



# The Transformation Mechanism of China's Scientific and Technological Achievements from the Perspective of Knowledge Flow

Liman Shan<sup>(✉)</sup>

School of Economics and Management, Beijing Information Science and Technology University, Beijing, China  
523191299@qq.com

**Abstract.** Technology has become a core element in developing the new economy and fostering new drivers of growth. This paper puts forward that the essence of the transformation of scientific and technological achievements is knowledge flow, and the stage characteristics of knowledge flow are consistent with the transformation process of scientific and technological achievements. On the basis of constructing the ecosystem for the transformation of scientific and technological achievements, the mechanism and evolution process of knowledge flow in the ecosystem for the transformation of scientific and technological achievements are explored.

**Keywords:** Transformation of Scientific and Technological Achievements · Knowledge Flow · Mechanism · the Ecological System

## 1 Introduction

As China's economy has shifted to a stage of high-quality development, technology has become a core element in developing the new economy and fostering new drivers of growth. In recent years, a large number of policies for the transformation of scientific and technological achievements have emerged in China. "Promote the transformation of scientific and technological achievements into real productive forces, and promote scientific and technological innovation to support and lead economic and social development" has been written into the first chapter of *the Law of the People's Republic of China on Scientific and Technological Progress* amended in 2021. In the face of the major outbreak of COVID-19, how to promote the application of new technologies, new products and new services in epidemic prevention and control and economic recovery, puts forward a more urgent demand for the theory and practice of the transformation of scientific and technological achievements.

Transformation of scientific and technological achievements is the product of the planned scientific and technological system of the Soviet Union, while the concept of technology transfer is commonly used in the world. The use of the term is only influenced by Chinese practice, and its connotation and practice are similar to technology transfer. The high failure rate of science and technology from the laboratory to the market has

given rise to theories such as *European Paradox*, *Valley of Death* and *the Darwinian Sea*. The root causes of the long-term problems in the transformation of scientific and technological achievements in China are as follows: there is insufficient attention to the knowledge-intensive attribute of scientific and technological achievements and the transformation ecosystem of scientific and technological achievements has not yet formed. Therefore, this paper will study the internal mechanism of the transformation of China's scientific and technological achievements from the perspective of knowledge flow.

## 2 Literature Review

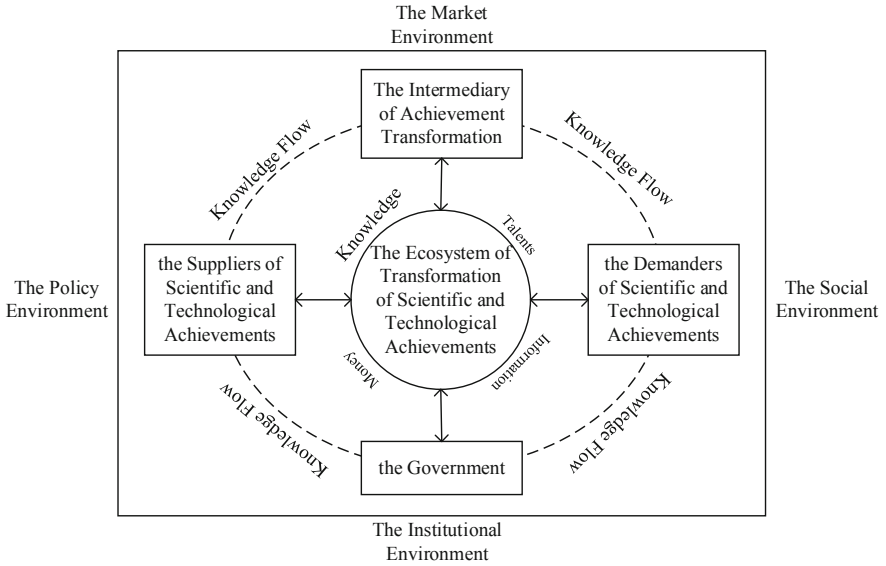
Scholars have conducted a detailed study on the related subjects and influencing factors of the transformation of scientific and technological achievements. The reasons for the slow speed of technology transfer are the policy of technology transfer, the willingness of researchers to participate, the institution of technology transfer, the distribution mechanism of transformation income and so on (Jia L, Zhang Zh and Tang L 2022). In addition, the transformation of scientific and technological achievements needs the support of multi-level financial system, while market factors have dynamic influence on the transformation of scientific and technological achievements. The existing researches were useful to the comprehensive understanding of the transformation of scientific and technological achievements, but there were few researches on the mechanism of transformation of scientific and technological achievements.

