

**Research on the Path and Empowerment Countermeasures for Cultivating Innovative and Entrepreneurial Talents in Applied Colleges from the Perspective of Industry -University -Research Cooperation**

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**ABSTRACT**

*Industry-university-research cooperation is an important mission of higher education. It can meet the demands of multiple subjects, such as universities, scientific research institutes, and enterprises, and help integrate educational resources; thus, it is an important way to train technological innovation talent in application-oriented universities. Given the background of industry-university research, this paper analyzes the problems faced by application-oriented universities in the training of innovative talent in application-oriented universities, including the lagging concept of collaborative education, the immature collaborative education model and mechanism, the mismatch between the major setting and industry of collaborative education, and cooperation in collaborative education. We elaborated the development of innovative talent in application-oriented universities from the perspective of industry-university research from four aspects: improving the enthusiasm of the subject of collaborative education, deepening the supply-side reform of talent training, cobuilding an innovation platform for the integration of industry-university research, and building an information service platform for collaborative education. We propose three empowering countermeasures, namely, the creation of a good institutional environment, the establishment of a leading group for collaborative education, and the establishment of a joint industry-university-research fund, to provide beneficial suggestions for the training of high-quality innovative talent in application-oriented universities in China.*

**Keywords:** integration of industry-university-research; application-oriented universities; innovative talent; training path; empowerment strategy

## **1. Introduction**

Cultivating a large number of high-quality innovative talents with both ability and political integrity has become the core competitiveness to enhance international competitiveness and achieve the sustainable development of the country, as well as the long-term development plans of the country and the nation. In recent years, countries have introduced measures to strengthen the construction of scientific and technological innovation talent teams. In 2021, the “National Scientific Literacy Action Planning Outline (2021--2035)” issued by the State Council of China clearly stated that training plans for scientific and technological innovation reserve talent should be implemented. The construction of scientific and technological innovation talent has aroused great concern among the Communist Party of China Central Committee. In the report to the 20th National Congress of the Communist Party of China (CPC), it was stressed again that education, technology, and talent are the basic and strategic support for the comprehensive building of a socialist modern country, and it is clearly stated that “the comprehensive Improve the quality of independent training of talents and focus on cultivating top innovative talents”, pointing out the direction for how to do a good job in talent team building in the new era and on the new journey. The cultivation of innovative talent is a very important and urgent strategic task and has become an important way and an inevitable choice for the country to implement an innovation-driven development strategy and a strategy of rejuvenating the nation through science and education.

As the party and the state attach great importance to the training of scientific and technological innovation talent, the pain points and shortcomings in the talent training process have also become hot topics that cannot be ignored in all sectors of society. “Why do our schools always fail to cultivate outstanding scientific and technological innovation talent?” The famous “Qian Xuesen’s Question” pointed out the key problems in the training process of innovative talent, which sounded the wake-up call for the entire education community. They have sounded the clarion call for deepening systemic reforms in the education field in the new era. The collaboration of industry-university-research education is a fundamental requirement and an important way to deepen the reform of higher education, achieve the integration of industry and education, and cultivate innovative talent (Lin & Geng, 2019). The construction of an innovative talent training model that integrates industry-university-research institutes is in line with the positioning of colleges and universities in cultivating application-oriented talent that meets the needs of industrial restructuring and upgrading and promoting high-quality economic development and can also meet the needs of supply-side structural reforms of innovative talent. The higher education stage is a critical period for cultivating innovative talent. Application-oriented colleges and universities bear an important mission in promoting the layout of China's

modernization drive. Therefore, in the new journey of accelerating the construction of a strong education country, the leading role and functional advantages of higher education should be well played. Actively advancing the layout, closely connecting the industrial chain and the innovation chain, deepening the integration of production and education, enhancing the innovation capability of core technologies, striving to promote the integrated development of education, technology, and talent, and actively creating a collaborative community of industry-university-research institutions. However, in the practice of training innovative talent in colleges and universities, there are still prominent problems such as unclear mission orientation, insufficient training in practical ability and innovation ability, insufficient teaching staff, mismatches between major settings and industrial development layouts, and a lack of in-depth industry-university-research cooperation (Wu et al., 2022). In view of this, this paper explores how to promote the in-depth integration of industry-university-research institutions in application-oriented universities; the organic connection of the industrial chain, the talent chain and the innovation chain; and the formation of a development pattern with the overall integration of education and industry, which is critical for accelerating the transformation of scientific achievements and the optimization and upgrading of the industrial structure. Therefore, achieving high-quality economic development is highly important.

