Research on Pathways for Enhancing the Innovation Capacity and Integrating Industry-Academia-Research-Use in Local Universities

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Keywords: Local Universities, Scientific and Technological Innovation, Collaborative Education and Research

Abstract: As an important component of science and technology innovation system, colleges and universities give full play to the functions of personnel training, and basic and applied research, which shoulder the functions of personnel training, scientific research, social service, cultural inheritance and innovation and international exchange and cooperation. At present, there exist prominent problems in local colleges and universities, especially those in economically underdeveloped areas, such as insufficient investment in scientific research funds, slow growth of talents, low ability of scientific and technological innovation, low output and transformation efficiency, and disconnection between the mode of scientific research and education and the needs of enterprises. Therefore, through innovating the collaborative research and education mode of university-enterprise scientific research organizations, Local universities should try every ways to accelerate the transformation and industrialization of scientific and technological achievements, and promote the improvement of collaborative innovation ability of scientific research based on regional advantages and characteristics, and the strategy of "strengthening universities with talents".

1. Introduction

In recent years, in the face of the growing trend of globalization, China's performance on the global economic stage has become increasingly impressive. It has emerged as one of the world's most significant economies and has achieved notable success in major scientific and technological innovation projects that address the nation's critical needs. Currently, new breakthroughs are emerging in the development of science and technology worldwide, new disciplines are arising, the trend toward coordinated development is becoming more evident, and industrial transformation is accelerating. "Scientific and technological innovation" has become a pivotal strategy influencing the nation's destiny. Presently, a new wave of scientific and technological revolution and industrial transformation is gaining momentum, and the world is experiencing profound changes not seen in a century. The scientific and technological revolution is intertwined with the strategic competition among major countries, and the high-tech sector has become the forefront and primary battleground of international competition. Despite its progress, China's scientific and technological development still faces challenges such as relatively weak original innovation capabilities, reliance on key and core technologies from other countries, and a shortage of top-tier scientific and technological talents. We must enhance our sense of urgency, intensify efforts in scientific and technological innovation, and secure the commanding heights of scientific and technological competition and future development. We will deepen the integrated reform of the systems and mechanisms for talent education in education, science, and technology, improve the coordination mechanisms between education and science, and accelerate the training of a large, well-structured, and highly qualified contingent of innovative talents. We will optimize the subject settings of colleges and universities, innovate personnel training models, and enhance the level and quality of independent personnel training.[1] We will expedite the development of national strategic human resources, focusing on cultivating outstanding engineers, skilled craftsmen, and highly skilled personnel. Major national strategies such as the Belt and Road Initiative and the Guiding Opinions on Promoting the Development of the

  DOI: 10.25236/ssehr.2024.005

Western Region in the New Era and Forming a New Pattern have brought excellent opportunities for the university's future development and provided vast space for both basic and applied research at universities.

2. Challenges Faced by Local Universities in Scientific and Technological Innovation

Currently, the number of scientific and technological achievements in China's colleges and universities is experiencing explosive growth; however, the issue of insufficient scientific and technological innovation capability remains prominent. Firstly, there is a shortage of high-level innovative talents. Local universities, particularly those in western China, are at a disadvantage in terms of their economic foundation, scientific research support, and ecological environment. The effect of talent accumulation is not significant, the growth of their teams is relatively slow, and there is a shortage of high-level and leading innovation figures. For instance, local universities in Gansu Province have not yet received the National Natural Science Foundation's Outstanding Young Scholars Fund or the Outstanding Young Scholars Science Fund, and their ability to undertake major national key projects is clearly inadequate. Secondly, the model of industry-university-research collaborative research is imbalanced. The cooperation model primarily focuses on service-oriented collaboration such as technical services, technology transfer, and commissioned development. There is limited cooperation on key core technologies and industrialization issues, and the efficiency of converting and implementing achievements is low. According to statistics, from 2016 to 2022, the average annual conversion rate of scientific and technological achievements in Chinese universities was only about 3%, and the efficiency of patent maintenance is not high. Thirdly, there is a disconnect between scientific and technological innovation achievements and market demand. The scientific research fields and specific projects of colleges and universities are often driven by their own academic preferences, and the innovation achievements primarily serve as evidence of their academic ability or the basis for promotion and title. Market demand and commercial value are rarely considered, leading to a disconnection or misalignment between scientific research and market demand. The ability of colleges and universities to serve local economic and social development needs further improvement. Fourthly, the depth and breadth of industry-university-research cooperation are insufficient. The enterprise-led technological innovation system is not sufficiently developed, university-enterprise cooperation is not close enough, scientific and technological achievements are not well aligned with industrial development, and there is a phenomenon of "research islands." Lastly, the incubation capacity of scientific and technological achievements in universities is insufficient, and there is a lack of incubation funds. In particular, the self-financing ability of local provincial universities is under significant strain, and there is a severe shortage of scientific research funds.

