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Research on the Enhancement of Technological Transformation Efficiency under New Quality Production Forces

Wendi Cui*

School of Management, Xi'an Polytechnic University, Shaanxi, Xi'an, 710048, China

Corresponding author: Wendi Cui, cuiwendi293@163.com

Abstract: The cultivation and development of new quality productive forces rely on the deep integration of scientific and technological innovation and industrial innovation. Currently, the scientific and technological achievement transformation system in our country is facing deep obstructions such as fragmented resource elements, coordination barriers, and insufficient compatibility of incentive systems. Innovation is disconnected from industry, unable to achieve efficient interaction between science and the market domain, resulting in the inability to transform scientific and technological achievements into real productive forces. Based on the background of new quality productive forces, this paper analyzes the current status of scientific and technological achievement transformation, addresses the identified problems, and proposes corresponding measures to provide strong support for improving the efficiency of the scientific and technological achievement transformation system and promoting and cultivating new quality productive forces.

Keywords: New Quality Productive Forces; Scientific and Technological Achievement Transformation; Efficiency Improvement
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Introduction

In the current era of rapid global technological advancement, scientific and technological innovation has become the core driving force for promoting high-quality development of the economy and society. Unlike traditional productivity and general productivity, the process of new quality productivity's incubation encounters various key core technology breakthroughs[1] and "knockout" type innovation difficulties and pain points[2]. Especially for strategic emerging industries and future industries that serve as the main frontlines, the required original innovation often involves large investment, long cycles, and high risks[2]. On one side is scientific and technological innovation, and on the other is industrial development. There exists an invisible "gap" between the two, and this "transformation gap" reflects not only the efficiency issue of technology transfer, but also the structural predicament of the innovation system. The traditional thinking of technological transformation regards scientific and technological innovation as the source and industrial innovation as the result, attempting to achieve the leap from the laboratory to the production line through linear recursion. However, this simplified model has significantly reduced its explanatory power and guiding force in today's era of accelerated technological iteration, interdisciplinary integration, and complex and changeable markets.

New quality productivity itself is a productivity form where innovation plays a leading role. It requires breaking the

institutional barriers of "two skins" between science and economy, and establishing a new type of relationship where the innovation chain and the industrial chain are coordinated. This article aims to transcend the traditional cognitive framework of "linear transformation", and re-examine the efficiency improvement of the technology transformation system from the perspective of system coupling. Therefore, this article first analyzes the problems currently faced by technology transformation in the Chinese context, then explores the deep reasons for these problems, and subsequently proposes systematic improvement measures oriented towards the development of new quality productivity, providing theoretical references and lessons for enhancing the efficiency of technology transformation and promoting the development of new quality productivity.

1. Structural Issues of the Technology Transformation System

1.1 Structural Break in the Innova2tion Chain

From the laboratory prototype to industrial application, scientific and technological achievements need to go through multiple stages such as basic research, application development, pilot-scale optimization, and large-scale production. Currently, in China's innovation chain, the basic research stage is supported by scientific funds, and the industrial application stage is covered by industrial policies. However, the intermediate area connecting these two stages has obvious institutional vacuum and resource shortage. This "death valley" causes a large number of scientific and technological achievements with potential new productive forces to die prematurely when crossing the gap from the laboratory to the market. Statistics show that although China has the highest number of patent applications globally, the patent conversion rate has remained below 10% for a long time, and the proportion of truly formed products is less than 5%. In the end, it is not that the scientific and technological achievements themselves lack value, but that there is a lack of engineering capabilities to transform laboratory principles into producible products. The absence of intermediate organizations such as pilot-scale bases and concept verification centers has led to a large number of innovative achievements stopping at papers and patent certificates, unable to enter the industrial cycle and be transformed into actual productive forces.

