Deepen Industry-academia-research Collaboration to Drive the Efficient Translation of Scientific and Technological Achievements

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Abstract

During the period of the 15th Five-Year Plan, the development of "new quality productive forces" - and, to that end, the deepening of industry-academia-research collaboration to drive the efficient commercialization of scientific and technological achievements - is a matter of utmost urgency. This paper analyzes the constraining factors within the process of technology commercialization - including weak internal innovation capabilities within enterprises and tenuous linkages between enterprises, universities, and research institutes - which result in a mismatch between market demand and technological innovation resources, thereby leading to low conversion rates for scientific and technological achievements. It is recommended that enterprises be empowered to play the leading role throughout the entire innovation chain of industry-academia-research collaboration. It is also recommended that the organic integration of innovative resources with market demand be strengthened. It is further recommended that the innovation chain, industrial chain, capital chain, and talent chain be deeply integrated. Finally, it is recommended that the efficient commercialization of scientific and technological achievements from universities be promoted, thereby contributing to the development of new quality productive forces.

Keywords

Industry-academia-research collaboration, Commercialization of scientific and technological achievements, Technological innovation, Industry chain

Introduction

The report of the 19th National Congress of the Communist Party of China proposed establishing a technological innovation system characterized by enterprises as the primary entities, market orientation, and the deep integration of industry, academia, and research. The 20th National Congress of the Party articulated the central task of comprehensively advancing the building of a strong nation and the great cause of national rejuvenation through Chinese modernization; achieving high-quality development relies on technological innovation to cultivate new drivers of growth. High-level technological self-reliance and self-strengthening hinge primarily on robustly promoting the deep integration of technological innovation and industrial innovation. The foundation of this integration lies in the continuous supply of core technologies and talent; the key to it is reinforcing the primary role of enterprises in technological innovation; the pathway to it involves facilitating the efficient transformation and application of scientific and technological achievements [1].

According to relevant data from the Annual Report on the

Transformation of Scientific and Technological Achievements in China, the total number of scientific and technological achievement transformation contracts signed by domestic universities and research institutes maintained steady growth from 2022 to 2024, hitting 563,000, 640,000 and 661,000 contracts respectively. The corresponding total contract values amounted to 177.66 billion yuan, 205.44 billion yuan, and 226.91 billion yuan. Both indicators demonstrated a steady upward trend, with an average annual growth rate exceeding 10.0%. As industry-academia-research cooperation between universities, research institutes, and enterprises continues to deepen, the development of the system for transforming scientific and technological achievements is steadily advancing [2]. At the end of

2024, 1,084 universities and research institutes - tailoring their approach to their own specific developmental characteristics - had established technology transfer institutions, accounting for 26.7% of all reporting institutions. Furthermore, the nationwide workforce dedicated full-time to the transformation of scientific and technological achievements within these institutions reached 18,248 personnel, indicating that both the institutional layout for technology transfer and the development of a specialized talent pool is becoming increasingly sophisticated.

Problem analysis

Uneven enterprise development, significant disparities in industrial structure, and unequal resource allocation

In terms of the current development status of industry entities, small, medium, and micro-enterprises (SMEs) and private firms are numerous, characterized by diverse business models and a fragmented structure. This makes it difficult for the government to implement systematic regulation and guidance. Furthermore, these enterprises often lack sufficient sensitivity to national policy directives and experience delays in accessing relevant information, thereby hindering the effective implementation and execution of pertinent policies. Conversely, large state-owned enterprises and multinational corporations - leveraging their substantial internal strengths - can align precisely with national policy guidelines and market trends to achieve rapid growth. However, they demonstrate significant shortcomings in driving the collaborative development of SMEs within related sectors, failing to foster a virtuous ecosystem for industrial synergy [3].

Firms lack original innovation and core tech breakthroughs with weak capacities

Utilized the findings of Andrade-Rojas et al, small, medium, and micro enterprises (SMEs) and private firms - constrained by their inherent resource endowments and developmental capabilities - face significant limitations regarding the attraction, cultivation, and retention of innovative technological talent. In contrast, while large enterprises possess a more robust economic foundation and stronger foundational capabilities in technological innovation, they nonetheless lack a stable and efficient technical support system for tackling critical core technologies. Furthermore, the overall original innovation capacity of enterprises remains insufficient. In the current technological innovation landscape, it is hard to produce high-quality original research results on a sustained basis. This hinders breakthroughs in key core technologies and restricts the effective resolution of “bottleneck” technical challenges [4].

