

Analysis and Exploration of Achievement Transformation Models in Chinese and Japanese Universities

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Abstract: With the global economy entering the knowledge economy era, technological innovation has become the core driving force for the development of various countries. Only by transforming technological achievements into goods or services can their economic and social value be truly realized. Especially in developing countries like China, whether technological achievements can be quickly and effectively transformed into real productivity is of decisive significance for economic growth, industrial upgrading, and international competitiveness enhancement. The outline of China's 14th Five Year Plan proposes to accelerate the construction of a strong country in science and technology and enhance the country's capacity for scientific and technological innovation. Universities, as the main base for talent cultivation and the main force of the national scientific and technological innovation system, should become an important platform for achievement transformation. However, the conversion rate of patent achievements in Chinese universities has always been low. This article reviews and draws on Japan's experience and practices in promoting achievement conversion, and explores new models of achievement conversion that are suitable for China's national conditions.

Keywords: Achievement transformation; Universities; Patent achievements.

1. Introduction

According to the "World Intellectual Property Indicators Report," in 2022, China filed approximately 1.6 million patent applications, ranking first in the world. By June 2023, China had accumulated 4.568 million valid invention patents, also topping the global list. However, data from the National Intellectual Property Administration shows that by 2022, the total number of patents in China exceeded 9 million, among which there were 490,000 patent applications from undergraduate institutions and 46,000 from vocational

colleges. As of September 2023, Chinese universities held 767,000 invention patents, while research institutions held 220,000, together accounting for 25.3% of domestic invention patents.

The "2022 China Patent Survey Report" reveals that the implementation rate of invention patents at Chinese universities stood at 16.9%. However, the industrialization rate was only 3.9%, significantly lower when compared to the industrialization rate of 48.1% for invention patents held by enterprises, indicating a substantial disparity between universities and enterprises in terms of the commercialization of their respective inventions [1].

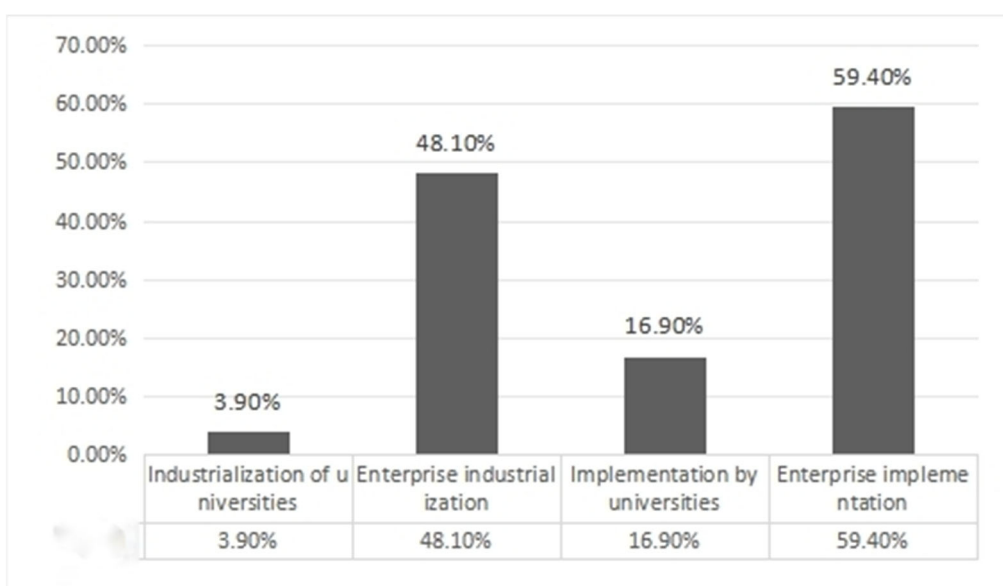


Figure 1. Implementation rate and industrialization rate of invention patents in universities and enterprises in 2022

From the above data, it can be seen that Chinese universities are not lacking in scientific and technological achievements. The specific reasons for the low patent

implementation rate and industrialization rate in universities can be summarized as follows (Figure 2):

The 2022 China Patent Survey Report shows that 47.8% of

universities believe that the reason for restricting patent conversion is due to "insufficient technical team capabilities", 46.2% and 36.8% are due to "patents not intended for transfer and conversion", "patents cannot meet market-oriented needs", 23.5% are due to "lack of rewards", 23.1% are due to

"lack of professional service platforms", 16.9% are due to "lack of benefits for inventors", 16.1% are due to "inability to implement preferential policies", 8.1% are due to "lack of exemption systems", and 4.5% are due to "difficulties in patent evaluation and pricing"[2].

