



# Research on Data-driven Precise Transformation Mechanism of Scientific and Technological Achievements in Colleges and Universities

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**Abstract.** From a data-driven perspective, the transformation of scientific and technological achievements in colleges and universities means the cross-link integration, dynamic adaptation, precise matching, and organization between the supply of scientific and technological achievements in colleges and universities and the enterprises' data demand for scientific and technological. In China, the linear transformation thinking of “making achievements before transforming them” and the management mode of division of responsibilities in colleges and universities lead to the extensive transformation of achievements. Therefore, a precise transformation mechanism of scientific and technological achievements in colleges and universities to ensure the targeted transformation is of great significance for breaking the linear transformation process, eliminating information asymmetry, promoting the precise docking between universities and enterprises, and realizing collaborative transformation. As for the whole data life cycle of scientific and technological achievement transformation, the transformation of scientific and technological achievements in colleges and universities includes the complete process of “data collection and classification — data analysis and mining — data sharing and push — data decision making and innovation”. To build a data-driven precise transformation mechanism of scientific and technological achievements in colleges and universities, efforts can be made from three dimensions: establishing a new concept of data-driven transformation of scientific and technological achievements, innovating a new management model of data-driven transformation of scientific and technological achievements, and promoting the benign interaction of data users of scientific and technological achievements transformation.

**Keywords:** Scientific and Technological Achievements of Colleges and Universities; Data-driven; Precise Transformation; High-quality Development

## 1 Introduction

Due to the enterprises' increasing demand for scientific and technological innovation and the imbalance between the timeliness of industrial scientific research and academic

scientific research, how to construct a precise mode to promote the accurate transformation of scientific and technological achievements in colleges and universities is an important issue faced by colleges and universities seeking transformation of scientific and technological achievements. According to the Opinions of the CPC Central Committee and the State Council on Improving the Systems and Mechanisms for Market-based Allocation of Factors of Production, it is important to cultivate a data element market at a faster pace, establish a unified and standardized data management system, improve data quality and standardization, and enrich data products.

## 2 Literature Review

Scholars have studied the significance, types, and mechanism of the transformation mechanism of scientific and technological achievements in colleges and universities from the perspectives of knowledge, innovation, and policy, analyzing the problems in the transformation process and putting forward measures and suggestions to improve the transformation mechanism of scientific and technological achievements. As big data technology provides new ideas and tools for innovating the transformation mechanism of achievements in universities, a data-driven approach ensures all-round, systematic, and comprehensive benefits for the transformation of scientific and technological achievements in colleges and universities. Xu Zhejun believes that big data methods play a role in scientific research evaluation, decision-making of projects, optimization of allocating scientific research resource, whole process management of scientific research projects and their planning in colleges and universities [1]; Zhang Longbin, based on the knowledge map of massive scientific and technological documents, has explored the deep knowledge in scientific and technological papers and applied it to the search and recommendation platform for scientific and technological talents [2]; Qian Xu and other scholars have put forward the basic idea of perceiving and evaluating science and technology innovation resources of national defense, offering effective quantitative data to help relevant institutions select talents, evaluate projects, conduct expert evaluation, and predict the trend of technology development [3]; Hu Jiyong and others have built a big data platform for sci-tech knowledge discovery, and conducted intelligent semantic search of 10 scientific research entities such as papers, patents, scholars, projects and institutions [4].

Through literature review, although scholars have conducted preliminary research on a precise mechanism for transforming scientific and technological achievements in the era of big data [5] and the measures of informationized scientific research management [6], research on the whole data life cycle model of transforming scientific and technological achievements in colleges and universities has lacked, especially the in-depth research on how to efficiently connect the data of supply and demand sides of scientific and technological achievements and construct an accurate transformation mechanism of scientific and technological achievements. In an era of the digital economy, when it comes to demands for accurate knowledge retrieval in the transformation of scientific and technological achievements in colleges and universities, targeted prediction of enterprises' demands for science and technology, accurate promotion and

publicity of scientific and technological achievements, intelligent matching between the supply of achievements and enterprises' needs for technology, problems persist such as data fusion, trend prediction, decision-making optimization. In this context, it is urgent to build a data-driven accurate transformation mechanism of scientific and technological achievements in colleges and universities, guide and drive knowledge flow, capital flow, and talent flow with data flow, effectively promote the matching between supply and demand, thus realizing the efficient integration and full flow between technical elements and data as well as capital elements, and promoting the transformation efficiency of scientific and technological achievements.

