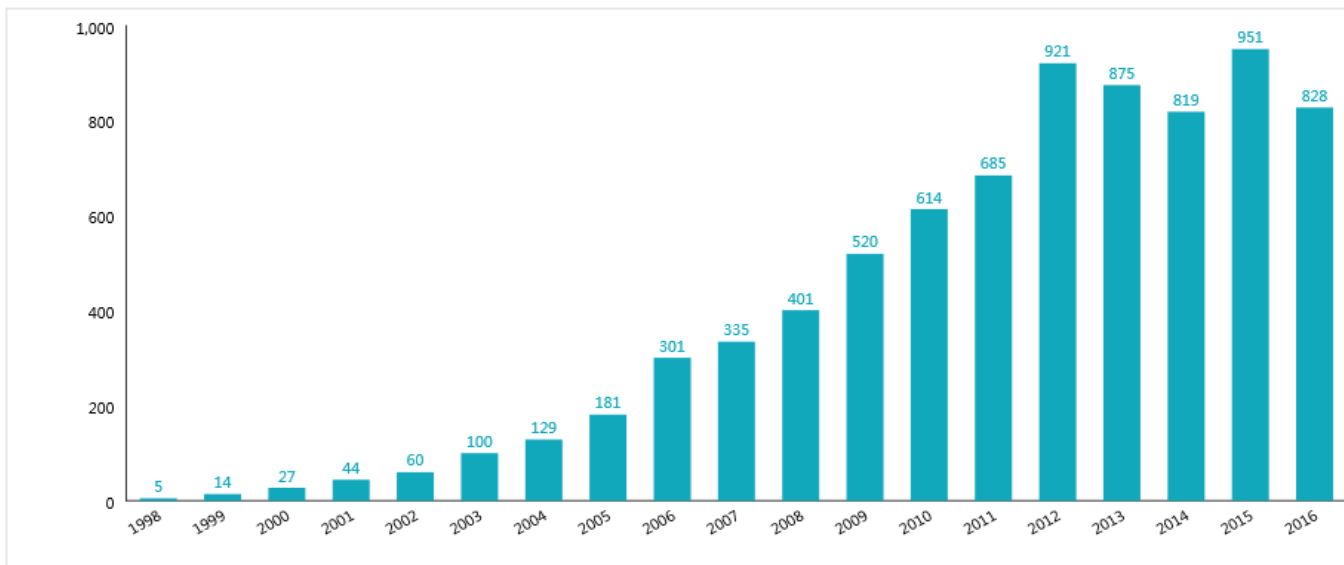
At the same time, the patent transfer applications of school-enterprise cooperation in China generally showed an increasing trend from 1998 to 2014, but there were two declining points, including a decrease of 9 patent transfer applications from 2000 to 2001, and a decrease of 100 patent transfer applications from 2012 to 2013.

The transfer of patent application and patent by university-enterprise cooperation filings contrast can be seen that although patent applications increasing trend of university-enterprise cooperation in our country, but the annual patent transfer rate is very low, between 6% and 15%, one of the highest patent transfer rate is 14.1% in 2003, from 2003 to 2014, the transfer of patent rate basic into a state, In recent three years, it has reached the lowest, respectively: 8.2%, 6.1%, 6.8%. It can be seen that the status quo of patent transfer of school-enterprise cooperation in China is not optimistic. The reason is that universities have strong scientific research ability, but weak consciousness of patent technology transfer, so that a large number of patents do not realize their due value, which cannot produce economic benefits and waste a large number of social resources.

• **Expose trends**



**FIGURE 2:** Patent disclosure trend of university-enterprise cooperation



**FIGURE 3:** Patent transfer disclosure trend of university-enterprise cooperation

As can be seen from Figure 2, the patent disclosure of school-enterprise cooperation in China has been on the rise from 1998 to 2016. Among them, the patent disclosure from 1998 to 2008 was relatively small with a small increase, and the patent disclosure from 2008 to 2016 increased significantly. The number of cases increased by 2,853 from 2014 to 2015.