1.2 Structural Imbalance of the Mainstream Relationship

The transformation of scientific and technological achievements involves various entities such as universities, research institutions, enterprises, government agencies, and intermediary organizations. These entities should form a collaborative and interactive innovation network. However, in reality, there is a significant structural imbalance among the entities. From the perspective of research objectives, the research evaluation systems of universities and research institutions have long focused on papers and awards as core indicators, leading to research topics deviating from the actual market demands. Researchers pursue recognition within the academic community rather than market-based matching, and there is a mismatch between the output of research results and industrial demands. From the perspective of capability distribution, universities and research institutions possess abundant innovative source resources but lack industrialization capabilities. Small and medium-sized enterprises have market acumen but lack the ability to identify and digest technologies. Leading enterprises, although having the transformation capabilities, tend to conduct internal research rather than external absorption. The mismatch of capabilities among the entities makes various innovation resources exist in different entities, making it difficult to cross organizational boundaries. From the perspective of power structure, administrative forces still dominate the resource allocation process, and the decisive role of the market mechanism has not been fully exerted. Government-led scientific and technological projects, park construction, and platform establishment often have a lag and deviation from market demands, resulting in redundant resource allocation and ineffective accumulation.

1.3 Lack of organizational structuring of the service system

An efficient transformation system requires specialized and market-oriented service organizations as its support. However, the current technology intermediary service system in China has obvious organizational structuring deficiencies. From the organizational form perspective, technology transfer institutions generally have the problems of "small, scattered, and weak". Most institutions remain at the shallow level of connecting and facilitating, lacking the ability to provide deep-level services such as technical assessment, legal and financial affairs, pilot production and maturation, and business planning. From the talent structure perspective, there is a serious shortage of comprehensive technical managers who understand technology,

law, market, and finance. The number of certified technical managers across the country is less than ten thousand, and the gap compared to market demand is huge. From the platform layout perspective, various technology markets, innovation stations, and technology transfer centers in different regions are redundantly constructed, but they lack interconnection and fail to form a unified national technology factor market network. Enterprises do not know where to find the technology when they have demands, and universities do not know where to promote their achievements. The lack of information symmetry severely restricts the optimization allocation of innovation resources. The organizational structuring deficiencies of the service system have led to the fact that scientific and technological achievements lack professional intermediaries during the process of moving from the laboratory to the market, resulting in high transaction costs and difficult improvement of transformation efficiency.

2. Analysis of the Deep Causes of the Problem

2.1 Conflict of Multiple Goals

The technology transfer system has multiple goals simultaneously, including scientific exploration and economic services, state-owned capital security and market vitality, public interests and private property rights. These pairs of goals are not naturally coupled but rather have profound internal tensions. The realization path often requires seeking dynamic balance under multiple constraints. The bureaucratic logic pursues procedural compliance, risk avoidance, and clear responsibilities, reflecting strict approval procedures, rigid assessment indicators, and clear accountability mechanisms. The market logic pursues efficiency priority, compatibility of incentives, and survival of the fittest, manifested as autonomous decision-making, risk assumption, and shared benefits. In the context of technology transfer, these two logics often lead to institutional design dilemmas and distorted operational mechanisms. Taking the transfer of scientific and technological achievements by positions as an example, the state-owned assets management department requires value assessment of the achievements to prevent loss, but the value of scientific and technological achievements has high uncertainty, and the assessment results are difficult to reflect the true market expectations. Researchers hope to make quick decisions to seize the market window, but the management must fulfill the approval procedures for the disposal of state-owned assets. As a result, the procedures are compliant, but efficiency is sacrificed; form is transformed, but substance is stagnant. This conflict and compromise of multiple goals is the deep institutional root of the low efficiency of the technology transfer system.

2.2 Delay in the Development of Factor Markets

The transformation of scientific and technological achievements is essentially a process of reconfiguration of innovative factors, which requires a well-developed market mechanism as a foundation. However, the development of the innovation factor market is currently significantly lagging behind the reform processes of the product market and the capital market. In the technology market, the non-standardization of technological achievements, the uncertainty of value, and information asymmetry all pose high transaction costs for technology transactions. However, the existing technology market still has significant deficiencies in the construction of mechanisms such as price discovery, credit guarantee, and dispute resolution, failing to effectively reduce transaction costs. In the talent market, the channels for researchers to flow to enterprises or the frontlines of industries are not sufficiently smooth. The institutional designs of universities and research institutions, such as staffing management, professional title evaluation, and social security, result in high costs and significant risks for researchers to leave the system. The structural defects of the financial market are also obvious, lacking specialized financial institutions that can effectively identify and price technological risks. The lag in the development of the innovation factor market has led to the lack of effective market signals for technology transformation and support from transaction mechanisms, making it difficult to achieve optimal allocation of factors.