Based on this, this paper studies the coupling mechanism of the data chain, value chain, and industrial chain in the transformation of scientific and technological achievements in colleges and universities, revealing the connotation of the precise transformation mechanism of scientific and technological achievements in colleges and universities. This paper reveals the core of the precise transformation mechanism of scientific and technological achievements: Based on enterprises' needs for science and technology and an intelligent platform for scientific and technological services, a mechanism has been improved for data collection, generation, analysis, mining, push, sharing, decision-making and application when scientific and technological achievements are transformed, and the implementation path is put forward of improving the accurate transformation mechanism of scientific and technological achievements.

### **3 Value Realization of the Precise Transformation Mechanism of Scientific and Technological Achievements in Colleges and Universities Based on Data-driven Approach**

In the whole life cycle of data collection, storage, mining, and use of scientific and technological achievements transformation, there are many data users, such as data providers and data managers. Universities are not only data collectors and managers but also data users like enterprises, governments, technology transfer institutions, and investment and financing institutions of scientific and technological achievements. From the data life cycle of transformation of scientific and technological achievements, the transformation process of scientific and technological achievements in colleges and universities is shown as follows: collection and analysis of scientific and technological needs — disclosure report of scientific and technological achievements — analysis and evaluation of scientific and technological achievements—the targeted push of scientific and technological achievements — optimal decisions of transforming achievements — evaluation and feedback on transformation effect (as shown in Figure 1 below). The data-driven transformation of scientific and technological achievements in colleges and universities should be value-oriented by serving users. Through horizontal and vertical link interconnection and information sharing on a unified platform, the utilization and analysis dimensions of scientific and technological resources should be scaled and the value should be maximized so that customized services and on-demand distribution can be carried out for users in all links.

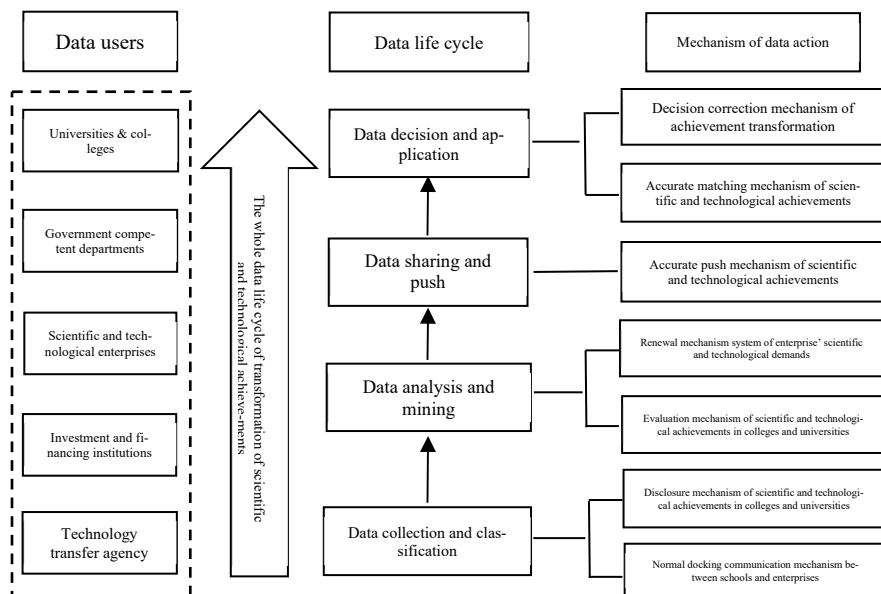


Fig. 1. The whole data life cycle model of the transformation of scientific and technological achievements in colleges and universities 【owner-draw】