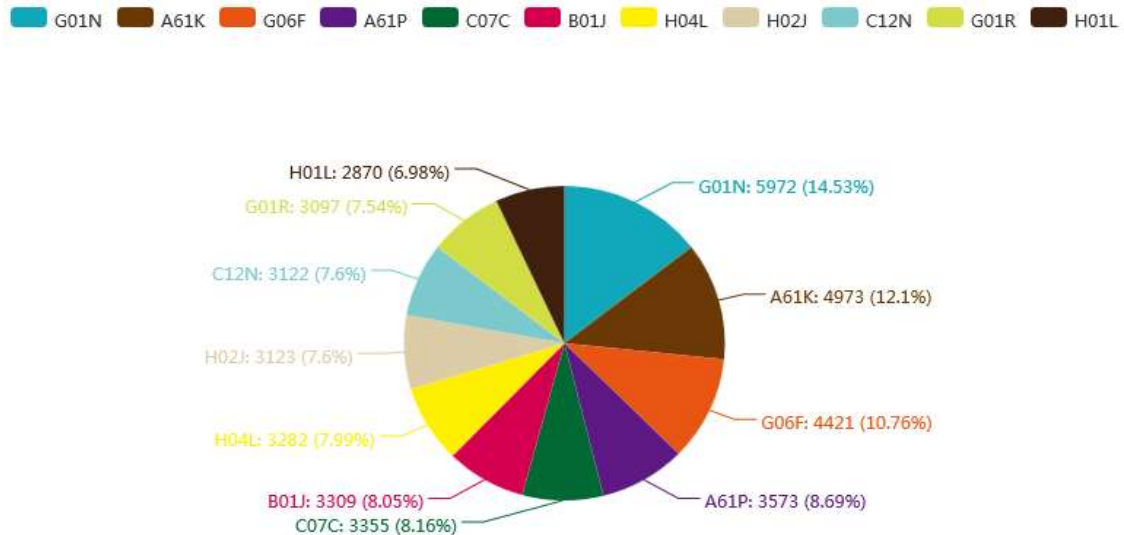
As can be seen from Figure 3, from 1998 to 2012, the number of patent transfer disclosure of school-enterprise cooperation in China increased year by year, with a large increase from 2005 to 2012. From 2011 to 2012, the number of patent transfer disclosure increased to a maximum of 236 cases. From 2012 to 2016, the number of patent transfer and disclosure reached 951 in 2015, but declined in other years.

According to the comparison between Figure 2 and Figure 1, the patent disclosure rate of school-enterprise cooperation in China is between 50% and 97%, because there is generally a lag period of 2 to 3 years from application to disclosure.

As the number of patent applications of school-enterprise cooperation increases year by year, the patent disclosure rate also keeps rising, reaching the highest levels in recent three years, which are 91.1%, 90.2% and 96.5% respectively, indicating that the patent output of school-enterprise cooperation in China is in a good situation. However, by comparing Figure 2 and Figure 3, it can be seen that the patent transfer trend of school-enterprise cooperation in China needs to be strengthened.

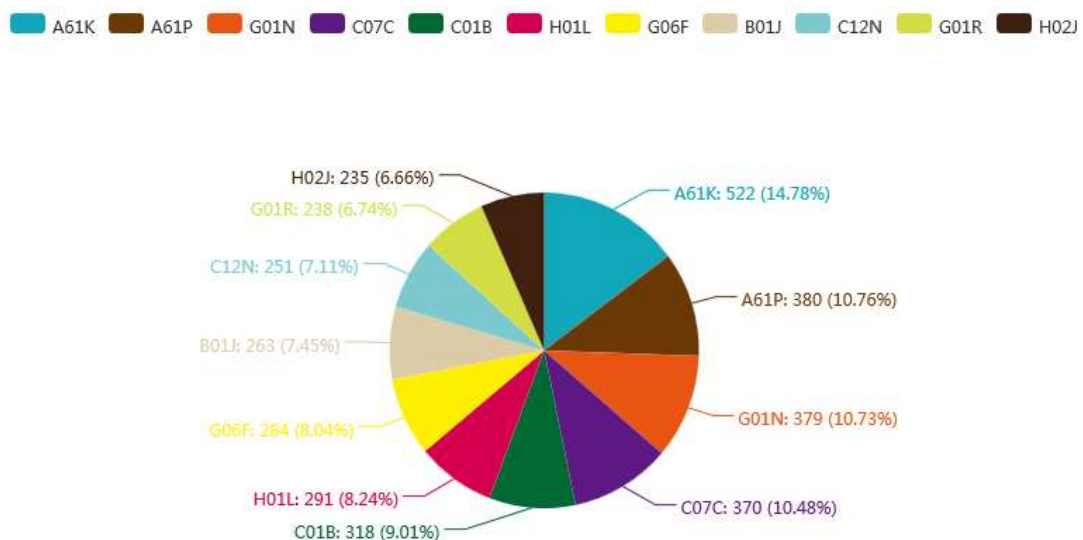
**Patent technology analysis of school-enterprise cooperation**

• **Technical Composition**



**FIGURE 4:** Patent technology composition of school-enterprise cooperation

The patented technologies of school-enterprise cooperation in China mainly include the following fields: physics, chemistry, biology, medicine, electronic devices, circuit systems, etc. Among them, G01N (to test or analyze materials by measuring their chemical or physical properties) accounted for the largest proportion, with 5972 patents, accounting for 14.53% of the total number of university-enterprise cooperation patents. Therefore, university-enterprise cooperation mainly focuses on science and engineering. Because enterprises lack research and development capabilities, they can take advantage of the advantages of universities to develop new technologies, equipment and products, improve production efficiency, enhance competitiveness and realize profit appreciation. At the same time, these areas are also the main aspects of competition among countries, indicating that the achievements of university-enterprise cooperation can show the frontiers and priorities in the field of science and technology and lead technological innovation.