2.3 Structural Constraints on Cognitive Abilities

Technology transfer is a highly complex and systematic activity that requires participants to possess cross-disciplinary knowledge and capabilities. However, in reality, the cognitive structures and ability endowments of various entities exhibit significant structural constraints. From the supply side, researchers have long specialized in specific academic fields and have a deep understanding of the technology itself, but they lack systematic knowledge of market demands, business models, and intellectual property operation. They tend to overestimate the maturity of the technology and underestimate the difficulty of

industrialization, and they lack an objective assessment of the commercial prospects of the results. From the demand side, business managers are familiar with production and operation, but they lack the ability to identify and evaluate cutting-edge technologies, and they have difficulty detecting and seizing potential technological opportunities at an early stage. From the service side, the practitioners of intermediary institutions mostly lack a background in science and engineering, have limited understanding of the technology itself, and are unable to provide in-depth professional services. This knowledge gap hinders effective communication between the supply and demand sides, makes it difficult to accurately assess the value of the technology, and makes it hard to promptly capture cooperation opportunities. The structural constraints on cognition and ability are the micro-level foundation for the inefficient operation of the technology transfer system.

3. Policies for Enhancing the Efficiency of the Technology Transfer System

3.1 Deepen Institutional Innovation to Resolve the Incompatibility of Incentives

To address the issues of insufficient property rights incentives and the absence of a risk-sharing mechanism, greater efforts are needed to promote institutional innovation and establish an incentive-compatible mechanism that is compatible with the cultivation of new productive forces. At the property rights system level, comprehensive reforms of the ownership or long-term usage rights of scientific and technological achievements should be implemented. Based on the summary of pilot experiences, the coverage of the empowerment reform should be expanded, and the ownership of scientific and technological achievements or a usage right of not less than ten years should be granted to researchers. The list of exemption from responsibility for due diligence should be improved. As long as the transformation process is compliant and the pricing procedure is fair, the subsequent fluctuations in market value should not be held accountable to the managers and researchers. At the income distribution level, a market-based income-sharing mechanism should be established. The proportion of rewards for scientific researchers from the income of scientific and technological achievements transferred by universities and research institutions should be no less than 70%, and researchers should be allowed to participate in the distribution of enterprise income through equity investment based on the value of the technology. For technology transfer institutions and technology managers, a salary incentive mechanism linked to the transformation effectiveness should be established to attract and retain high-level professional talents.

3.2 Reconstruct the Innovative Organizational Model and Fill the “Death Valley”

In order to solve the problems of innovation chain breakage and the lack of intermediate links, it is necessary to start from organizational innovation and build a support system covering the whole cycle of achievement transformation. On the front end of the results, support the construction of a number of proof-of-concept centers focusing on specific areas. The task of these centers is to carry out preliminary verification of technical feasibility and commercial potential of laboratory results, and help promising results cross the first threshold from technology to product. The proof-of-concept center should be led by universities and institutes, jointly built by leading enterprises and investment institutions, operated in a market-oriented way, and the government should give start-up funds and operating subsidies. In the middle end of the achievements, the layout and construction of a number of open and shared market-oriented pilot test platforms. Relying on the national high-tech zone, economic development zone and other industrial clusters, the pilot test platform with the functions of engineering technology development, sample trial production and process verification will be built. The platform should adopt the mode of “enterprise main body, market operation and government guidance” to provide low-cost engineering services for universities, institutes and small and medium-sized enterprises. On the back end of achievements, we will support leading enterprises to lead the formation of innovation consortias, carry out collaborative research around key links of the industrial chain, and accelerate the large-scale application and iterative upgrading of technological achievements.

