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Guided by Industrial Demands, Exploring "Four-in-One" Models for the Transformation of Scientific and Technological Achievements in Universities —Exploration and Thinking of USTB Science Park

PLANERY 3 - INDUSTRIAL DEVELOPMENT DRIVEN BY INNOVATION SPACES

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EXECUTIVE SUMMARY

Science Park of University of Science and Technology Beijing (USTB) has explored and established a new transformation of scientific and technological achievements model, based on a fixed two-way channel for the transformation of scientific and technological achievements and driven by a "four-in-one" approach that includes industry-oriented scientific research and innovation, transformation of scientific and technological achievements, talent recruitment and cultivation, and financial support. This paper systematically elaborates on the construction of the joint innovation center of "university + enterprise" and the school-enterprise research center of "industrial research institute + enterprise", exploring the construction of an industry-oriented "four-in-one" platform, to promote the construction of science park that integrates education, technology, and talent.

FOREWORD

Under the background of the promulgation of the "Outline of the Plan for Building a Strong Country in Education (2024-2035)" and the promotion of the integrated development of education, science and technology, and talent, as well as the deepening implementation of the innovation-driven development strategy, the National University Science Park of University of Science and Technology Beijing(USTB), as a leading place for the integration of industry and education, a practice base for innovation and entrepreneurship of teachers and students, a carrier for technology transfer, an incubator of technology enterprises, and a cultivator of industrial ecosystems, has closely aligned itself with the university's central mission. Leveraging its advantages in flexible operational mechanisms, close market integration, and the aggregation of innovative resources, the science park has established a fixed two-way channel for achievement transformation. Building on this foundation, it is exploring a new industry-oriented "four-in-one" model to advance the construction of a science park that integrates education, science and technology, and talent.

CURRENT ISSUES IN ACHIEVEMENT TRANSFORMATION AND INDUSTRY-UNIVERSITY-RESEARCH COLLABORATION IN HIGHER EDUCATION INSTITUTIONS

For a long time, the transformation rate of scientific and technological achievements in universities has been relatively low. Many achievements are "sleeping" in laboratories, "lying" on bookshelves, or "sitting" in papers, without being applied in the market and industry. As a result, the advantages of universities in scientific and technological innovation and talent have not been effectively translated into industrial development advantages or national competitive advantages. On one hand, many scientific and technological achievements are research-oriented, where achievements are produced first and then applications are sought. This leads to a disconnect between research and industry. In particular, achievements with low maturity cannot be directly utilized by enterprises, making them unwilling to bear the risks associated with transformation. On the other hand, during the establishment of many research projects, enterprises are either minimally involved or not involved at all. This results in a lack of market insight and a disconnect from market demands.

In terms of industry-university-research collaboration, most current efforts are primarily focused on superficial forms of cooperation, such as technology transfer, licensing, development, and commissioned projects. Collaborative innovation in this field often follows a model where universities and research institutions provide R&D personnel and technology, while enterprises contribute equipment and funding. This superficial cooperation, to some extent, hinders the development of deeper collaboration. As a result, it often lacks practical technical application scenarios, limiting its potential impact and relevance to real-world industrial needs.

University science parks should fully leverage their advantages, such as flexible operational mechanisms, close market integration, and the aggregation of innovative resources, to elevate collaborative innovation characterized by industry-university-research cooperation to a new level. By focusing on industry-driven demands, they should promote the integrated development of scientific research innovation, achievement transformation, talent recruitment and evaluation, and financial support to explore new models for transforming scientific and technological achievements from universities.

BUILDING AN ACHIEVEMENT TRANSFORMATION COMMUNITY BASED ON A FIXED TWO-WAY TRANSFORMATION CHANNEL

To enhance the efficiency of transforming scientific and technological achievements from universities, it is essential to establish a fixed two-way achievement transformation channel between university and enterprise, with enterprise playing the central role, to replace the previously loose, one-way, and superficial connections with a deeply integrated collaboration model. This mechanism lays a solid

foundation for improving the effectiveness of transforming university achievements into practical applications.