## **2. Problems facing the training of innovative talent in collaborative education**

### **2.1. The concept of collaborative education lags behind**

At present, the collaborative education strategy is the main way to cultivate innovative talent in developed countries, and the core implementation method is the collaborative training of industry-university-research institutes (Liu&Wang,2019). Because schools, scientific research institutions and enterprises have different organizational attributes, there are significant differences in goal orientation and task emphasis and focus, and the compatibility benefits are weak. Colleges and universities pay more attention to social benefits, mainly cultivating students' general basic abilities, while ignoring the cultivation of scientific research thinking, innovation ability, and industrial practice ability; although scientific research institutions have concentrated a large amount of innovation resources and a technological foundation, they have no economic benefits. Under the influence of market competition pressures such as these, scientific researchers pay more attention to scientific research and development (R&D) but are less active in the transformation and application of scientific achievements, lack emphasis, and have less participation in the construction of industry-university-research collaborative education in colleges and universities. With respect to scattering and fragmentation, most enterprises pay more attention to short-term economic benefits, lack long-term thinking on how to enhance their technological innovation capabilities and market competitiveness, and fail to realize the role of industry-university-research cooperation in laying a talent foundation for the future development

of enterprises. lack of initiative and enthusiasm to integrate into the construction of the industry-university-research personnel education system, and the emphasis on industry-university-research collaborative innovation remains to be increased.

## **2.2. The collaborative education model and mechanism are immature**

The innovation mechanism of industry-university-research cooperation can actively promote the transformation and industrialization of scientific research achievements and is conducive to the construction of a training mechanism for applied innovative talent (Yang, 2018) . To innovate the "community" of collaborative education and to build a mechanism for the integration of industry-university-research institutes, the education chain, industrial chain, supply chain, talent chain and value chain are needed to form a systematic and organic whole to jointly influence synergetic education. At present, a reasonable operation and management mechanism has not yet been formed among the main bodies of local governments, universities, enterprises, and scientific research institutes. Regional governments lack scientific and detailed guidance, coordination, and supervision mechanisms in terms of policy guidance, resource coordination, cooperation models, and guarantee mechanisms, and the effect of government-led intervention is not obvious. As a result, the main goal of educating people is the construction of an industry-university-research collaborative education system. There are prominent problems such as unclear positioning, unclear division of responsibilities, insufficient conditional guarantees, unstable sustainable cooperation, and imperfect mechanism construction. Specifically, in terms of school-enterprise cooperation, school-enterprise cooperation remains mostly on the surface, and it is difficult to carry out in depth, mainly because the interests and concerns of the various subjects in the collaborative education of industry-university-research have not been fully protected, and the root cause lies in institutional constraints. Although local governments have successively promulgated relevant policies and laws, the documents have not explained in detail the powers, benefits that can be obtained, and responsibilities that each subject of collaborative education should enjoy; as a result, a situation of "hot schools and cold enterprises" is common. Yes, in terms of the integration of industry and education, the policies and systems are not perfect, and the channels for the supply and demand of industry and education are not smooth, making it difficult for excellent market forces to be introduced into the classroom system in colleges and universities, and the effect of industry-university-research integration is not obvious.

## **2.3. The specialty setting of collaborative education does not match the industry**

On the basis of the high-quality development of the regional economy, exploring the deep integration of vocational education and the economic industry is one of the important tasks of vocational education reform and governance in the new era. Although China has decades of

practical and exploration experience in integrated education, Haining city also has published relevant documents, such as “Several Opinions on Deepening Industry--Education Integration” and “Implementation Plan for the Empowerment and Improvement of Vocational Education Integration (2023--2025)”, which have been issued successively; however, the current professional layout and industrial layout of industry-university-research collaborative education, “Two skins”, and the professional structure of industry-university-research institutes are not closely aligned with the development of industries, and the professional level is not enough to support the development needs of the regional industrial economy. At present, China is in a period of rapid economic upgrading and restructuring, but the major setting in colleges and universities still focuses on the traditional logic of major construction, pays little attention to the connotative development of majors, productive training, and R&D-oriented school–enterprise cooperation, and neglects industry. The practical needs of society, especially the demand for new types of compound talent, such as new materials, new technologies and new processes, have caused the professional setting to lag behind the regional economic and industrial structure. Innovation drives industry-university-research cooperation, and science and technology innovation empowers high-quality development. The major goals should focus on the needs of industrial development, the latest technological innovations, and the frontier development direction of the industry.