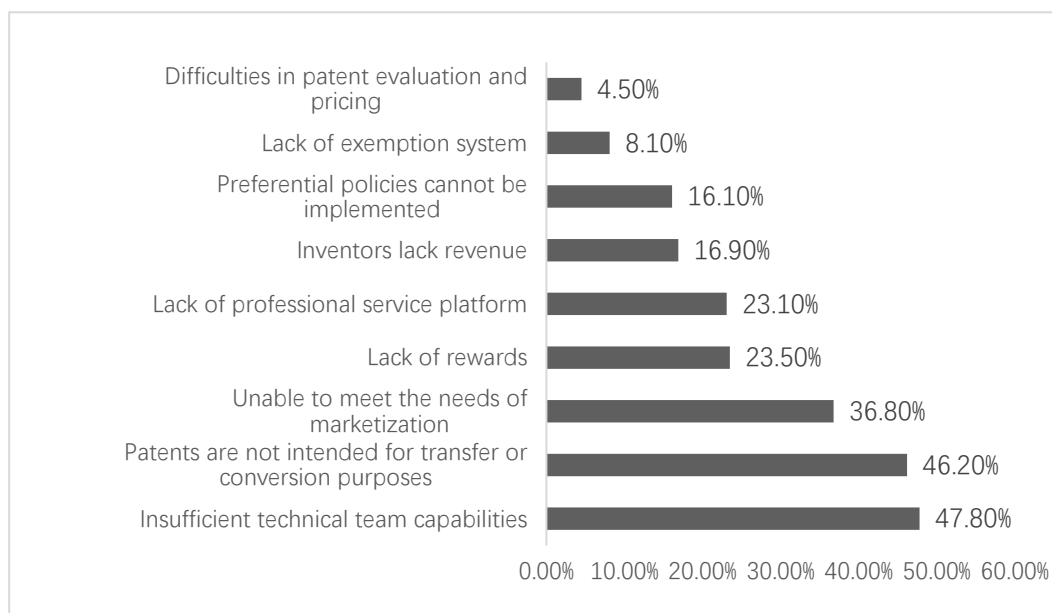


Figure 2. Universities believe that restricting patent conversion

From the above data, it can be seen that the lack of technological research and development capabilities, weak awareness of patent conversion, and disconnection between scientific and technological achievements and market demand are the top three reasons for the low implementation rate and industrialization rate of patents in universities.

1.1. Lack of technological research and development capabilities

As one of the sustainable and stable research platforms, universities have always had the natural advantages of high-level talent gathering, cutting-edge innovation direction, and deep scientific research foundation in scientific and technological innovation and research and development. However, local universities, especially local private universities, have weak research capabilities. Mainly manifested in the following points:

1. The teaching staff structure is imbalanced, with a small number of doctoral and senior title teachers, and a lack of influential experts or leaders in the professional field.

2. Young teachers lack research and development experience and guidance from relevant experts.

3. Lack of funding support, private universities mainly rely on collecting student tuition fees, and insufficient research funding is one of the bottlenecks restricting scientific research work.

1.2. Weak awareness of patent conversion

At present, there is a situation in the scientific research system of Chinese universities where the emphasis is on papers over achievements, and insufficient consideration is given to the transferability and market value of patents. At the same time, due to incomplete reward mechanisms and non-standard regulations, some university researchers do not have a market-oriented orientation towards research and development results at the beginning, and do not pay enough

attention to patents themselves, resulting in lower conversion efficiency. In most universities, the fact that achievement transformation is not included in the performance evaluation system or professional title evaluation system is also a reason for the low attention of university researchers to patent transformation.