"Fixed" refers to the establishment of a stable and reliable transformation platform by all parties in the channel of scientific and technological achievements without being affected by the change of participants, which helps ensure that the transformation of scientific research achievements can proceed continuously, stably, reliably and efficiently. "Two-way" means the cooperation in this channel is serving both sides.

By establishing a fixed two-way achievement transformation channel, i.e., creating a seamless integration pathway from enterprises to universities and from universities to enterprises, a solid foundation is laid for the next step: an industry-oriented "four-in-one" new model.

ADHERING TO THE INDUSTRY-ORIENTED "FOUR-IN-ONE" APPROACH TO EXPLORE A NEW MODEL FOR SCIENTIFIC AND TECHNOLOGICAL ACHIEVEMENT TRANSFORMATION

On the foundation of establishing a fixed two-way achievement transformation channel, improving the efficiency requires two additional steps. On one hand, it is essential to be enterprises-centered, guided by industrial needs, driven by market demand, and supported by academic disciplines. On the other hand, the development needs of enterprises extend beyond researching findings, which requires a comprehensive ecosystem that integrates multiple dimensions of support, including scientific research innovation, achievement transformation, talent recruitment and evaluation, and financial backing. Therefore, it is crucial to construct such an industry-oriented "four-in-one" platform.

Industry-oriented scientific research innovation must focus closely on the practical production needs of enterprises, aiming to enhance efficiency, reduce costs, improve product quality, and develop new products, rather than merely publishing academic papers. (1) Use market demand as the primary driver for research direction, significantly reducing the gap between scientific innovation and value creation and aim for a rapid iteration model where "discovery leads to invention, and invention leads to application". (2) Driven by the market demands, the enterprises should play a leading role in helping experts and professors find the needs, while actively engage with the latest research developments to steer the direction. With a professional team composed of technology managers and scientific researchers serving both parties, this two-way mentorship program embeds the "genes" of achievement transformation to ensure that research outcomes are designed with practical applications. (3) Throughout the process of scientific research and innovation, enterprises are deeply involved in the preliminary planning and interim feedback, which ensures that the outcomes of scientific innovation are closely aligned with the practical application scenarios of the industry right from their inception.

Industry-oriented transformation of achievements, (1) The scientific research achievements generated from industry-oriented research, which is situated within the enterprise's industrial chain, significantly shorten the distance from the laboratory to the production line without the need for lengthy adaptation in order to be transformed to be applied. (2) When transforming achievements, it is crucial to fully consider the urgent needs of enterprises and the market capacity of products, among other factors, to effectively enhance the success rate of achievement transformation. (3) The transformation of achievements is not limited to fostering the development of a single enterprise; rather, it focuses on the common needs of the entire industry, propelling the advancement of a sector through commercialization and industrialization.

Industry-oriented talent recruitment and evaluation, (1) The science park works in close collaboration with the relevant departments of the university to promote the consideration of market recognition of achievements as a significant criterion during talent recruitment and evaluation, moving away from the

traditional model that solely values papers, awards, and titles, and instead emphasizes industrial capability, thereby driving the reform of the evaluation system for achievement transformation talents and the system for professional title assessment. This shift aims to break the unidimensional aspect of academic evaluation, encouraging talents to closely integrate scientific research with industry, and enabling more innovative achievements to transit from the laboratory to the marketplace. (2) In the process of talent cultivation, the science park collaborates closely with the relevant departments of the university to promote a model that considers the needs of enterprises and trains talents according to these in order to realize talent development during the process of scientific research innovation and achievement transformation. It is initiated bilaterally from the establishment of enterprise projects and the selection of master's students, formulating a joint university-enterprise training program supported by real projects, to cultivate high-quality talents in real scenarios. When jointly training engineering doctoral students, the prospective enterprise applicants are required to bring their own projects centered around major management and key technical issues in the development of the enterprise, establishing a doctoral training mechanism guided by significant tasks and objectives. (3) In the process of collaborative achievement transformation between enterprises and universities, talent is simultaneously cultivated, and both can be transferred to the enterprises, realizing a dual transfer of talent and projects. While the university research team is conducting development, the enterprise participates throughout the entire process, providing market feedback and financial support. During the project advancement, university students and researchers engage in practical work within the enterprise, gaining an understanding of production and market demands. When the project matures, the technological achievements are transferred to the enterprise for industrial production, and the talents involved being familiar with the project processes and enterprise operations, directly enter the enterprise to work, achieving a dual transfer of talent and projects. This not only allows university research achievements to "take root and sprout" but also injects innovative vitality and professional talent into the enterprise, vigorously promoting industrial upgrading and economic development.