#### **2.4. Cooperation in collaborative education is not in-depth**

Firstly, the cooperation between application-oriented universities and enterprises is often characterized by low levels, short cycles, and small scales, and the depth and breadth of industry-university-research cooperation remain to be further increased. Although many colleges and universities have attempted to combine industry-university-research institutes, most of them use lower-level cooperation methods such as technology transfer, entrusted development, or cooperative development; they have not truly established professional experimental laboratories with enterprises and scientific research institutes. There are fewer application-oriented universities that use high-level cooperation methods, such as laboratories, cooperative R&D institutions, and innovation alliance centers. Although some strategic cooperation agreements have been signed for many school-enterprise cooperation projects, the agreements do not determine the substantive cooperation content. Therefore, the superficial cooperation model cannot effectively improve the innovation ability and practical ability of students. Moreover, industry–university–research cooperation is essentially centered on a specific project of the enterprise, and there is seldom a continuous series of technology research and development and a transformation of achievements, which is unfavorable for the long-term development of enterprises and makes it difficult to establish a long-term cooperation mechanism. Secondly, some colleges and universities have not invested enough in the construction of training venues,

and lack of innovation and entrepreneurship platforms such as crowdsourcing spaces, technical skills innovation platforms, and large innovation parks in the process of cultivating innovative and applied talents, which makes it difficult to support the in-depth development of industry-university-research cooperation.

### **3. Collaborative education and innovative talent training path**

#### **3.1. Improving the enthusiasm of the subject of collaborative education**

In the process of industry-university-research collaborative education, colleges and universities are key sources of innovative talent. As the source of innovation and the main position for talent training, colleges and universities should consciously shoulder the heavy responsibility of cultivating innovative talent, take initiative and cooperate with scientific research institutes and enterprises to build close cooperative relationships. First, we must break through the traditional concept of "university dominance" and realize the importance of talent training to meet the needs of regional economic development and industries. Therefore, it is particularly important to improve the degree of integration of the training of innovative talent in colleges and universities and the integration of industries and the strengthening of the collaborative education of teaching and scientific research. On the one hand, colleges and universities should fully understand the status quo of regional industrial development, analyze the industrial layout and industrial development needs, accurately grasp the trend and direction of industrial development, revise talent training programs around the needs of local industrial development, introduce industrial needs into classroom teaching, and implement talent training programs in a timely manner. and adjusting the curriculum system to cultivate high-quality innovative talent in line with the industrial layout; on the other hand, the advanced scientific research platform, cutting-edge scientific research projects and first-class innovation team of the institute provide good scientific research innovation practice resources and an environment for student training. Through the establishment of a deeper and more comprehensive science and education collaborative training mechanism with scientific research institutions, the mutual penetration and cross-integration of course learning and scientific research are promoted, the scientific literacy of students is improved, and the cultivation of innovation ability is strengthened.

As a talent examiner and a practical skill trainer, an enterprise should also be aware of the importance of the cyclic development of talent training for the long-term development of an enterprise. As talent centers, universities have rich scientific research resources and advantages in terms of human resources. Through strengthening technical cooperation and exchanges, universities can effectively enhance the production capacity and technological innovation capability of enterprises and accelerate the transformation and application of scientific achievements. Scientific and technological innovation and development can be realized through



the school-enterprise joint research group, and the core competitiveness of the enterprise can be enhanced. Similarly, the integration of science and education can improve not only the scientific research ability of students but also the R&D concentration and talent supply level of scientific research institutes, further improving the level of innovation at the source and realizing the cultivation of talent and the production of knowledge innovation.

