

# Patent Quality Management in Universities Based on Life Cycle Theory

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**ABSTRACT.** *As the main force of basic research and the source of technological innovation, universities produce a large number of scientific and technological achievements every year, which promotes the overall scientific and technological progress of the society. However, due to the influence of policies, environment, technology and other factors, Chinese universities have been paying attention to the growth of the number of patents for a long time, ignoring the requirements on patent quality, resulting in the low overall patent quality of universities and resulting in the waste of knowledge resources. Based on this, this paper starts from the perspective of university patent administrators, combines the actual management needs of university patents, and applies the life cycle theory to analyze specific stages of patent management, trying to improve the efficiency of university patent management.*

**KEYWORDS:** *university patent, quality management, life cycle theory*

## 1. Introduction

As one of the main bodies of scientific and technological innovation, universities and colleges receive a large amount of scientific research funds from the state and enterprises every year, and produce a large number of scientific research achievements, which are not only presented in the form of papers, but also in the form of patents, driving the overall technological progress and economic development of the society. In 2015, the number of patent applications of Chinese institutions of higher learning was 190,351, with universities accounting for 6.8% of the total. Among them, the number of invention patent applications of universities was 109,911, accounting for 10% of the total, indicating that university patents, especially invention patents, occupy an important position in China's patents.

Data from the China ministry of education showed that the patent conversion rate of Chinese universities was only 2% in 2017, lower than that of developed countries and the same period of social patent transformation, indicating that university patents deviate from social demand, resulting in low patent utilization efficiency.

## **2. Research significance**

At present, China universities apply for a huge number of patents every year, the average annual number of applications has exceeded that of European and American universities, but the gap in patent quality is huge. Take Tsinghua University and Stanford University as examples. Tsinghua University, as the leading university in China, has 1,883 invention patents in 2011, 28 of which have been successfully converted, with a conversion rate of 1.5%. In the same year, the number of invention patents of Stanford University was 215, and the conversion rate was 47.0%, showing a significant difference [1].

This not only shows that we have been too extensive in patent quality management in the past, but also shows that universities and colleges have great potential to improve patent quality.

## **3. University patent administration subject**

According to the survey data from the national knowledge administration, 44.1 percent of Chinese universities and colleges have set up full-time management agencies for intellectual property rights, 47.7 percent have set up part-time management agencies, and 8.2 percent have not yet set up management agencies. Among them, 2 full-time managers account for 79.7% and 2 part-time managers account for 68% [2]. However, the number of patents granted by colleges and universities is more than one thousand each year, and it is still growing rapidly. Therefore, it is difficult for patent administrators to shoulder the responsibility of patent operation management, which may lead to the accumulation of patents and difficulties in patent operation. Therefore, it is of practical significance to evaluate patent quality from the perspective of university patent administrators.

American colleges and universities mostly adopt the system of on-campus pre-examination, and patent administrators have great authority. Through the patent operation office, technical experts are organized to conduct early evaluation of unapplied technical solutions, and then business personnel with science and engineering backgrounds seek potential transformation customers, and finally apply for patents for promising technologies [3]. Therefore, American universities grant fewer patents annually, but their conversion rate is very high. At present, it is not mature for Chinese universities to follow American universities' lead. First, they need to improve their own patent quality, and then they can carry out patent operation and management.

#### 4. Division of patent management life cycle in universities

In 1966, Vernon first proposed the product life cycle theory, which was divided into introduction period, growth period, maturity period and decline period. Vernon believed that this cycle occurred at different time and process in countries with different technology levels, reflecting the differences in the competitiveness of the same product in different markets [4]. Foster applied Vernon's theory to explain the life cycle of innovative technology and depicted the technology life cycle with the curve of standard S [5].

From the perspective of patent administrators in universities, this paper divides university patents into four stages of patent life management based on the life cycle theory and the management functions of patent administrators and the legal process status of patents.

The first stage is the patent application stage. Phase patent application and patent technology life cycle period overlap, in the patent application stage, due to the application timing, the application by the applicant to the quality control and management are difficult to grasp the specific situation of to apply for a patent, can only provide the inventor patent related policy services, such as guide patent application, application fee waiver. At present, colleges and universities still encourage staff and students to apply for patents to promote the increase of the number of patents, so there is no higher requirement for patent quality in the application stage. However, with the adoption of more patent quality evaluation indicators in some assessments, colleges and universities have also changed, such as paying more and more attention to PCT patent applications. Therefore, in the stage of patent application, management personnel are in a passive situation, and it is difficult to carry out patent management.