3. Reflections and Recommendations for Enhancing the Scientific and Technological Innovation Capabilities of Local Universities

(1) Innovate the University-Enterprise Collaborative Education Model

Currently, universities, particularly local universities, lack leadership in scientific and technological innovation, and the integration of school-enterprise collaboration and innovation is insufficient. Local universities should actively integrate superior disciplines and technical resources both within and outside the university, gather various innovation resources and factors from enterprises and industries, and support interdisciplinary teams in conducting research collaboration and research based on platforms such as industrial research institutes (centers), innovation consortia, enterprise joint laboratories, technological innovation centers, and engineering research centers. Enterprises should participate in the scientific and technological innovation and personnel training in colleges and universities, address key and common technologies in the development of enterprises and industries, jointly train technical and managerial personnel, enhance the core competitiveness of enterprises, and boost the scientific and technological innovation capability of universities.

Local universities should adhere to the concept of building a high-level talent team through both

education and recruitment. They should improve the mechanism for training and discovering strategic scientific and technological talents, leading scientific and technological talents, and innovation teams in important subject areas and innovation directions. They should optimize the institutional environment for the growth and development of faculty and scientific research and education, create high-level personnel training plans, and establish special funds. They should select and train a group of influential discipline leaders both domestically and internationally and a high-level teaching and scientific research team that leads innovation.[2]

It is essential to accelerate the growth of young teachers, fully leverage the roles of leading talents and academic leaders in organizing, planning, demonstrating, and guiding, and promote the active integration of young teachers into scientific research teams. We should formulate teacher training plans, tap into teaching and scientific research resources, cultivate and train talents through major scientific and technological research practices, and encourage young scientific and technological talents to excel. This will ultimately form a virtuous cycle of "cultivating talents, introducing talents, driving talents, and attracting talents." We will vigorously promote the coordinated and comprehensive development of colleges and universities, address the talent bottleneck faced by the scientific research development of local colleges and universities, provide solid talent support for scientific and technological innovation, and offer intellectual support for the construction of first-class universities and first-class disciplines.[3]

Through initiatives such as the "science and technology specialist" program and the "young doctor into the enterprise and park" program, universities can proactively engage in the technological research and development of enterprises, adopting a "from small to large, from point to surface" approach to joint talent cultivation. This provides an effective pathway for the training of "mass innovation" talents. Breaking down the barriers of traditional education, students can have the opportunity to participate in real-world industrial projects and scientific research activities while acquiring theoretical knowledge. In this process, they can be exposed to the most cutting-edge technology and industry trends, develop the ability to solve practical problems, and lay a solid foundation for their future career development.[4]

(2) Innovate the Collaborative Research Model of Scientific Research Institutions

As one of the primary entities in scientific and technological innovation, the crucial manifestation of a university's scientific and technological innovation capability is its ability to conduct scientific research, solve scientific problems, and undertake scientific research projects. Universities should coordinate the resource allocation between major key projects and basic research, adhering to a balanced approach of goal-oriented and free exploration. On the one hand, they should excel in addressing core scientific problems and technologies, while on the other hand, they should excel in conducting foundational research on mechanisms and causality, exploring the underlying "why" questions.[5]

Local institutions of higher learning, especially those in less developed regions, face insufficient funding for scientific research, inadequate early-stage investment, insufficient accumulation of achievements, and weak core competitiveness in undertaking major national key projects. Therefore, local institutions of higher learning must fully leverage their strengths in distinctive scientific research disciplines, conduct forward-looking and systematic layouts based on regional strengths and characteristics, and implement action plans for cultivating basic research. In line with national and local needs, academic frontiers, and university development strategies, they should determine key support directions for basic theoretical research, strengthen the demand-oriented, goal-oriented, and frontier-oriented basic research system, and establish a mechanism for the advanced deployment and construction of major scientific research platforms. It is essential to use major key research projects as the starting point, promote the effective integration of high-quality resources both within and outside the university, select and cultivate a number of major key project question banks, enhance the core competitiveness of scientific and technological research, lay a solid preliminary research foundation for the breakthrough of national major key projects,[6] and fully leverage the core driving role of organized scientific research. Local universities in the west should actively integrate into the "science and technology corridor" of the Silk Road, conduct research and layout for national strategies and

regional characteristics related to the "One Belt and One Road," the upper reaches of the Yellow River Basin, Qilian Mountain ecological security, east-west cooperation, rural revitalization, new energy, new materials, and the technological support for traditional industries, thereby enhancing the geographical advantages and influence of scientific and technological innovation.[7]