### **3.2. Deepening the supply-side reform of talent training**

#### ***3.2.1. The reform of the curriculum system and teaching content should be strengthened***

The **first is to create high-level course resources**. Enterprises and scientific research institutes provide platforms, funding, technology, and teachers to meet the latest requirements for the cultivation of innovative talent, the innovation achievements of cutting-edge science and technology, and the latest courses of industries and technologies in the new era. Progress will be integrated into the teaching process, the curriculum system will be reconstructed, the new kinetic energy of the opening and development of education will be shaped, the joint development of teaching resources such as textbooks and classroom cases, the collaborative update of teaching content, and the acceleration of the construction of the teaching resource bank to support the development needs of the industry; **the second is to expand the classroom space**, and in the process of school-enterprise cooperation, science and education integration, and work-study integration, we will explore teaching methods such as “design-experience teaching” and “project-based courses” to help promote the integration of industry-university-research and enhance teaching efficiency; and **third, organize and implement practical teaching activities** to use practice as the basis. Learning-oriented and ability-based methods, as value yardsticks, focus on the combination of learning and application and the integration of knowledge and action. In accordance with the talent training model of “theory-practice-theory-practice”, theoretical teaching and production practice training are alternately conducted, the course structure is adjusted, and the student’s ability to identify problems, the ability to analyze and solve problems, and the fourth is to explore a training model that is conducive to individual development, respect and recognize the individual differences of students, and provide a variety of curriculum systems and learning opportunities so that students can flexibly choose studies according to their employment interests to expand the learning space for students to develop and choose independently.

#### ***3.2.2. The integration of industry-university-research faculty should be strengthened***

Improving the practical ability of full-time teachers in colleges and universities is the key to improving the education quality of application-oriented colleges and universities. Enterprises and research institutes provide training funds and resources. Universities, research institutes and

enterprises jointly organize and carry out skills training, horizontal project research, academic sharing, scientific research exchanges and other work for full-time teachers to understand and grasp the latest market demand, industry, etc. To update teaching content in a timely manner, reform teaching methods, optimize classroom teaching and match talent supply and industry demand; formulate management measures for the practices of full-time teachers in enterprises and scientific research institutions for investigation and observation, posttraining or fixed-post practice, participation in product R&D and design and technological innovation; clarify the implementation rules and assessment mechanism; and promote the inheritance of skills and the promotion of achievements by strengthening the practice and scientific research ability of full-time teachers. To better serve education and teaching and improve the quality of talent training.

At the same time, on the basis of the school-running characteristics of the industry-university-research integration model, high-quality teaching resources from research institutes and industry mentors are selected to build a high-level faculty team consisting of full-time teachers, industry mentors and scientific research experts. Through the implementation of the “post teacher” system, a group of industry mentors with rich practical experience and industry background as well as high-level scientific research experts from various scientific research institutes have come to the podium, which has greatly improved the level of the dedicated teaching team. Industry mentors and scientific research experts integrate their wisdom, concepts, latest industrial needs, technological development, and cutting-edge scientific progress into their classroom teaching, enabling students to stand at the forefront of industrial development and scientific research.

In addition, colleges and universities should implement the supervisor responsibility system in the integration of industry-university-research institutes and improve the institutions related to the construction of the teaching staff, including the standardization of the selection process of on-campus full-time teachers, industry supervisors and scientific research supervisors; the improvement and strengthening of the qualification review of supervisors; the establishment of supervisor postadjustment and enrollment quota dynamic adjustment mechanisms; the revision of the supervisor’s work regulations to implement the supervisor postresponsibility system; the construction of teachers’ ethics and the level of cultivating talent through morality; and the promotion of the people-centered incentive system to stimulate the enthusiasm and vitality of the individual to the maximum extent.

### ***3.2.3. The construction of practice bases on and off campus should be strengthened***

A comprehensive practice base that integrates scientific research, education, and production has the functions of talent training, business incubation, technology research and development, and achievement transformation. It can provide all-round support and services for industry-



university-research cooperation and is an important factor in promoting the deep integration of industry-university-research institutes. It can effectively promote the rapid development of emerging industries, the transformation and application of scientific achievements and the cultivation of high-quality innovative talent. Enterprises and scientific research institutes provide funds, platforms, software and hardware equipment or scientific research facilities to establish open scientific research bases, key laboratory incubation bases and practice bases that integrate the functions of talent training, scientific research and technical services. We will strive to play the supporting role of the base in the integration of industry and education and the integration of science and education to promote the development of scientific research and internship training for students; cultivate high-quality innovative talent with an innovative spirit, practical ability and employment competitiveness; and enhance the effectiveness of practical education.