**FIGURE 5:** composition of patent transfer technology in university-enterprise cooperation

Although the composition of patent transfer technology in China's university-industry cooperation is also concentrated in the above areas, the proportion has changed. Among them, A61K (medical, dental or dressing accessories) was the most in terms of number of patent transfer technologies, accounting for 14.78% of the total patent transfer technologies, with 522 cases. However, the patent transfer rate was not high, ranging from 6% to 11%, with the highest patent transfer rate of 10.6% for A61P (specific therapeutic activity of a compound or drug preparation). It is worth noting that H04L (transmission of digital information, such as telegraph communication), which ranks 7th in the composition of university-enterprise cooperation patent technology, has 3282 patents, but no list 2, that is, its patent transfer ranks 11th. C01B (non-metallic elements; Its compounds), and its total number of patents does not appear in Table 1, that is, it is outside the 11th place. It can be seen that China's research and development efforts in chemistry and medicine are larger and the market demand is more. However, the patent transfer rate is low in physics, electronics and other fields due to the lack of talents, the difficulty of technological innovation and the limited market demand.

## CONCLUSION

Nowadays, with the rapid development of economy and the rapid progress of science and technology, the competition of market subjects is more about the competition of innovation ability. In order to implement the "innovation-driven development strategy", it is necessary to gather the strength of various innovation subjects and jointly promote the overall innovation level of China. Colleges and universities are important innovation subjects in Our country, with rich innovation resources, and apply for a large number of patents every year, but also obtain a large number of patent authorization. However, at present, the patent transfer rate in universities is low, and a large number of patented technological achievements have not been effectively transformed and played their due role, which has become a problem that the whole society needs to think and pay attention to. Taking technological innovation as the background and patent data of the State Intellectual Property Office based on university-enterprise cooperation as the data source, this paper analyzes the patent application trend, patent technology composition, geographical distribution, applicant types and other characteristics of university-enterprise cooperation in China, and analyzes the problems and countermeasures of university-enterprise cooperation from the perspective of patents. In order to provide some reference value for China's industry-university-research patent policy and technological innovation policy. School-enterprise cooperation is a long-term interactive process between enterprises and universities. Due to my limited knowledge and ability, this paper has many deficiencies in the research content, problems and countermeasures, which is also the direction of future study and research efforts.

## REFERENCE

- [1] Wu Yong. Research on problems and Countermeasures of Cooperation between Universities and Enterprises in China [D]. Changsha: Hunan University, 2011:1-24.
- [2] Wang Han. Research on characteristics and mode of school-enterprise cooperative innovation from the perspective of patent [D]. Guangzhou: South China University of Technology, 2014:1-4.
- [3] Chen Xiangyang. Research on influencing Factors of College patent Technology Industrialization [D]. Zhengzhou: Zhengzhou University, 2015:1-10.
- [4] Li Qingxia. Current situation and incentive policy selection of Patent technology transformation in Chinese Universities [D]. Changsha: Hunan University, 2010:1-26.
- [5] Huang Qing. Research on the relationship between industry-university-research cooperation policy and knowledge innovation chain in universities [D]. Hangzhou: Zhejiang Sci-tech University, 2016:1-7.
- [6] Dai Hua, Kang Jianhui. Research on the patent right ownership of university-enterprise cooperation in university scientific and technological innovation [J]. Law and society, 2008,12 (1) :1.
- [7] Long He. Research on The Development Mode of School-enterprise Cooperation and Interaction in China [J]. Journal of Economics and Management Science, 2011, (S1) :18-30.
- [8] Liu Yicen. Model and Analysis of Technology Transfer in Domestic and foreign Universities [D]. Chongqing: Chongqing University, 2006:52-54.
- [9] Fang Yuan, Zhang Long, Wang Zhisen. Research and practice on the implementation mode of university patent strategy [J]. Technology and innovation management, 2013,34 (03):190.

- [10] Zhang Lin. Game Analysis on the object Selection of industry-university-research Cooperation innovation [J]. Science and Technology Management Research,2012, (19):3-5.
- [11] Wang Feng, Liu Xiang. Innovation Science and Technology,2013, (06):3-5. (in Chinese)
- [12] Fan Jieping. Research on the quality of School-enterprise joint Patent Application in China [D]. Guangzhou: South China University of Technology, 2012:1-28.
- [13] Luo Xiaohan. Research on university patent transformation based on industry-university strategic alliance [D]. Chongqing: Chongqing University of Technology, 2015:22-48.
- [14] Yang Yang. Research on the status quo, problems and countermeasures of Patent transformation in Chinese universities [D]. Changsha: Central South University,2014:16-18.