

# *Research on Industry-Education Integration and Collaborative Innovation from the Perspective of Five-Industry Linkage*

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**Abstract:** The paper comprehensively examines industry-education integration and collaborative innovation through the lens of the five-industry linkage theory. It covers theoretical foundations, practical cases, influencing factors, and effectiveness evaluation of these concepts. Furthermore, it offers strategies and recommendations to foster industry-education integration and collaborative innovation. The analysis highlights the pivotal role of these phenomena in talent development, enterprise innovation, and industrial progress. Key determinants such as policy environment, cultural elements, and organizational mechanisms significantly shape industry-education integration and collaborative innovation. Successful practical cases provide valuable insights for further research. Future studies should focus on refining mechanisms and models, intensifying applied research efforts, and enhancing impact evaluation, thereby providing both theoretical and practical support for industrial upgrading and economic development.

## 1. Introduction

Industrial restructuring, technological innovation, talent development, and entrepreneurship have emerged as key issues for national economic growth in today's rapidly developing world. In this context, integrating production and education, along with collaborative innovation, has become vital for driving industrial development and fostering talent cultivation <sup>[1]</sup>.

As society and the economy continue to develop and the knowledge economy rapidly advances, traditional education models have shown their inability to meet the demands of the current era. Integrating production and education, along with collaborative innovation, has emerged to address this issue. Close cooperation and collaboration across various fields such as industry, education, and scientific research have facilitated knowledge transfer and innovative leaps, providing robust support for industrial upgrading and innovation <sup>[2]</sup>.

Integrating production and education, along with collaborative innovation, not only promotes

industrial restructuring and technological progress but also enhances the quality and efficiency of talent development <sup>[1]</sup>. This bridges the gap between industry and education, laying a solid foundation for the sustainable development of the economy and society. Therefore, conducting in-depth research on the practical paths and mechanisms of integrating production and education and fostering collaborative innovation is of great theoretical and practical significance for promoting industrial structure optimization, driving technological innovation, and talent development <sup>[2]</sup>.

## **2. Five-Industry Linkage Theory and Its Application**

### **2.1. Overview of the Five-Industry Linkage Theory**

The theory of five-industry linkage is a comprehensive theoretical framework that encompasses the interrelationships and interactions among industry, sector, enterprise, occupation, and profession <sup>[3]</sup>. In this theory, industry is considered a collective term for economic activities, encompassing related sectors and enterprises. Sectors consist of enterprises or institutions with similarities in specific fields, representing the subdivision of industries. Enterprises, as the main drivers of industrial development, are the fundamental units of business activities. Occupations refer to specific jobs or fields of work that individuals engage in, reflecting their roles in economic activities. Professions are disciplinary directions established to meet occupational needs and serve as the basic units for talent cultivation and education. The interrelationships among these five levels form the industrial ecosystem, which is crucial for promoting economic development, nurturing talent, and achieving industrial upgrading.

### **2.2. Theoretical Basis of Five-Industry Linkage in Industry-Education Integration**

In the practice of integrating industry and education, the theory of five-industry linkage serves as a theoretical foundation <sup>[3]</sup>. Through industry-education integration, enterprises can collaborate with educational institutions to cultivate talents that meet the requirements of professions and specialties based on industry and enterprise needs. This collaboration helps enterprises acquire the professional talents they need and also facilitates updating curriculum settings and teaching contents in educational institutions to better align with the needs of industrial development.

### **2.3. Theoretical Analysis of Collaborative Innovation from the Perspective of Five-Industry Linkage**

From the perspective of five-industry linkage, collaborative innovation has emerged as a vital approach to driving industrial development and fostering economic growth <sup>[4]</sup>. Cooperation between industries and sectors promotes the sharing of technology and resources, while cooperation between enterprises and occupations facilitates talent mobility and career development. Collaboration between educational institutions and professions fosters the inheritance and innovation of knowledge and skills. Such cross-disciplinary and cross-level collaborative innovation provides a strong impetus for the development of industrial chains and facilitates the upgrading and optimization of the industrial ecosystem.