### **3.3. Coconstruction of an innovation platform for the integration of industry, university, and research institutes**

#### ***3.3.1. Construction of several integrated innovation platforms***

In the report to the 20th National Congress of the Communist Party of China (CPC), General Secretary Xi Jinping emphasized the following: “strengthening the deep integration of industry-university-research research led by enterprises, strengthening the goal orientation, and improving the transformation and industrialization of scientific and technological achievements.” Therefore, enterprise-led integration of industry-university-research institutes is an important aspect of improving enterprise innovation ability. The key to shaping high-quality economic development. The industry-university-research integrated innovation platform is an important carrier that gathers the latest technological achievements, resources, and talents and carries out technological innovation activities. The integrated development of the industrial and innovation chains has an important supporting role (Su, 2023). To unblock the last mile of technological innovation, we need to establish and optimize a number of innovation platform carriers in the physical space to achieve the organic integration of resources, technology, personnel, and management. Committed to the comprehensive and rapid development of disciplines, scientific research, and industry. Local universities, scientific research institutions and enterprises should jointly establish innovation alliances, engineering research centers, key laboratories, enterprise technology R&D centers, innovation practice bases and other industry-university-research integrated innovation platforms for joint planning, construction, operation and management to strengthen industry-university-research collaborative innovation. Scientific and technological innovation talent, which can address critical problems, promote the precise docking of resource services and development needs, and accelerate the transformation of scientific and technological achievements, should be continuously cultivated.

### ***3.3.2. Promote a number of integrated innovation projects***

To accelerate the "double first-class" construction of colleges and universities, further deepen the reform of industry-education integration, cultivate innovative talent in the technical field, and win the battle against key core technologies, the state should vigorously promote the construction of an innovation platform project on the integration of industry-university-research to promote student training, scientific research and integrate innovation in three aspects of industrial transformation. The project is oriented to the planning and layout of industrial agglomerations; promotes close collaboration among universities, research institutes and enterprises; promotes the coconstruction and sharing of resources; and provides comprehensive education subjects for collaborative education subjects to carry out innovative talent training, discipline construction, scientific research and industrial innovation and development. As an innovation platform, scientific research drives the development of disciplines, and the level of student training and the value of scientific research results are brought into play through industrial transformation. It is highly important for further promoting the organic integration of higher education, scientific research and industrial development and contributes to the transformation and upgrading of the industrial structure and the "double first-class" initiative. The construction of a university that serves the national strategy and the realization of national rejuvenation has solid disciplinary conditions and a talent base.

### **3.4. Construction of a collaborative education information service platform**

The establishment and supervision of a collaborative education information service platform can be led by the local government. This platform is an industry-university-research platform that integrates information sharing, exchange and services. The value of resources such as scientific and technological achievements, patented technologies, and talents of institutes and universities should be fully realized to meet the development needs of local enterprises and industries. By building an open gathering place for talent resources, cutting-edge technological achievements, technology solution resources, capital resources and technology release needs, it will provide both supply and demand sides with a variety of resources for optimization, which can help enterprises enhance their technological innovation capabilities and serve enterprises in innovation R&D, problems encountered in the process of R&D outsourcing, equipment upgrading and transformation, enterprise restructuring, and product iterative upgrades promote the transformation and application of technological innovation achievements. Therefore, the establishment of an information service platform can eliminate information islands and resource islands and can effectively solve the difficulty of promoting and implementing cooperation between schools and enterprises. High-quality development is highly important.