### 3.1 Data Collection and Classification

Data collection and classification is the logical starting point of the whole life cycle management of transforming scientific and technological achievements in colleges and universities. In a sense, comprehensive, objective, and convenient data collection ensures the smoothness of the accurate transformation mechanism of scientific and technological achievements. In practice, the problems of asymmetric information of technology supply and demand and mismatch between supply and demand are often encountered in the process of transferring and transforming scientific and technological achievements in colleges and universities. How to get through the “last mile” in transforming achievements is an urgent issue for colleges and universities when they transforming scientific and technological achievements [7]. The transfer and transformation of scientific and technological achievements usually involve donors (universities, institutes, R&D enterprises — knowledge suppliers) and recipients (enterprises — knowledge recipients) [8]. Therefore, the collection of transformation data of scientific and technological achievements includes donors’ data, recipients’ demand data, and data on government policies, and the business environment. Among them, the recipients’ scientific and technological demand is the starting point of the donors’ scientific and technological achievements, which affect and determine the direction of scientific and technological innovation. Based on this, in the stage of data collection and classification, while the basic data of scientific and technological achievements are grasped such as intellectual property rights, the original data should also be collected such as

scientific and technological personnel, scientific research papers, and scientific research projects. Besides, demand data of science and technology in regions and enterprises must be actively collected as the data basis for knowledge transfer, transformation, application, and innovation.

### **3.2 Data Analysis and Mining**

Data analysis and mining of transformation of scientific and technological achievements, in essence, means to transform potential and original data into visual and high-value data, so as to gain insight into the scientific and technological needs of enterprises and present the scientific and technological innovation ability of colleges and universities as well as the hot spots of regional scientific and technological innovation in an all-round way. For example, at Tsinghua University, the task of transforming scientific and technological achievements involves establishing a comprehensive patent service system focusing on “key talents, key projects, and major achievements”, and controlling the key nodes from invention to termination of the whole life cycle; in the weekly patent information publication, such information is highlighted as the patent types and departments, the ranking of patent applications of the top five inventors, and the brief introduction of key patent technologies. From the perspective of knowledge, scientific and technological achievements can be regarded as a “knowledge package” which consists of tacit knowledge hidden in scientific and technological personnel and explicit knowledge in the form of patent texts [9]. Through correlation analysis and cluster analysis of transformation factors such as personnel who make scientific and technological achievements, scientific and technological achievements, intellectual property rights, scientific and technological papers, and scientific and technological needs of transferee enterprises, useful information on scientific and technological achievements are extracted from complicated data to provide core data for accurate display of scientific and technological achievements. For example, by constructing an accurate transformation mechanism of scientific and technological achievements between universities and enterprises, the enterprises’ needs for technology research, personnel training, management consulting, etc. are transformed into an available database of enterprises’ needs for technology. Additionally, the research trends of scientific and technological innovation programs in colleges and universities and the innovation ability of scientific and technological talents are visually processed and presented through accurate portrait technology, and the “point-to-point” docking is carried out thanks to accurate matching technology.

### **3.3 Data Push and Sharing**

From the perspective of data push and sharing, the transformation data of scientific and technological achievements serves the purpose of the decision-making regarding the transformation of scientific and technological achievements in colleges and universities internally, and meets the needs of the scientific and technological innovation of enterprises, scientific and technological management and decision-making of government externally, helps technology transfer institutions promote and popularize scientific and