Industry-oriented financial support entails the establishment of specific achievement transformation funds around universities, which involves enterprises that excel in the corresponding professional fields based on the specialties, significantly reducing communication costs during the financing process and enabling efficient and swift transformation of achievements into enterprises. Leveraging their extensive experience within the industry and acute market insights, enterprises can accurately identify the most promising research projects. In this process, due to the high compatibility, communication costs are greatly reduced. Enterprises do not need to spend considerable time and effort understanding research achievements that have low relevance to their business, and university researchers can quickly obtain accurate feedback from enterprises on technology application and market demand. Meanwhile, based on years of researching in the professional field, enterprises and universities reduce the risks associated with the fund's investments in small, early-stage, and technological ventures during the operation. Once the achievements mature, the close cooperative relationships established through the fund allow for the efficient and swift transformation of these achievements into participating enterprises and the entire industry. This not only accelerates the industrialization process of university research achievements but also promotes the development and upgrading of the entire industry, achieving a win-win situation for universities, enterprises, and the industry as a whole.

THE PRACTICE OF THE "FOUR-IN-ONE" SCIENTIFIC AND TECHNOLOGICAL ACHIEVEMENT TRANSFORMATION MODEL ORIENTED BY INDUSTRIAL DEMAND AT THE USTB SCIENCE PARK

4.1 Establish a "University + Enterprise"(U+E) Joint Innovation Center to Implement a Fixed Two-way Channel for U+E Achievement Transformation.

The "U+E" Joint Innovation Center will leverage the resource advantages of large state-owned enterprises and central enterprises, as well as the educational, scientific, and talent advantages of universities, to strengthen U+E collaboration, which engages in comprehensive cooperation in areas

such as scientific research innovation, achievement transformation, talent cultivation, and the sharing of laboratory scientific instruments and equipment. The USTB Science Park, actively connects with large domestic state-owned enterprises and central enterprises to jointly establish U+E joint innovation centers, such as, Baotou Steel Share Co., Ltd. and USTB Joint Innovation Center, China Tobacco Corporation Hefei Design Institute and USTB Joint Innovation Center and so on. The "U+E" Joint Innovation Center establishes a fixed two-way achievement transformation channel, implementing a collaborative innovation model where "talent and R&D are at USTB, and transformation and industry are at the enterprises", as it aims to achieve integrated development of education, science, and talent.

4.2 Relying on the U+E Joint Innovation Center, a "Four-in-One" Scientific and Technological Achievement Transformation Model for Large Enterprises is Constructed.

The "U+E" Joint Innovation Center adheres to an industry-oriented "four-in-one" approach, including industry-oriented scientific research innovation, industry-oriented achievement transformation, industry-oriented talent recruitment and evaluation, and industry-oriented financial support.

Focusing on industrial demands, the center tracks the latest cutting-edge technologies in research and development directions, guided by industry needs in order to break the small cycle of conducting only basic theoretical research and laboratory application studies, not merely publishing high-level papers and patent applications, but also placing greater emphasis on industrial application. In the operation of Baotou Steel Share Co., Ltd. and USTB Joint Innovation Center, the expert committee is chaired by Academician Mao Xinping from USTB, who oversees and ensures the industry orientation of scientific research innovation. Initially, it has established seven research centers such as one for carbon neutrality and so on, each led by a distinguished professor.

The transformation of achievements aims to enhance productivity and elevate the core competitiveness of enterprises, emphasizing practical value, which continuously guides the direction of research achievements with a focus on industry, market, and problem-solving, ensuring that the transformed achievements are integrated into the industrial chain, either upstream or downstream. During the collaboration, both parties have accelerated the transformation of a batch of scientific and technological achievements, such as hydrogen energy materials, into real productive forces through the Joint Innovation Center. This ensures the success rate of achievement transformation and improves the efficiency of the transformation process.