## **3. Case study of the integration of industry and education and collaborative innovation**

### **3.1. The concept and characteristics of the integration of industry and education**

Industry-education integration refers to a model in which industry and education collaborate to

promote talent development, scientific and technological innovation, and industrial growth through cooperation, resource sharing, and information exchange<sup>[5]</sup>. Its characteristics include close integration, collaboration, resource sharing, demand-driven, and innovation-focused approaches. Industry-education integration aims to closely align industry and education, align education and training with industry needs, jointly develop and share educational resources, and enhance the quality and efficiency of education. Additionally, industry-education integration adjusts education and training content and direction based on market demand and industrial trends, facilitates the transformation and application of scientific and technological advancements, and drives industrial innovation and upgrading.

### **3.2. Practical cases of integration of industry and education from the perspective of the linkage of five industries**

From the perspective of the linkage of the five industries, practical cases of industry-education integration demonstrate the close relationship and interaction among industries, enterprises, occupations, and professions <sup>[6]</sup>. For instance, a renowned information technology company has collaborated with a local higher education institution to establish an information technology talent training program. In this initiative, the company supplies advanced technical equipment and practice platforms, while the university offers professional teaching resources and instructors. Through this collaboration, students can gain exposure to the latest technology and industry trends, enhancing their practical skills and fostering innovation. Additionally, the company has acquired talent reserves and technical support, thereby fostering innovation and development within the enterprise.

### **3.3. Application and effect analysis of collaborative innovation in the integration of industry and education**

Collaborative innovation is crucial in integrating industry and education, facilitating the deepening of their integration and the optimization and upgrading of the industrial chain <sup>[7]</sup>. For instance, a multinational company has collaborated with local universities on talent development and research cooperation initiatives. In such projects, enterprises propose technical needs and R&D directions, while universities coordinate the involvement of teachers and students in scientific research endeavours. Through this collaboration, not only does it promote the transformation and application of scientific research results, but it also offers students increased practical and employment opportunities. Additionally, the company has acquired research and development results for new technologies and products, enhancing its competitiveness and innovation capability. This collaborative innovation model offers a new development pathway for industry-education integration, achieving the objective of deep integration among industry, university, and research.

## **4. Analysis of the influencing factors of industry-education integration and collaborative innovation**

### **4.1. The impact of the policy environment on the integration of industry and education and collaborative innovation**

The policy environment plays a crucial role in guiding and supporting the integration of industry and education, as well as collaborative innovation. Governments formulate relevant policies and regulations to provide legal assurances and policy support for industry-education integration, while also encouraging collaboration between enterprises and educational institutions. For instance, governments can implement preferential tax policies to incentivize enterprises to invest more in

education and training. They can also establish industry-university-research cooperation bases to offer financial and venue support. Furthermore, they can formulate policy guidance on talent training and scientific and technological innovation to steer industry-education integration and collaborative innovation in the appropriate direction<sup>[1]</sup>.

#### **4.2. The role of cultural factors in the integration of industry and education and collaborative innovation<sup>[2]</sup>**

Cultural factors are pivotal in the integration of industry and education, as well as collaborative innovation. A positive cultural atmosphere fosters communication and collaboration between industry and education, enhancing mutual trust and fostering willingness to cooperate. Cultural factors also influence the values and behaviours of enterprises and educational institutions, directly impacting the effectiveness of industry-education integration and collaborative innovation. Therefore, in promoting industry-education integration and collaborative innovation, it is essential to consider the role of cultural factors, enhance cultural exchanges and integration, and cultivate a conducive atmosphere for cooperation.

#### **4.3. The role of organizational mechanism in promoting the integration of industry and education and collaborative innovation**

An effective organizational mechanism is crucial for promoting the integration of industry and education, as well as collaborative innovation. An effective organizational mechanism is crucial for promoting the integration of industry and education, as well as collaborative innovation. For instance, the government and relevant authorities should consider setting up a leading group or specialized institutions for industry-education integration to plan and coordinate collaborative innovation efforts, establishing an information platform and resource-sharing mechanism to facilitate information exchange and resource-sharing between industry and education, and implementing a performance evaluation mechanism to incentivize cooperation between enterprises and educational institutions, thereby enhancing the enthusiasm and efficiency of cooperation. A well-functioning organizational mechanism can offer institutional assurance and organizational support for industry-education integration and collaborative innovation, thereby fostering industrial development and economic growth<sup>[3]</sup>.