## **4. Empowerment measures**

### **4.1. Creating a favorable institutional environment**

Government departments should strengthen the formulation and revision of relevant policies and regulations to strengthen the in-depth integration of industry, university, and research institutes. In-depth promotion of the collaborative innovation of “government, industry, learning, research and application” should be carried out, and efforts should be made to solve issues concerning enterprises’ science and technology talent policy, the correlation between scientific research projects and market demand, and scientific research assessment indicators to reform the talent evaluation mechanism and establish and improve the scientific research mechanism oriented by innovation ability, talent quality, and contribution. The vitality of innovation should be stimulated, and a comprehensive evaluation system that can effectively promote the dedicated research and innovation of scientific and technological talent should be developed. The focus is on evaluating the effectiveness of the transformation of scientific and technological achievements and the development of scientific and technological personnel training plans to provide solid institutional support and guarantee the transformation of scientific and technological achievements and the cooperation of industry-university-research institutes. Talent training policies should focus on the implementation of major national scientific and technological tasks, concentrate on solving the prominent core technical issues facing key industrial chains, and consider the application of scientific and technological achievements and the effective implementation of goals and tasks as the criteria for evaluating excellent talent.

We must train, introduce and make good use of talent in an all-round way and implement the strategy of strengthening the country with talent. First, in terms of talent introduction, a special talent fund can be set up to build a cross-border integrated innovation platform, and through the implementation of models such as “platform + talent” or “project + talent”, the social service system to promote industry-university-research cooperation can be improved, and the talent chain can be used as a driving force to promote the in-depth cross-integration of the industrial chain, the innovation chain, and the education chain. Second, in terms of talent employment, we must adhere to the focus on application, make good use of various types of strategic talent, and implement the principle of “the horse race is not the same as the horse”. Systems such as “revealing the list and taking the lead” have stimulated the vitality of scientific and technological innovation so that more scientific personnel with real talents and practical learning can play their roles regardless of seniority. Moreover, it is necessary to build platforms for various types of talent to start businesses, establish and improve a benefit distribution mechanism that can fully reflect the value of innovation factors such as knowledge and technology, improve innovation incentives and guarantee mechanisms. Through clear supporting policies and a sound system, the problems encountered in industry–university–research cooperation are effectively solved, and the

policy basis for the establishment of long-term and stable cooperative relationships among the main bodies is provided.

#### **4.2. Establishment of a leading group for collaborative education**

To ensure that the parties in the industry-university-research collaboration form a mutually beneficial and win-win cooperative relationship with a broader, deeper, and more lasting degree and to protect the interests of the various parties involved in the industry-university-research institute, the overall planning and regulation role of the government needs to be fully played, and local government departments should be established. Led by the education department, market management department, human resources and social security department and relevant committees and offices, the Industry – University –Research Collaboration Leading Group is formed to manage resource synergy, power and responsibility relationships, benefit distribution, and joint training jointly. The implementation of various construction tasks of industry-university-research institutes should be regularly performed; cooperative development plans should be formulated; the work direction, objectives and priorities of industry-university-research institute cooperation should be clarified; effective communication with education departments, technology departments and industrial departments at all levels should be strengthened; the leading role of the government should be coordinated; the difficulties encountered in the collaborative education of industry-university-research institutes should be overcome; and the atmosphere for industry-university-research cooperation should be constantly optimized.

#### **4.3. Establishment of industry–university–research joint funds**

Relevant departments of the local government can set up industry-university-research joint funds to provide investment support to university scientific research projects or industry-university-research cooperation technological innovation projects with good development potential, with the objectives of promoting industry-university-research collaborative innovation, promoting the industrialization of scientific and technological achievements, and realizing the benefits of technological innovation and society. The close integration of economic development. The fund should have a special management organization responsible for the standardized use and management of the funds and rationally distribute the project funds on the basis of evaluation factors such as innovation, scientific achievements, team strength and the economic benefits of the projects. Routine supervision and review during the implementation of fund-funded projects require project leaders to provide detailed project plans and progress reports and regularly monitor and evaluate project progress and costs to ensure that industry-university-research cooperation projects are completed on time and on budgets.

Industry-university-research joint funds can help researchers in universities and scientific research institutes increase the transformation rate of scientific achievements and empower the innovation and development of industries; support the construction of technological innovation platforms and scientific research centers in colleges and universities, which is conducive to the in-depth organized scientific research in universities and the acceleration of the high-quality development of technological innovation in colleges and universities; finally, funds can be used to set up awards related to industry-university-research cooperation to commend those in enterprises, scientific research institutes, universities and other units and individuals who have outstanding performance in the process of industry-university-research cooperation and who have made significant contributions to economic and social benefits and who have good leadership and demonstration roles in innovation.

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