1.3. The disconnect between technological achievements and market demand

The traditional scientific and technological innovation model in Chinese universities is a model of research topics, papers, patents, achievement transformation, market investment, and further research projects. We have not yet established a technology innovation system that effectively combines technology and industry chains. Universities mainly obtain research funding in the form of research projects, and the completion of most projects does not include patent conversion as an indicator requirement. Therefore, university researchers lack practical research in the process of completing projects, mostly in the experimental and sample stages. Technological innovation achievements lack practical application, making it difficult to match market demand. There are few patent achievements that can be connected with the market and rapidly industrialized.

The development of a market economy requires new technologies and products. The competitiveness of achievements in the market is an important factor in the success of achievement transformation.

In addition to the three major reasons mentioned above, it can also be seen from the data that the reward mechanism is not perfect enough, and non-standard regulations account for a considerable proportion. Most of my universities lack professional intermediary institutions for achievement transformation, often placed under the supervision of subordinate departments, and lack planning and coordination for achievement transformation. The departments are unable

to adjust the transformation reward mechanism in a timely manner according to the market and policies, and there is a lack of professional personnel who understand policies and laws and regulations. The transformation of results has limitations in practical operation. The transformation of scientific and technological achievements is a process involving interdisciplinary knowledge and multi-party collaboration. It not only requires researchers to have a strong scientific theoretical foundation and technological innovation ability to produce high-quality and practical scientific and technological achievements, but also requires participants to understand market economic laws, including market demand analysis, product positioning, business model design, industrialization cost control, marketing strategies, and other knowledge. Professional personnel can provide a series of value-added services such as intellectual property protection, project evaluation, investment and financing docking, policy consultation, legal aid, etc., helping scientific and technological achievements to achieve industrialization smoothly and ultimately creating significant social and economic benefits.

2. The Achievement Transformation Model of Japanese Universities

In 1998, Japan promulgated and implemented the “Law on Promoting the Transfer of Research Achievements from

Universities and Other Institutions to Private Enterprises” (“大学等における技術に関する研究成果の民間事業者への移転の促進に関する法律 ”, Hereinafter referred to as the “TLO Law”). The purpose of this bill is to accelerate the effective transfer of scientific and technological achievements from Japanese universities and research institutions to private enterprises, improve the technological level of industries, promote the integration of industry and academia, and enable more efficient transformation of scientific and technological achievements from universities into the market, injecting vitality into Japan's economic recovery. TLO Law establishes TLO institutions (Technology Licensing Organization“技術移転機関”).

The main business activities of TLO institutions include:

1. Explore, evaluate, and identify various research and technological achievements of universities.
2. Replace universities with patent applications and intellectual property protection for this achievement.
3. Seek potential business cooperation through various means.
4. Sign a contract to transfer the patent to the intended enterprise and ensure the effective marketization of relevant achievements to achieve profits.
5. Return the obtained profits to the inventor and their university in proportion[3].

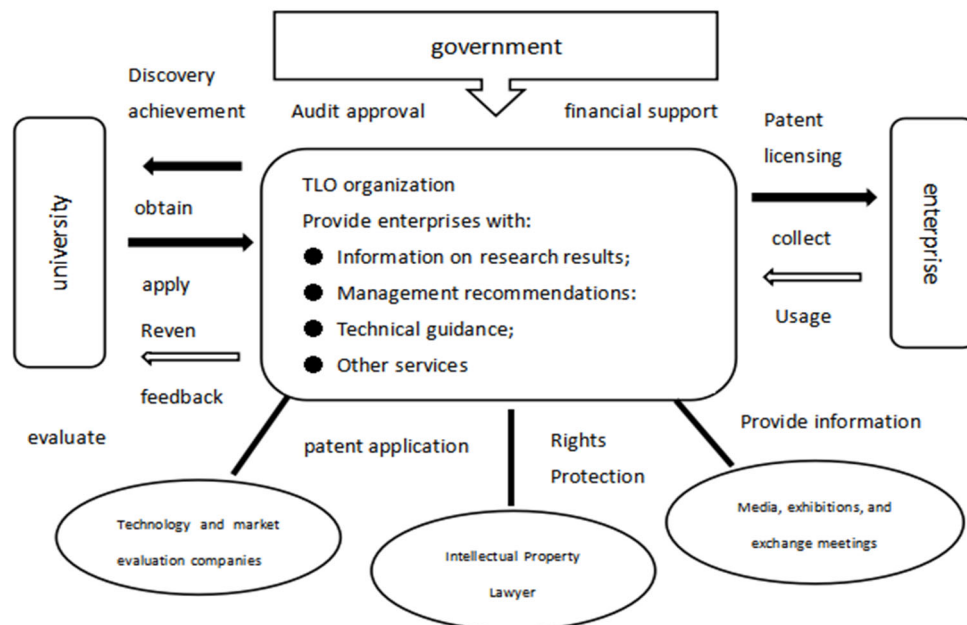


Figure 3. TLO Mechanism Operation Mode [4]