The second stage is the patent operation and management stage. The stage of patent operation and management is the most important stage in the life cycle of patent management, which can determine whether the patent can be successfully transformed. If not, all the efforts made before the university will be wasted. At this stage, the patented technology matures with the growth of time, reaches the optimal application opportunity, and can adapt to the actual production requirements. The patent administrator shall work with the inventor to popularize the patented technology and find the suitable object of transformation. Operating management phase in patent patent legal authority has been stable, patent technology also gradually matures, the vast majority of patent quality evaluation indicators have also been fixed, patent management of colleges and universities patent convenient to actual situation, can try to apply patent quality evaluation tool to extract high quality patent, to carry out specific operations, improve work efficiency.

The third stage is the patent application stage. After the successful transformation of the patent, the ownership is transferred from the university to the transferee, who takes economic remuneration or shares as the bargaining chip. In the process of patent transformation, the patent administrator shall assist the inventor in handling business negotiations and signing technology transfer contracts. In the application

stage, the university should assist the transferee to successfully transform the patented technology into production practice, and try to further improve the technology, so as to achieve a win-win situation for both parties. The fourth stage is the patent abandonment and maintenance stage.

The stage of patent abandonment and maintenance overlaps with the decline period of the patent technology cycle. Due to the large number of patents in universities, the cost of patent maintenance is high every year. In order to improve the efficiency of the use of funds, I choose to give up maintaining a part of low-quality expired patents every year. The evaluation of patent quality can help to screen out the low-quality patents which are about to expire, and avoid the high-quality patents being wrongly abandoned and maintained. Due to the low quality and poor application prospects of some patents in colleges and universities, they may be abandoned and maintained before reaching the decline period of patented technologies, thus ending the life cycle of patent management in advance.

After the patent is authorized, the evaluation index of patent is not unchanged, but in a dynamic change. For example, the index of cited patent can better reflect the patent quality, but the newly applied patent will not produce cited data, which needs a period of time to wait. Therefore, the evaluation results of patent quality will not remain the same value in the life cycle of patent management, so it is necessary to divide the intervention time of patent quality evaluation.

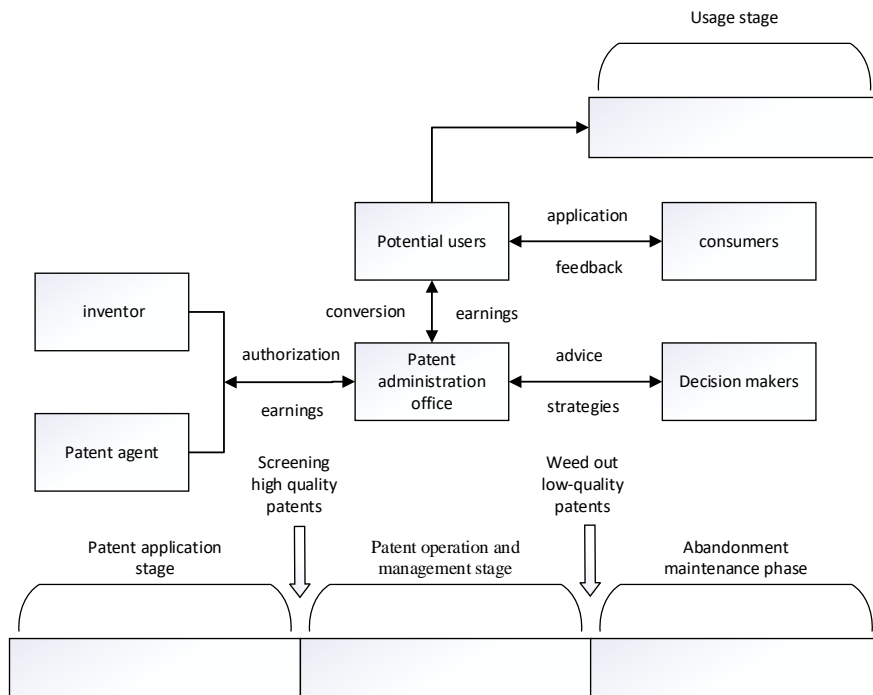


Figure. 1 University patent quality management flow chart

As is shown in the figure 1, the patent administration institution of colleges and universities is at the core of the patent management framework of colleges and universities, playing a key role of "connecting the top with the bottom, communicating with the outside". On the one hand, the administrative personnel can control the overall patent quality according to the patent strategy of the decision-making level of the university; on the other hand, they can contact with the inventor to determine the specific management status of a single patent in details. Patent administrators are a window of university's external affairs. On the one hand, they try their best to apply university's patent technology to the external society, so that universities can truly become the driving force for social development. On the other hand, they can absorb external funds to support university's in-depth research and development, so as to achieve a win-win situation. With the help of patent quality evaluation tools, patent operation managers in universities can screen out high-quality patents, get away from the huge number of patents, and focus on the operation and transformation of high-quality patents, rather than just the filing of patent documents.

## **5. University patent management strategy**

In order to improve the quality and efficiency of patent utilization, patent management in universities and colleges has its focus in each stage of its work.