3.3 Cultivate a Specialized Service Ecosystem and Reduce Transaction Costs

To address the fragmentation of the service system and the lack of professional capabilities, it is necessary to focus on the direction of specialization and marketization, and systematically cultivate a technology transfer service ecosystem. At the level of talent development, efforts should be made to accelerate the cultivation of a high-quality team of technology managers. Incorporate technology managers into the national occupational classification dictionary and establish a professional title evaluation channel. Support universities in establishing master’s degree programs in technology transfer to

cultivate interdisciplinary talents who are proficient in both technology and management. Encourage industry associations to organize specialized training and qualification recognition, and establish a working mechanism where technology managers are involved throughout the process of technology transfer. At the institutional capacity building level, focus on enhancing the professionalism of technology transfer institutions. Support universities and research institutions in establishing specialized technology transfer institutions with independent legal person status, operate according to market principles, and establish flexible salary incentive systems. Encourage social forces to establish professional technology transfer service companies, forming a market-oriented and diversified service supply pattern. At the platform construction level, utilize technologies such as big data and artificial intelligence to create a national integrated technology element market network. Promote the interconnection of science and technology markets and technology trading platforms across regions, establish a national technology achievement information database, unify the registration standards for achievements, break information barriers, and achieve precise matching and efficient circulation of innovation resources.

3.4 Establish a Full-Cycle Financial Support System and Cultivate Patient Capital

To address the issues of capital maturity mismatch and risk aversion, a financial support system covering the entire life cycle of technological transformation needs to be established. In the seed and start-up stages, vigorous development of angel investment and venture capital should be pursued. Through tax incentives, risk compensation, government-led funds providing concessions, etc., guide social capital to invest in early-stage hard technology projects. Establish a national technology transfer guidance fund sub-fund and clearly stipulate the proportion of investment in "early-stage, small-scale, and hard technology" projects. In the growth stage, develop financial tools such as intellectual property pledge financing, technology insurance, and investment-lending linkage. Support commercial banks in establishing technology finance divisions or technology branches, and develop credit evaluation models and credit products suitable for technology enterprises. Explore the establishment of an intellectual property assessment and disposal mechanism to provide a foundation for pledge financing. In the mature stage, support qualified hard technology enterprises to utilize the multi-level capital market for financing. Improve the functional positioning of the Sci-Tech Innovation Board and the Growth Enterprise Market to serve technological transformation, and smooth the capital exit channels. Explore the establishment of an S fund (second-hand share transfer fund) to provide an exit channel for early-stage investment. By establishing a financial support system covering the entire life cycle of technological transformation, provide abundant "blood" for the cultivation of new productive forces.

4. Conclusion and Outlook

This study focuses on the improvement of the transformation efficiency of scientific and technological achievements under the background of new quality productivity, starts from the diagnosis of structural problems, deeply analyzes the deep causes of the problems, and systematically puts forward the policy optimization path. It is concluded that at present, the transformation system of scientific and technological achievements in China is faced with multiple obstacles, such as structural break of innovation chain, structural imbalance of subject relationship, and structural defect of service system. These structural problems are not accidental local obstacles, but the result of long-term accumulation of multiple factors

Based on the above analysis, this study proposes that the policy path to improve the efficiency of the transformation of scientific and technological achievements should adhere to the system thinking, from the subject activation, chain connection, ecological cultivation and other aspects of coordinated promotion: deepen the reform of property rights system and income distribution system, solve the dilemma of incentive incompatibility; Reshaping the innovative organizational model, and filling the "valley of death" through institutional design such as proof-of-concept centers and market-oriented pilot test platforms; Cultivate professional service ecology, accelerate the construction of technical managers and unified technical factor market construction; We will build a financial support system that covers the whole cycle of achievement transformation, and vigorously develop patient capital.

Facing the future, with the deepening of the concept of new quality productivity and the promotion of practice, there is still a huge space for the transformation of scientific and technological achievements. For example, digital technology, especially artificial intelligence, has a profound impact on the transformation mode of scientific and technological achievements.

The boundary reconstruction of government and market in the transformation of scientific and technological achievements under the new nationwide system, how to realize the organic combination of efficient market and effective government, etc. Continuous exploration of these issues will help deepen the understanding of the law of transformation of scientific and technological achievements, and provide more solid theoretical support for accelerating the formation of new quality productive forces and realizing high-quality development.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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