(3) Establish an Information Sharing and Exchange Platform

Information asymmetry is a significant obstacle in the current cooperation between universities and local enterprises. Leveraging the academic characteristics and strengths of the university, active communication channels should be established with industries and enterprises, and joint efforts should be made to construct multiple scientific and technological achievement incubation platforms and demonstration bases for transformation and application. Based on these demonstration bases (centers), the university will explore the development of an information technology sharing platform that integrates information release, communication and interaction, and resource sharing. Through the platform's bridging role, universities and enterprises can promote achievements, publish technical needs, and connect talent with market demands, thereby facilitating the efficient alignment of scientific and technological resources with the technical needs of enterprises and enabling both parties to more efficiently identify cooperation points and talent requirements.

A fund for the incubation of achievement transformation should be established to support the transfer and transformation of applied achievements through "early investment and small investment." High-value transformation achievements should be encouraged to actively attract social financial capital for venture capital, providing comprehensive financial services for the transformation of achievements and accelerating the transformation and industrialization of scientific and technological achievements. A distribution policy oriented towards increasing the value of knowledge should be implemented, increasing the proportion of benefits shared by researchers in the transformation of results. The transformation of results should be considered as one of the criteria in the evaluation of scientific research performance, professional title evaluation, etc., guiding the transfer and transformation of applied scientific and technological achievements through the evaluative "baton" role. Active encouragement should be given to applied research to seek external resources, transitioning from a closed-door approach to an outward-looking one.

(4) Developing "Entrepreneurship and Innovation Courses" and "Entrepreneurship and Innovation Mentors"

Education is the cradle of talent development. Through close integration with industry and scientific research, it can provide students with more practical and innovative educational resources. By optimizing the teaching model, such as through the integration of industry and education and collaboration between schools and enterprises, innovative talents can be cultivated to meet societal needs. Relying on the College of Innovation and Entrepreneurship, we will explore methods to hire highly skilled experts from enterprises to develop "innovation and entrepreneurship courses" and serve as "innovation and entrepreneurship mentors" outside the school. We will also organize activities for "entrepreneurs" to visit the campus and conduct theoretical and practical teaching and research based on the needs of enterprises and economic development. By holding social service practice activities and offering relevant courses, the school guides teachers and students to gain a deep understanding of the actual needs of local economic and social development and encourages them to actively participate in social services.[8]

Secondly, on the basis of deepening existing scientific research collaborations, local universities should actively expand channels, strengthen academic exchanges, and enhance the level of international cooperative research. Universities in western China, in particular, should strengthen exchanges and cooperation with universities in countries along the Silk Road Economic Belt to build an innovation community characterized by shared ideas, interconnected factors, integrated chains, and smooth personnel flow.[9-10] They should deepen cooperation with existing research platforms of universities along the Silk Road Economic Belt, promote extensive collaboration with international institutions and enterprises, establish industry-university-research bases, elevate the level of international academic exchanges and cooperation, and enhance the international influence of scientific research.

4. Summary

As key components of the scientific and technological innovation system, universities and colleges should, on the one hand, fully leverage their role in personnel training to foster social and economic development.[11] On the other hand, they should continuously enhance their capacity for scientific and technological innovation, establish a seamless connection between basic research, applied research, and industrial development, effectively address core scientific issues and technological challenges, and drive the high-quality development of various sectors. They should comprehensively serve local economic and social development. With the ongoing advancement of science and technology, the integration of scientific and technological innovation and collaborative education will become increasingly close, and the models of collaborative education will continue to be innovated and refined. By establishing an industry-education integration community, co-building industrial research institutes with enterprises, and fostering an integrated innovation system, the deep integration of the talent chain, education chain, innovation chain, and industrial chain will be achieved. This deepened integration of scientific and technological innovation and collaborative education will continuously cultivate high-quality innovative talents, provide robust talent support and intellectual resources for scientific and technological innovation, facilitate continuous breakthroughs in scientific and technological innovation, and promote economic development and social harmony and stability.

Acknowledgement

Fund Project: Education Ministry's Employment-Education Integration Project Based on Supply and Demand (Project No.2024093038739); Gansu Province College Industry Support Plan Project (Project No. 2021CYZC-75); Gansu Provincial Education Science "14th Five-Year Plan" Project (Project No. GS [2024]GHB1507)

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