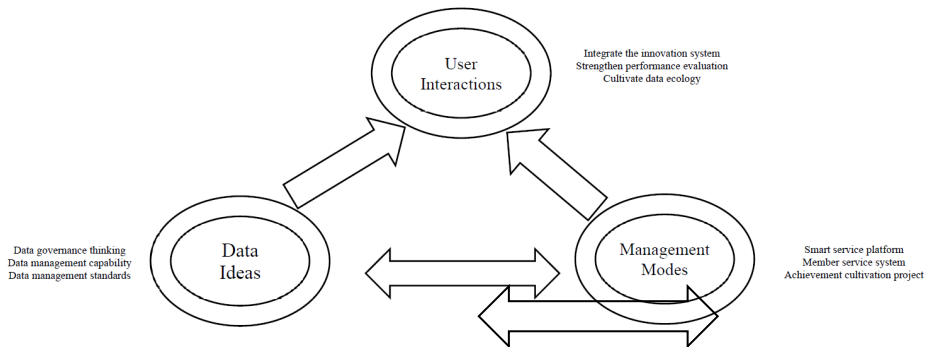
technological achievements. Therefore, only by accurately pushing and sharing the transformation data of scientific and technological achievements to users such as scientific and technological personnel and enterprises as needed can the value of the concerned data be maximized. After analysis, mining, and visual display, scientific research data can serve government competent departments, and management institutions for the transformation of scientific and technological achievements in universities, enterprises, investment, and financing institutions, intellectual property operation institutions, as well as industry associations, and offer reference to public decision-making consultation by means of data sharing or accurate push which follow the principle of “sales funnel”. This means gradually narrowing the push scope according to “potential customers — intended customers — cooperative customers”. Those who are not willing to feedback push information in time are regarded as invalid users, and their data push and sharing are terminated, while those who actively offer data feedback and have effective demand data of technology will be paid continued attention and be contacted to enhance the loyalty of users’ data push and sharing of scientific and technological achievements.

### **3.4 Data Decision-making and Application**

Using data for scientific decision-making is the key to realizing the value of transformation data of scientific and technological achievements, and also the core of the accurate transformation mechanism of scientific and technological achievements. Transformation data users of scientific and technological achievements mainly include universities, enterprises, government competent departments, investment, and financing institutions, and social intermediary service institutions such as technology transfer institutions. Taking into consideration the transformation data users’ characteristics, the data can be provided according to individual needs, so as to ensure the maximum benefit of the application of transformation data for scientific and technological achievements. For example, colleges and universities can apply scientific research data to innovate management methods and optimize scientific and technological management decisions. According to the research ability of colleges and universities and the research and development of projects, enterprises timely offer feedback on scientific and technological needs to promote scientific and technological cooperation and transform achievements. Investment and financing institutions can carry out value analysis of investing and financing scientific and technological achievements to determine investment projects according to the evaluation data of pre-patent application and transformation value of scientific and technological achievements. In addition, in order to promote the development of China’s high-tech industries and improve the conversion rate of scientific and technological achievements, it is imperative to develop venture capital from the aspects of the development environment, laws and regulations, fiscal and taxation policies, and personnel training, and guide venture capital to play its value [10].

## 4 Implementation Path for Constructing the Precise Transformation Mechanism of Scientific and Technological Achievements in Colleges and Universities

With the explosive growth of enterprises' demand for scientific and technological innovation, it is of great significance to solve the problem of accurate matching between a sea of scientific and technological demand and scientific and technological achievements, improve the matching between scientific and technological supply and industrial demand in colleges and universities, and promote the virtuous circle of scientific and technological innovation in colleges and universities and high-quality development of the regional economy. Based on this, the implementation path of the accurate transformation of scientific and technological achievements in colleges and universities, according to the requirements of data-driven accurate transformation of scientific and technological achievements, includes three dimensions: establishing a new concept of the data-driven transformation of scientific and technological achievements, developing a new management model of the data-driven transformation of scientific and technological achievements, and promoting the benign interaction of transformation data users of scientific and technological achievements (as shown in Figure 2).



**Fig. 2.** Precise transformation and development path based on “concept-model” innovation  
【owner-draw】

### 4.1 Establish a New Concept of the Data-driven Transformation of Scientific and Technological Achievements

1. It is important to cultivate data governance thinking of transforming scientific and technological achievements. The transformation of scientific and technological achievements in colleges and universities should actively adapt to the rapid development of information technology, establish the concept of thinking with data, guiding with data, making decisions with data and innovating with data, reshape the service process of transformation management of scientific and technological achievements based on data flow, and promote the transformation management service of scientific

and technological achievements from the experience-guided decision to data-led decision.