### **5. Evaluation of the effect of the integration of industry and education and collaborative innovation**

#### **5.1. Evaluation of the impact of industry-education integration and collaborative innovation on talent training**

Industry-education integration and collaborative innovation play crucial roles in promoting talent development. Firstly, through collaboration with enterprises in education and training programs, educational institutions can gain a deeper understanding of market demand and industry trends, allowing for adjustments in educational content and training direction to cultivate professionals better aligned with market needs. Secondly, collaborating with enterprises on practical and scientific research projects provides students with enhanced practical opportunities and research platforms, thereby improving their practical skills and fostering innovation awareness. Additionally, collaboration between enterprises and educational institutions can offer students increased employment opportunities and development prospects, achieving a win-win outcome for industry-education integration.

## **5.2. Evaluation of the impact of the integration of industry and education and collaborative innovation on the innovation ability of enterprises**

Industry-education integration and collaborative innovation have positively contributed to enhancing enterprise innovation capabilities. Through collaboration with educational institutions on scientific research projects, enterprises can access additional scientific research resources and talent support, facilitating the acceleration of research, development, and promotion of new technologies and products. Additionally, collaboration with educational institutions can promote technological renewal and management innovation within enterprises, enhancing their competitiveness and market share. Therefore, industry-education integration and collaborative innovation are of significant importance in enhancing enterprise innovation capabilities, providing new momentum and assurance for sustainable enterprise development<sup>[5]</sup>.

## **5.3. Evaluation of the impact of industry-education integration and collaborative innovation on industrial development**

Industry-education integration and collaborative innovation play a significant role in promoting industrial development. Firstly, through collaboration with educational institutions on scientific research projects, the industry can acquire more scientific and technological advancements, thereby promoting technological progress and industrial upgrading. Secondly, industry-education integration provides additional talent reserves and technical support for the industry, addressing talent shortages and technical barriers, and thereby offering strong support for industry development. Additionally, industry-education integration has promoted the optimization of the industrial chain and the formation of industrial clusters, enhancing the overall competitiveness and developmental level of the industry. Therefore, industry-education integration and collaborative innovation play a crucial role in promoting industrial development, providing new impetus and support for the healthy and sustainable growth of the industry.

## **6. Strategies and suggestions for the integration of industry and education and collaborative innovation**

### **6.1. Policy recommendations to promote the integration of industry and education and collaborative innovation**

To promote industry-education integration and collaborative innovation, various policy measures should be implemented. Firstly, the government should issue policy documents supporting industry-education integration and collaborative innovation, clarifying relevant policies and regulations, and providing legal assurances and policy support for industry-education cooperation. Secondly, the government should establish an incentive mechanism to encourage enterprises and educational institutions to actively collaborate, providing suitable incentives and financial support for collaboration projects. Additionally, there should be an increase in financial investment to establish platforms and facilities for industry-education integration and collaborative innovation. These platforms and facilities will support the development of scientific research and practical projects. Furthermore, it is crucial to establish a robust supervision mechanism and evaluation system to oversee and assess the impact of industry-education integration and collaborative innovation. This system will promptly identify and address any issues that may arise during the implementation process.

## **6.2. Suggestions for improving the organizational mechanism of industry-education integration and collaborative innovation**

To enhance the efficiency and effectiveness of industry-education integration and collaborative innovation, it is imperative to bolster the development of organizational mechanisms<sup>[1]</sup>. Firstly, it is necessary to establish a multi-level and diversified organizational structure for collaborative innovation between industry and education, including joint laboratories, industrial technology innovation alliances, and research cooperation bases. This will provide solid mechanism guarantees for the deep integration and innovative cooperation between industry and academia. Secondly, relevant departments and institutions should establish specialized management bodies responsible for overall planning, organizational coordination, and resource integration, ensuring the orderly and efficient advancement of collaborative innovation between industry and education. Meanwhile, establishing mechanisms for information sharing and communication will facilitate the circulation of information resources between industry and education, enhancing the quality and efficiency of cooperation. Lastly, enterprises, universities, and training institutions should intensify efforts in talent cultivation and skill enhancement, preparing internationally competent talents for collaborative innovation between industry and education and providing intellectual support and talent assurance for industrial development.