Weak industry-university-research links lower tech commercialization amid supply-demand mismatch

Currently, the commercialization of technological achievements in my country’s universities remains mired in the “Valley of Death” dilemma. The tenuous connections between enterprises, universities, and research institutes have created a disconnect between market demand and technological innovation resources, resulting in a persistently low rate of technology commercialization. University-based technology transfer continues to suffer from issues such as a supply-demand disconnect, rigid institutional mechanisms, and disjointed transfer pipelines; traditional models struggle to adapt to the developmental requirements of “new quality productive forces” [5]. Furthermore, online technology transfer platforms often remain stuck in the rudimentary stage of mere information display, characterized by insufficient information exchange and inefficient resource matching. Concurrently, there is a shortage of targeted, in-person matchmaking activities, making it difficult for universities and enterprises to establish intuitive connections and foster deep mutual trust. These dual shortcomings - both online and offline - have caused innovation resources and market demand to become completely decoupled; vast quantities of research findings lie “dormant” within universities and research institutes, while enterprises face a severe shortage of the technologies they urgently require.

Resolving the aforementioned bottlenecks requires a three-pronged approach focusing on platform optimization, activity enhancement, and institutional safeguards: First, optimizing online technology transfer platforms to bolster intelligent matching capabilities and facilitate deep-level interactions, thereby shifting the focus from mere “information listing” to “precise matchmaking”. Second, enriching the range of routine offline matchmaking events and collaborative problem-solving scenarios to streamline the channels through which market demand is communicated. Third, building

an institutional framework featuring government guidance, market leadership and multi-party collaboration. By improving benefit-sharing mechanisms and facilitating the flow of innovation factors, we can cultivate a new industry-university-research cooperation ecosystem. This ecosystem is marked by accurate demand matching, efficient resource circulation and in-depth cooperation results. It will effectively bridge the "Valley of Death" in technology commercialization and strengthen the practical application value of scientific and technological achievements [6].

Comments

Build an innovation matrix led by tech firms, coordinated by SMEs and joined by private enterprises

We will further deepen reforms to the science and technology management system. This entails coordinating the development of various innovation platforms, strengthening the integrated management and mobilization of innovation resources, optimizing the regional layout of scientific and technological innovation, and enhancing collaborative linkages between central and local authorities [7]. By reinforcing policy guidance, we will fully leverage the leading role of technology-leading enterprises - supporting them in spearheading or participating in major national science and technology projects, and constructing collaborative innovation platforms based on a "large enterprise + SME" model. Furthermore, we will encourage these leading enterprises to open innovative resources, such as technology, equipment, and data - to SMEs, thereby driving collaborative innovation among them. Concurrently, we will actively guide private enterprises to participate broadly in scientific and technological innovation, and establish a robust, integrated ecosystem for industry-academia-research-application collaboration that features multi-stakeholder synergy and multi-element linkage. This initiative aims to foster the deep integration of the innovation chain, industrial chain, capital chain, and talent chain, thereby comprehensively enhancing the efficiency of scientific and technological achievement transformation and elevating the overall capacity for industrial innovation.

Strengthen enterprises' leading role in innovation and integrate education, technology and talents

It is essential to establish a talent cultivation paradigm guided by the industrial needs of enterprises. This entails supporting universities and vocational institutions to cooperate with industrial enterprises in jointly developing academic programs and reforming curricula. It aims to cultivate targeted, skilled and innovative talents that meet industrial development needs, and achieve precise alignment between talent supply and market demand. Concurrently, mechanisms for incentivizing and safeguarding high-caliber innovative talent must be improved. Enterprises should be supported in utilizing diversified incentive methods - such as equity options and profit-sharing from projects - to effectively resolve the practical dilemma of "difficulty in attracting and retaining" core technical talent. Furthermore, leading technological enterprises should be encouraged to leverage their inherent strengths to establish high-level research and development (R&D) platforms. By partnering with universities and research institutes to form diversified innovation consortia, they can integrate innovation resources - including capital, talent, and industrial supply chains. Guided by market demand, they should forge a seamless, end-to-end pathway spanning basic research, applied research, and industrial commercialization, thereby utilizing paradigm innovation to accelerate and enhance the transformation of university-generated scientific and technological achievements into tangible productive forces.

Boost research cooperation synergy to accelerate tech achievements transformation

(1) Relying on the insights from Crammond, R's 2024 research regarding UK university measures and mechanisms, it is necessary to establish specialized innovation vehicles - analogous to the UK's University Enterprise Zones - and to optimize collaborative matching platforms. Furthermore, by leveraging regular, market-oriented cooperative activities, precise matching between supply and demand can be facilitated, thereby upgrading both the quality and scope of collaborative endeavors. Concurrently, a robust institutional framework featuring multi-party linkages and shared benefits should be established to reinforce long-term mechanisms of support [8]. Ultimately, this approach aims to construct a new ecosystem for industry-academia-research collaboration - defined by precise demand matching, efficient resource flow, and deep-rooted cooperation - that effectively resolves issues such

as bottlenecks in achievement transformation and the mismatch of innovation resources. This will continuously enhance the efficiency of scientific and technological achievement transformation, providing solid support for the development of "new quality productive forces" and the pursuit of high-level scientific and technological self-reliance.