### ***5.1 Patent application stage***

The patent application stage is the initial stage of patent administration. This stage mainly focuses on the inventor. The patent administrator is responsible for assisting the inventor to deal with the matters in the application stage. In order to control the patent quality in the patent application stage, patent administrators should do the following:

(1) Encourage joint research and development between inventors and enterprises or universities. School-enterprise cooperation can promote the innovation of technology and knowledge and improve the conversion rate of scientific and technological achievements. In addition, technology research and development work is a risky work. Joint enterprise or other universities for cooperative development can complement each other in technology and improve the probability of successful research and development.

(2) Assist the inventor to apply for a patent in a standardized way. The quality of patent text is also a component of patent quality. Although some universities' invention patents are highly innovative, they ignore the quality of patent text, resulting in the low value of eventually granted patents. The university should cooperate with the Patent Office, standardize the content of patent text, reasonably expand the scope of technical protection, and achieve the purpose of enhancing the value of patent.

(3) Rational distribution of patents. It is difficult for a patent to fully protect a technology. Colleges and universities should set up peripheral patents around the "core patent" to protect the patent and improve the value of the patent. It is also a feasible way to establish "patent pool" through cooperation with colleges and universities or enterprises. In addition, due to the limited life of patent, in order to improve the efficiency of patent utilization, we should actively carry out patent operation at the stage of patent application.

### ***5.2 Patent operation and management stage***

Patent operation management stage is the most important stage in the life cycle of patent management, which is related to the successful transformation and application of patent. In the stage of patent operation and management, managers should give full play to their subjective initiative to carry out targeted operations for high-quality patents and find suitable transformation objects.

(1) Carry out patent administration at different levels. Due to the large number of patents in colleges and universities, it is difficult to carry out effective operation due to limited patent management funds and personnel allocation. In order to improve the efficiency of patent management, it is a more reasonable method to classify the patents of colleges and universities according to the quality of patents and carry out the hierarchical management and operation.

(2) Increase capital input and build a professional team. Colleges and universities are the owners of the patents of colleges and universities, so they have the obligation to put the technical resources of colleges and universities into full play and further improve the quality of patents, so as to realize the social benefits of colleges and universities. At present, due to the shortage of patent management personnel, it is difficult for colleges and universities to carry out effective patent operation. Therefore, colleges and universities should strengthen capital input, establish high-quality patent operation team, and assist inventors to carry out patent transformation work.

(3) Carrying out patent promotion. Universities, as research and development institutions, do not have the capacity to produce. In order to successfully convert the patents of universities, it depends on the cooperation between universities and enterprises. As the window of "internal and external communication", patent administrators in colleges and universities should try their best to show the scientific research achievements of colleges and universities to production enterprises, try to "go out of campus", and attract production enterprises to establish cooperative relations with colleges and universities.

### ***5.3 Usage stage***

The transfer of patents from universities to enterprises is the result of the operation of universities' patents and the recognition of the quality of universities'

patents. At this stage, universities should pay attention to the issues after the transformation of patents.

(1) Do a good job in patent transformation services. After the successful transformation of the patent, the ownership of attribution is transferred from the university to the transferee, which does not mean the end of the cooperation. The inventor should assist the transferee to put the patented technology into practice, laying the foundation for further cooperation in the later period.

(2) To protect the intellectual property rights of colleges and universities from infringement. In recent years, there have been more and more violations of intellectual property rights of colleges and universities, which have damaged the reputation and interests of colleges and universities. In order to protect the reputation and interests of colleges and universities, they should strengthen the work of intellectual property protection and use legal weapons to combat intellectual property infringement. The patent administrators in colleges and universities should enhance their awareness of law and deal with patent infringement in case of legal disputes.

#### ***5.4 Abandon the maintenance stage***

Reasonably waive maintenance of low quality patents. Patents for inventions have a legal life of 20 years, but with the exception of a few "core patents", most patents do not last until their expiry (maintenance costs increase rapidly as they do). The number of patents in universities is huge, and the annual maintenance cost of patents is expensive. In order to reduce the expenditure, it is bound to end the life of patents in advance. As the end of patent life cycle, abandoning maintenance stage should be treated with caution in order to avoid the loss of high-quality patents.

From the perspective of technology disclosure, universities give up part of the patent maintenance, can promote technology sharing, increase the efficiency of social operation. Colleges and universities may also grant some patents to teachers and students of colleges and universities for entrepreneurial use, so as to improve the utilization efficiency of patents.

### **6. Conclusion**

Patent quality management in universities is conducive to improving patent quality and use efficiency. From the perspective of patent administrators, this paper divides patent management in universities into four stages and analyzes the different stages. It is considered that it is appropriate to intervene in patent quality management in the operation stage and the abandoning maintenance stage.

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