TLO institutions not only enable enterprises to quickly understand the new achievements of universities, but also connect universities with the market. Reduced the information asymmetry of technological achievements, thereby improving the conversion rate of technology. According to the different funding parties, TLO institutions can be divided into three categories: internal TLO institutions operated and managed by universities with internal funding, external integrated TLO institutions established by universities in the form of joint-stock companies outside of campus, and fully independent wide area TLO institutions unrelated to universities[5]. These three types each have their

own advantages and disadvantages, and universities establish different types of TLO institutions according to their own situations.

The advantage of an internal TLO organization is that it facilitates the unified management and operation of the school, and the distribution of benefits is simple. The disadvantage is that the school lacks experience and professional talents in transformation, and lacks accurate judgment on the evaluation of scientific research achievements, which affects the subsequent development of scientific and technological transformation.

The external integrated TLO institution is an independent

institution established outside the school but funded and controlled by the school. More specialized in the market prospects of scientific research achievements and the operation and management of subsequent development. But the disadvantage is that the profits obtained by the school will correspondingly decrease.

The Technology Licensing Office (TLO), as an independent legal entity, plays a crucial role in the transformation of scientific and technological achievements. The characteristic of such institutions is that their business coverage is extensive and not limited to a single university. They can establish cooperative relationships with multiple universities, integrate the advantageous resources of universities from different regions and disciplinary backgrounds, and comprehensively carry out business activities such as the development, transformation, and technology transfer of scientific and technological achievements.

External independent TLO, due to its complete professional talent team and extensive school enterprise network, can play a significant advantage in market-oriented operation, helping to improve the level of market-oriented transformation of scientific and technological achievements in universities and maximize the economic benefits of scientific and technological achievements. Through deep cooperation with multiple universities and enterprises, they can not only ensure their own performance growth, but also effectively promote the research results of universities to go out of the ivory tower, becoming a real driving force for promoting economic and social development, and thereby assisting the overall industrial upgrading of the country[6].

As early as October 1999, the Japanese government passed the "Special Measures for Industrial Revitalization" ("産業活力の再生及び産業活動の革新に関する特別措置法"), which implemented a series of preferential policies for officially recognized TLO institutions, such as halving patent fees and examination application fees within three years. At the same time, the law stipulates that the patent rights for scientific research results generated from the use of government funded research and development funds belong to universities, but the government reserves the "intervention right" and may reclaim ownership when necessary. However, at that time, Japan's national universities had not yet achieved independent legal status, which to some extent constrained the initiative of national universities to transform scientific and technological achievements.

In order to solve this problem, the Japanese government introduced the National University Corporation Law in July 2003, which restructured the original national research institutions into independent legal entities, clarified the ownership relationship of scientific and technological achievements in universities, and gradually shifted the identity of university teachers and researchers from a civil servant system to a non civil servant system, allowing national universities to gain greater flexibility in cooperation with enterprises and greatly enhancing their ability to combine industry, academia, and research.

According to data released by the Japanese Ministry of Education, Culture, Sports, Science and Technology, the number of joint research projects between schools and enterprises increased significantly from 9255 to 29174 per year from 2003 to 2020; The number of patent implementation cases has also increased from 2462 per year to 10349, demonstrating a very high patent conversion rate of

80%[7]. This series of data indicates that Japan's achievements in the transformation of scientific and technological achievements have been comparable to those of developed countries in Europe and America, achieving a high-level integration of technology and industry.