## **6.3. Strengthen the cultural construction of integration of industry and education and collaborative innovation<sup>[2]</sup>**

Cultural development plays a crucial role in fostering industry-education integration and collaborative innovation. Firstly, governments, businesses, and universities should cultivate a culture of mutually beneficial cooperation, promoting an open, inclusive, and mutually beneficial collaborative mindset to facilitate active interaction and collaboration between the industry and education sectors. Secondly, it's essential to establish incentive mechanisms and a culture that inspires employees and educators to actively engage in collaborative activities, thereby enhancing the drive and enthusiasm for collaborative innovation. Lastly, relevant authorities should intensify efforts in publicity and promotion, widely showcasing exemplary cases and advanced experiences of industry-education integration and collaborative innovation. By setting examples and models, they can foster a positive social atmosphere and public opinion environment, thus creating a conducive cultural environment for deepening industry-education integration and collaborative innovation.

## **7. Conclusions and prospects**

### **7.1. Summary of research conclusions**

Industry-education integration and collaborative innovation are crucial pathways for promoting industrial development and talent cultivation, playing significant roles in talent development, enhancing enterprise innovation capabilities, and fostering industrial growth<sup>[3]</sup>. In practice, industry-education integration and collaborative innovation promote the optimization and upgrading of industrial structure, enhance the innovation capabilities and competitiveness of enterprises, and offer additional practical opportunities and development platforms for talent development. Policy, organizational mechanisms, and cultural factors are pivotal in promoting and implementing industry-education integration and collaborative innovation. This necessitates concerted efforts from governments, enterprises, and educational institutions to enhance cooperation and exchanges, fostering a conducive environment and collaborative atmosphere.

## 7.2. Prospects for future research on the integration of industry and education and collaborative innovation

In the future, industry-education integration and collaborative innovation will remain significant topics of interest in both academia and industry, necessitating further research and discussion. Firstly, there is a need to delve into the mechanisms and models of industry-education integration and collaborative innovation to enhance cooperation quality and efficiency. Secondly, applied research in these areas should be strengthened across various industries and fields to cater to diverse sectoral needs. Additionally, efforts should focus on evaluating the impact of these initiatives on social and economic development, including their role in fostering economic growth, employment, entrepreneurship, and social stability.

In summary, future research should comprehensively explore industry-education integration and collaborative innovation, providing both theoretical and practical support for advancing industrial upgrading and economic development.

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### References

- [1] Liao, X., Fu, Z., Huang, Z., Li, Z., Pan, Q., Qian, L., ... & Li, X. (2021). Exploration and practice of "integration of production and education, integration of science and education and integration of theory and practice" in medical talent training. *Advances in Applied Sociology*, 11(6), 308-314.
- [2] Sun, J., & Yao, X. (2022). Research on application-oriented undergraduate education based on the deep integration of industry and education. *International Journal of Education and Humanities*, 3(1), 55-58.
- [3] Tao, Y., & Feng, J. (2021). Research on the "3+1" Talent Training Mode of Application-oriented Undergraduate Education. In *2021 2nd Asia-Pacific Conference on Image Processing, Electronics and Computers (IPEC2021)* (pp. 798-801). Dalian, China: ACM.
- [4] Gao, Z., & Wu, B. (2021, March). Research on the innovation system of university production and education integration based on computer big data. In *IOP Conference Series: Earth and Environmental Science* (Vol. 692, No. 2, p. 022025). IOP Publishing.
- [5] Zhang, F., & Wu, Y. (2020). Formation mechanism of knowledge stickiness in the collaborative innovation of industry-university-research. *Tehnički vjesnik*, 27(5), 1452-1460.
- [6] Olawale, D., Talaga, P., Wolverson, R., Hashimoto, M., & Emery, J. (2021, October). Collaborative Innovation: A framework for promoting innovation-driven entrepreneurship across campus. In *2021 IEEE Frontiers in Education Conference (FIE)* (pp. 1-8). IEEE.
- [7] Beck, S., Bergholtz, C., Bogers, M., Brasseur, T. M., Conradsen, M. L., Di Marco, D., ... & Xu, S. M. (2022). The Open Innovation in Science research field: a collaborative conceptualisation approach. *Industry and Innovation*, 29(2), 136-185.