The important role of knowledge flow in innovation has been recognized by theoretical circles. Studies on the process, mechanism, model, influencing factors and spatial relations of knowledge flow have covered industry-university-research cooperation, industrial cluster innovation, technological innovation, innovation network, open innovation and other fields (Su Y, Lin Zh and Ou Zh 2020). Previous studies showed that knowledge flow helps to improve innovation output, innovation capability and innovation performance. However, few scholars analyzed or constructed the mechanism of the transformation of scientific and technological achievements from the full perspective and multi-dimension of knowledge flow. The few related researches mainly focused on the analysis of the motivation, mode, influencing factors and path of the transformation of scientific and technological achievements. Knowledge potential difference, knowledge demand, knowledge spillover and policy promotion are the fundamental, direct, potential and indirect causes of the transformation of scientific and technological achievements respectively, of which knowledge stock, knowledge distance, knowledge reflux, learning ability and science and technology service are important influencing factors (Mi J et al. 2020). A few studies explored the paths and influencing factors of the transformation from different forms of knowledge flow such as knowledge spillover, knowledge diffusion, knowledge transfer and knowledge sharing (Shen Q et al. 2018).

## 3 Construction of Knowledge Flow Mechanism in the Ecosystem

### 3.1 Knowledge Flow in the Ecosystem

The transformation of scientific and technological achievements is a complex, dynamic and collaborative ecosystem (see Fig. 1), which is made up of the suppliers of scientific and technological achievements, the demanders of scientific and technological



**Fig. 1.** The Ecosystem of Transformation of Scientific and Technological Achievements [Owner-draw]

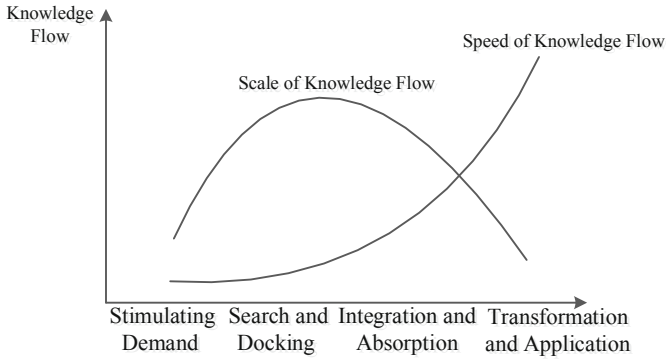
achievements, the intermediary of achievement transformation, the government and other subjects. The life support system consists of the market environment, the policy environment, the institutional environment and the social environment. Knowledge, capital, talent, information and other continuous interact between each other in the ecosystem. Knowledge is a kind of resource with certain scarcity and is not a public good. It is unevenly distributed in the transformation ecosystem of scientific and technological achievements. Therefore, to realize the value of knowledge, it is necessary to promote the flow of knowledge in the form of exchange or trade. Knowledge flow is characterized by continuity, synergy, nonlinearity, value-added, mutability and uncertainty. The knowledge discussed in this paper mainly focuses on the realization of industrialization and economic value in the market. The knowledge flow is defined as the process in which the knowledge demanders obtain knowledge from the suppliers through media for the needs of learning, absorption, innovation or use knowledge, then carry out knowledge innovation activities through integration and absorption into their own knowledge in a certain environment. Knowledge flow is an activity between different subjects in the transformation of scientific and technological achievements. The essence of the transformation of scientific and technological achievements is the process of knowledge flow. Knowledge is the energy that scientific and technological achievements transform the ecosystem. Scientific and technological achievements come into being, spread, flow, share, apply and realize economic and social value in the form of knowledge flow. The knowledge flow in the transformation of scientific and technological achievements is not a mechanical, monotonous and rigid movement, but a kind of value-adding flow. As an important subject of the transformation of scientific and technological achievements, the quantity and quality of scientific and technological achievements provided

by the supplier depends on the quantity of its own knowledge resources. The ability of the demander of scientific and technological achievements to digest and absorb external scientific and technological achievements also depends on the amount of its own knowledge resources. Researchers in companies, universities and research institutions contribute directly to the flow of knowledge in the process. Knowledge matching between the supply and demand of scientific and technological achievements is a prerequisite. The quantity and quality of knowledge resources of different subjects are the basis of the ecosystem operation. Market-oriented and specialized intermediary institutions and good external environment are more conducive to promote the flow of knowledge among different subjects.