(2) Based on Synergistic mechanism and strategy optimization of the integration of industry and education in higher vocational education by Ou and Luo 2024, it has been established that the synergistic configuration of multiple factors is the key to enhancing the efficiency of scientific and technological achievement transformation within higher vocational colleges. The study identified multiple pathways to high-efficiency transformation based on government-industry-academia-research collaboration. Furthermore, it suggests that higher vocational colleges with different resource endowments should adopt differentiated development pathways suited to their own conditions. This provides targeted and practical guidance for optimizing achievement transformation strategies, promotes the practical application of technical achievements, and boosts colleges' ability to serve industrial development [9].

(3) Based on Wang's 2025 configuration analysis of the technology-organization-environment framework, three core dimensions jointly underpin efficient achievement transformation. They include technological maturity in the technological dimension, platform and talent support in the organizational dimension, as well as policy and market traction in the environmental dimension. [10]. Simultaneously, the study identified multiple equivalent configuration pathways capable of driving high transformation performance, emphasizing the critical importance of the dynamic alignment among technology supply, organizational management, and the external environment. This research provides both theoretical and practical guidance for universities seeking to resolve transformation bottlenecks and elevate their overall transformation performance. Both categories of studies highlight the strengths of configurational analysis. This method helps reveal the synergistic effects of multiple influencing factors. Meanwhile, the studies clarify the practical value of differentiated adaptation pathways and offer diverse references for optimizing the configuration of scientific and technological achievement commercialization. It applies to different types of higher education institutions, including general universities and higher vocational colleges.

Conclusion

This paper presents a systematic study on the commercialization of scientific and technological achievements in higher education institutions and the deep integration of industry, academia, and research. It identifies "enterprise leadership and market orientation" as the core principles for collaborative innovation between universities and enterprises. Breaking away from the single-dimensional analytical approach characteristic of existing research, this study dissects key issues such as the low degree of alignment between university and enterprise needs, imperfect collaborative mechanisms, and obstructed channels for technology transfer. Building upon this foundation, the paper constructs a multi-dimensional collaborative optimization framework encompassing "mechanism refinement, policy guarantees, platform construction, and benefit distribution". It puts forward specific pathways, including improving linkage mechanisms, strengthening policy support, building professional docking platforms, and optimizing benefit and risk sharing systems. These measures help bridge the "last mile" of technology transfer and realize the precise docking of university innovation supply and industrial demand.

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Conflicts of Interests

The authors declare no conflict of interest.

References

[1] Yayha, M. A., Samoea, R. F., Abedah, M., Fahmi, A. M., Temnikov, V. (2024) Innovation and technology management in modern enterprises. *Journal of Ecohumanism*, 3(5), 895-908.

[2] Chen, K., Zhang, C., Feng, Z., Zhang, Y., Ning, L. (2022) Technology transfer systems and modes of national research institutes: evidence from the Chinese academy of sciences. *Research Policy*, 51(3), 104471.

[3] Zhu, H., Liu, R., Chen, B. (2023) The rise of specialized and innovative little giant enterprises under China's 'dual circulation' development pattern: an analysis of spatial patterns and determinants. *Land*, 12(1), 259.

[4] Andrade-Rojas, M. G., Saldanha, T. J., Kathuria, A., Khuntia, J., Boh, W. (2024) How information technology overcomes deficiencies for innovation in small and medium-sized enterprises: closed innovation vs. open innovation. *Information Systems Research*, 35(4), 1981-2012.

[5] Mian, S. H., Salah, B., Ameen, W., Moiduddin, K., Alkhalefah, H. (2020) Adapting universities for sustainability education in industry 4.0: channel of challenges and opportunities. *Sustainability*, 12(15), 6100.

[6] Kreiser, P. M., Kuratko, D. F., Covin, J. G., Ireland, R. D., Hornsby, J. S. (2021) Corporate entrepreneurship strategy: extending our knowledge boundaries through configuration theory. *Small Business Economics*, 56(2), 739-758.

[7] Wang, F., Liu, L. (2024) Research and practice on the government-Industry-academia-research collaborative education mechanism, for the integration of economics and management majors with big data technology. *Creative Education*, 15(12), 2521-2543.

[8] Crammond, R. (2024) Enhancing enterprising education through industry intervention: a review of UK university measures and mechanisms. *How to Enable Engagement Between Universities and Business*, 49-61.

[9] Ou, Y., Luo, J. (2024) Synergistic mechanism and strategy optimization of the integration of industry and education in higher vocational education. *International Conference on Frontier Computing*, 479-490.

[10] Wang, X. (2025) How to promote university technology transfer? A configuration analysis based on technology, organization and environment framework. *PLOS One*, 20(3), e0318563.