3. The Enlightenment of Japan's Achievement Transformation Model on Chinese Universities

Establishing a comprehensive system for managing and transforming scientific and technological achievements in universities is an important part of promoting scientific and technological innovation construction. In addition to strengthening policy guidance, it is also necessary to gradually improve the procedures and systems for the transformation of scientific and technological achievements in universities, ensuring their enthusiasm and initiative. The TLO model in Japan provides useful reference for the construction of the management system for the transformation of scientific and technological achievements in Chinese universities.

3.1. Establish a specialized organization for managing and transforming scientific and technological achievements

The process of transforming scientific and technological achievements is closely linked to each other, and each link requires deep professional knowledge support and refined management. Due to the shortage of professional talents, Chinese universities often face many difficulties in the process of transforming scientific and technological achievements into practical productivity. Therefore, establishing specialized institutions responsible for the management and transformation of scientific and technological achievements is one of the key measures to promote the deep integration of industry, academia, and research, and accelerate the direct transformation of scientific and technological achievements into practical applications. Universities can cultivate a professional team of talents proficient in scientific and technological achievement management by establishing professional intermediate transformation platforms for scientific and technological achievements, thereby more effectively solving bottleneck problems in the process of achievement transformation and improving the efficiency and success rate of scientific and technological achievement transformation. Professional intermediary transformation institutions can coordinate and arrange the scientific and technological achievements of universities, conduct scientific, fair, and professional evaluations of various scientific and technological achievements produced by schools and research institutions, and screen out scientific and technological achievements with high innovation, practicality, and market potential; Plan transformation paths for different types of technological achievements; A professional talent team understands the transformation process, provides consulting services on intellectual property protection, contract legal affairs, and other aspects, helps scientific research teams avoid legal risks in the process of achievement transformation, and protects the rights and interests of all parties. We can actively connect with potential partners such as enterprises and investment institutions, organize various scientific and technological achievement promotion activities, and assist in finding

suitable application scenarios and market channels for scientific and technological achievements. Coordinate and strive for support policies for achievement transformation from various levels of government departments, raise and manage transformation funds, and provide strong financial support for the incubation, transformation, and industrialization of scientific and technological achievements.

3.2. Strengthen industry university cooperation and promote direct transformation

The closer the industry university research cooperation between universities and enterprises, the wider the scope of cooperation, and the faster the transformation of achievements by universities. At the same time, technological innovation achievements are more quickly and effectively transformed into actual productivity, serving social and economic development. Governments, universities, and enterprises can establish achievement transformation funds to support research achievement transformation projects with market prospects, reduce transformation risks, and improve transformation efficiency. Forming a good ecosystem for collaborative innovation, promoting the efficient and smooth transformation of scientific research achievements into practical productivity, and serving national economic construction and social development.

3.3. Strengthen policy guidance and leverage the role of the government

Compared to former Japanese national universities, Chinese public universities also face the same difficulties. On the one hand, there is a risk of state-owned asset loss due to the failure of promoting achievement transformation. On the other hand, universities still focus on talent cultivation and scientific research, and many tasks such as patent application, achievement transformation, enterprise promotion, and market profitability require cooperation from relevant government departments. The lack of self-awareness and subjectivity in the transformation of achievements in universities stems from the fact that research personnel in universities have not received the benefits of achievement transformation. The role of the government is to guide technology transfer between university researchers and enterprises. The government can formulate policies to clarify the ownership of intellectual property rights, reward incentive fee ratios, provide support from relevant legal personnel, and reduce patent application fees.

4. Conclusion

The transformation of scientific and technological achievements is an important national strategic task. In recent years, China has revised the Law on Promoting the Transformation of Scientific and Technological

Achievements, strengthened legal provisions on the ownership of scientific and technological achievements, distribution of benefits, and transformation processes, and actively promoted and encouraged universities and researchers to actively participate in the transformation of scientific and technological achievements. By establishing various joint research and development institutions, technology transfer centers, and other entities, the integration of industry, academia, and research is deeply integrated, closely combining the scientific research achievements of universities with the needs of the industry. By continuously innovating and improving institutional design, optimizing resource allocation, we strive to maximize the social and economic value of scientific and technological achievements in universities. China will gradually build a scientific and technological achievement transformation system that conforms to the laws of scientific and technological innovation and adapts to the requirements of the market economy, striving to transform rich scientific and technological achievements into real productive forces faster and better, and driving sustained and healthy economic and social development.

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