The recruitment and evaluation of enterprise talents primarily focus on industrial scientific research talents. Utilizing the geographical advantages of the Joint Innovation Center, talents are gathered in Beijing. In the cooperation with Baotou Steel, the Baotou Steel and USTB Joint Innovation Center is established within the science park, addressing the urgent need for high-end talents through a talent enclave. When forming the Steel Backbone Class, the process is initiated bilaterally from the establishment of enterprise projects and the selection of master's students, formulating a joint U+E training program supported by real projects, cultivating high-quality talents with a strong backbone for national contribution in real projects and scenarios. In the joint training of engineering doctoral students, the prospective in-service employees of the enterprise are required to bring their own projects centered around major management and key technical issues in the development of the enterprise, establishing a new mechanism for doctoral student training guided by significant tasks and industry orientation.

The transformation and industrialization of achievements cannot be separated from financial support. In the process of preparing to establish a scientific and technological innovation fund, the science park actively contacts large enterprises such as Baotou Steel and Shougang Group to participate in the fund's establishment. The industrial fields of these enterprises are highly compatible with the specialized characteristics of the university, significantly reducing communication costs between both parties and

enabling the fund to better conduct project screening, due diligence, and investment decisions. Simultaneously, the abundant industrial resources of these enterprises can empower the invested university enterprises, allowing achievements to be rapidly transformed and implemented.

In summary, by establishing "U+E" Joint Innovation Centers with large state-owned enterprises and central enterprises, a fixed two-way channel for achievement transformation between universities and enterprises has been created. The new industry-oriented "four-in-one" model promotes the integrated development of scientific research innovation, achievement transformation, talent recruitment and evaluation, and financial support.

4.3 Establish "Industry Research Institute + Enterprise" U-E Research Centers to Construct a "Four-in-One" Scientific and Technological Achievement Transformation Model for Small and Medium-sized Enterprises.

Unlike the establishment of "U+E" Joint Innovation Centers with large domestic state-owned enterprises and central enterprises, small and medium-sized enterprises (SMEs) have varying needs at different stages of their development. Addressing the characteristic needs of SMEs, the USTB Science Park actively connects with high-quality SMEs, using the USTB Institute of Emerging Technologies as a link to jointly establish multiple "Industry Research Institute + Enterprise" U-E Research Centers, such as the Muxi High-Performance GPU Joint Research Center, the New Energy Materials and Low-Carbon Technology Research Center and so on, covering multiple disciplinary fields such as new materials, GPU computing power, intelligent manufacturing, and energy conservation and environmental protection.

The Industry Research Institute, centered on SMEs, establishes a fixed two-way channel for U+E achievement transformation, adhering to the industry-oriented "four-in-one" approach, closely integrates the industrial needs of enterprises with the educational, scientific, and talent resource advantages of universities, achieving integrated development. In the operation of the Muxi High-Performance GPU Joint Research Center, School of Computer and Communication Engineering led more than 30 students to assist Muxi Company in GPU stress testing, followed by collaboration on FFT performance optimization research for Muxi GPUs, realizing the integration of education, science, and talent.

CONCLUSION

The USTB Science Park has explored and established a new model of achievement transformation based on a fixed two-way channel for industry-oriented scientific research innovation, industry-oriented achievement transformation, industry-oriented talent recruitment and evaluation, and industry-oriented financial support. This "four-in-one" model addresses the issues of low transformation rates and inefficient transformation channels of university scientific and technological achievements. Through the concrete practices of establishing "U+E" Joint Innovation Centers and "Industry Research Institute + Enterprise" U+E Research Centers, significant effectiveness has been achieved in enhancing the efficiency of university scientific and technological achievement transformation, promoting the deep integration of the innovation chain, industry chain, capital chain, and talent chain. The "four-in-one" achievement transformation model provides a replicable and promoted mode for university science parks to facilitate the transformation of university scientific and technological achievements, and also lays a solid foundation for the construction of science parks that integrate education, science, and talent.