2. Attempts are made to strengthen data management for the transformation of scientific and technological achievements. Data management institutions must be established for the transformation of scientific and technological achievements; posts must be added for managing, collecting, analyzing, mining, innovating, and applying transformation data of scientific and technological achievements; the management personnel must be trained for transformation data of scientific and technological achievements to meet the needs of transformation data management of scientific and technological achievements.

3. Commitment should be made to formulate data management standards for the transformation of scientific and technological achievements. The responsibilities must be clarified for collecting, analyzing, and sharing transformation data of scientific and technological achievements at all levels; the contents and methods of data collection and the scope and principles of data sharing must be standardized to ensure authentic and effective data. The awareness of data confidentiality should be strengthened in the transformation of scientific and technological achievements; personnel who make scientific and technological achievements should be disclosed in colleges and universities; patents must be evaluated before application, and the technical route and intellectual property ownership involving scientific and technological innovation must be clarified.

#### **4.2 Develop a New Data-driven Model for Managing the Transformation of Achievements**

1. The membership system must be established for science and technology services in colleges and universities. Accurate classification is required according to users' scientific and technological needs to provide personalized services for transferee enterprises and improve customers' loyalty to cooperation. For enterprises that sign up for platform services, they can be informed of the whole life cycle of achievements from establishing scientific research projects to industrializing achievements.

2. The network system should be built on intelligent science and technology service platform in colleges and universities. Focusing on the goals of "multidisciplinary consultation on scientific and technological problems in enterprises, quick response to scientific and technological services in different places, and accurate and efficient push of scientific and technological achievements in universities", the mode of Internet technology service platform based on 5G technology should be built to create a networked, intelligent and information-based technology service big data platform which is highly interactive, inclusive and confidential. This helps to integrate scientific and technological talents, scientific and technological achievements, enterprises' needs, investment, and financing information, thus integrating online and offline services which are fused into the scientific and technological innovation system in all aspects.

3. The transformation and cultivation project must be improved with scientific and technological achievements. According to the scientific and technological needs of regions and enterprises, the government, universities, and enterprises jointly set up transformation and cultivation projects of scientific and technological achievements, and



entrust universities to research the scientific and technological needs put forward by enterprises after they are evaluated and determined by the government, universities, and enterprises. Colleges and universities should serve enterprises and society with an open attitude, stimulate the enthusiasm of enterprises to participate in scientific and technological innovation in colleges and universities, ensure the projects meet the needs and markets of enterprises, and encourage enterprises to participate in research. Through various channels, information can be obtained regarding the interest and demands of society, the market, and enterprises, and the selected projects must be disclosed to the public through the network platform, so as to make adjustments in time.

## **5 Conclusion**

The results indicate that mutual trust between universities and enterprises and normal docking is the basis of the accurate transformation of scientific and technological achievements; the data analysis and application of scientific and technological achievements in colleges and universities is the core of the accurate transformation of scientific and technological achievement, while the service platform for the transformation of scientific and technological achievements supports the precise docking of scientific and technological achievements. Based on this, it is needed to change the concept of transforming and governing scientific and technological achievements in colleges and universities, strengthen the thinking of big data management, build a data-driven transformation and governance model for scientific and technological achievements, and enhance the ability to transform and governing scientific and technological achievements. In addition, the system empowerment thinking must be strengthened to build a professional and comprehensive smart technology service platform for colleges and universities, and improve the efficiency of accurate docking between universities and enterprises. Guided by demand, a reporting, analysis, and guidance mechanism must be established to collect and meet enterprises' needs for science and technology. Moreover, a mechanism must go hand in hand with technological innovation to transform, cultivate and accurately promote scientific and technological achievements, and a reward and incentive mechanism must be built based on the sharing of benefits and risks.

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