### 3.2 The Mechanism of Knowledge Flow in the Ecosystem

In the process of knowledge flow in the transformation of scientific and technological achievements, knowledge potential difference is the fundamental motivation, knowledge demand is the direct motivation, and knowledge spillover is the potential motivation. The knowledge flow in the transformation of scientific and technological achievements has a vector character. The direction of knowledge flow is determined by the knowledge potential difference. The knowledge flows from the supplier with more quantity and higher quality of knowledge to the demanders with lower quality. In this process, the knowledge flow is two-way and reversible. The knowledge flow is usually paid, and the process of knowledge flows associated with the flow of capital. The flow of knowledge and the flow capital are in opposite directions. To achieve the transfer of scientific and technological achievements, The demanders with low potential need to pay a certain fee to the suppliers with high potential. The appropriateness of the knowledge potential difference plays an important role in the stable and efficient transfer and diffusion of scientific and technological achievements. When the knowledge potential difference is too large, it is difficult for the demanders to effectively identify their own needs and the value of scientific and technological achievements. The insufficiency of knowledge base and the disconnection of knowledge structure also affect the result of the transfer and transformation of scientific and technological achievements. When the knowledge potential difference is too small, the economic benefits brought by the new knowledge are not enough to offset the economic cost of the transfer and transformation of the scientific and technological achievements, and the incentive for the transfer and transformation of the scientific and technological achievements is insufficient.

The scale of knowledge flow in the transformation of scientific and technological achievements is jointly determined by knowledge potential difference, flow threshold, absorption capacity, market-oriented mechanism, cooperation and sharing mechanism, supply and demand matching mechanism and other factors. The speed of knowledge flow is constrained by the searching ability, learning ability and motivation level of the demander of scientific and technological achievements. The faster the flow of knowledge, the more conducive to updating the knowledge stock. The better the degree of knowledge integration, the more conducive to the transformation of scientific and technological achievements. The innovation resulting from continuous knowledge flow have multiplier effect and recycling effect. Unimpeded and diversified knowledge flow channels help to identify needs and obtain market environment information in time, avoid



**Fig. 2.** The Evolution of Knowledge Flow in Different Stages of Transformation of Scientific and Technological Achievements [Owner-draw]

the delay and distortion of information in the transformation of scientific and technological achievements, and support the improvement of the scale and speed of knowledge flow. As the high-level forms of knowledge flow, knowledge spillover and knowledge sharing contribute to the improvement of the ecosystem function of scientific and technological achievements transformation. The same transformation body of scientific and technological achievements may belong to several different knowledge flow chains. The self-organizing nature of the transformation ecosystem of scientific and technological achievements makes knowledge flow spontaneously among different knowledge chains to a certain extent. The synergistic effect between different knowledge chains promotes the knowledge flow between different agents and within and outside the ecosystem. When spontaneous knowledge flow is insufficient, it is necessary to give better play to the role of government promotion.

### 3.3 The Evolution of Knowledge Flow in the Ecosystem

The process of transforming scientific and technological achievements is a process of constantly discovering and solving problems. It is a dynamic process in which the demander of scientific and technological achievements obtains knowledge from the supplier through media, and the value of innovation achievements will be realized. It mainly includes four stages: (finding problems) stimulating demand, search and docking, integration and absorption, transformation and application (solving problems). In this process, the knowledge potential difference between the suppliers and demanders of scientific and technological achievements is gradually reduced, and the scale of knowledge flow is inverted U shape and reaches the peak in the middle stage of search and docking-integration and absorption (see Fig. 2).

## 4 Conclusions

This paper analyzes the law, mechanism and evolution of the knowledge flow by constructing the ecological system of the transformation of scientific and technological

achievements. This study not only helps to enrich the theoretical research on the transformation of scientific and technological achievements, but also provides a new way to solve the problem of the transformation of scientific and technological achievements.

**Funding.** This work was financially supported by the Beijing Social Science Foundation for Youths (20JJC019) and R&D Program of Beijing Municipal Education Commission (SM202111232003).

## References

- Jia L, Zhang Zh, Tang L (2022) Problems and Countermeasures of Improving Technology Transfer of Universities and Research Institutions in China. *Bulletin of National Natural Science Foundation of China* 36(2):309-315.
- Mi J, Guo B, Chen H, Fan J (2020) Knowledge Potential Difference and Knowledge Flow Mechanism in Innovation Ecosystem. *Journal of Beijing Institute of Technology (Social Sciences Edition)* 22(6):78-87.
- Su Y, Lin Zh, Ou Zh (2020) The Impact of Knowledge Flow on the Two Stages of Regional Innovation Activities. *Science Research Management* 41(7):100-109.
- Shen Q, Yang W, Xu L, Liu X, Hou Y (2018) Evolutionary Game Analysis of Improving the Transformation Value of Agricultural Scientific and Technological Achievements Based on Knowledge Sharing. *Jiangsu Agricultural Sciences* 46(20):391-394.

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

