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Research on Long-Term Mechanism of School-Enterprise Cooperation in Vocational Education Based on Technical Knowledge Base

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Abstract: Technological innovation-driven industrial transformation serves as a fundamental catalyst for the advancement of school-enterprise collaboration in vocational education. In the context of rapidly emerging industries, this study proposes an innovative cooperative model in which schools and enterprises jointly establish and share technology knowledge repositories, forming a collaborative framework that facilitates continuous knowledge exchange and practical skill development. The research investigates strategies for constructing sustainable mechanisms grounded in these repositories, emphasizing their role in fostering long-term, mutually beneficial partnerships. Initially, the study examines the strategic significance of technology knowledge repositories in enhancing vocational education collaboration, highlighting how systematic knowledge management can strengthen the integration of theoretical learning with industry practice. It then outlines concrete approaches to building enduring collaboration frameworks, focusing on the enhancement of organizational safeguards, the design of effective incentive structures, the promotion of stakeholder consensus, and the implementation of rigorous outcome evaluation and feedback mechanisms. By integrating these elements, the study establishes a comprehensive and sustainable operational system that not only supports continuous innovation but also enhances the capacity of vocational institutions and enterprises to adapt to evolving technological and industrial landscapes.

Keywords: vocational education; school-enterprise cooperation; technical knowledge base; long-term mechanism

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1. Introduction

Technological innovation acts as a key driver of industrial transformation, giving rise to new industries, evolving business models, and innovative operational frameworks. As emerging technologies, advanced production processes, and updated industry standards continue to develop, the demand for high-quality skilled talent has become increasingly stringent. In response, modern vocational education must undergo comprehensive reform and adopt strategic development measures to meet the rapidly changing needs of industries. The Ministry of Education's Office issued the "Notice on Key Tasks for Accelerating the Reform of Modern Vocational Education System," which outlines eleven priority initiatives aimed at strengthening the integration of education and industry. Among these, the top four initiatives emphasize establishing municipal industry-education alliances, creating industry-specific integration communities, developing open regional practice centers, and continuously building professional teaching resource repositories [1]. These initiatives reflect a national strategic commitment to fostering coordinated industry-education integration, highlighting the importance of aligning vocational education with industrial demands.

From the perspective of technology transfer in school-enterprise collaboration, this study proposes a model centered on technology knowledge repositories to enhance vocational education partnerships. Recognizing the pivotal role of technology transfer in such collaborations, establishing knowledge repositories through systematic absorption, codification, and transformation of technological knowledge ensures precise alignment between educational resources and corporate requirements. These repositories serve as a bridge connecting academic training with practical industry needs, enabling schools to cultivate talent equipped with relevant skills while supporting enterprises in technological innovation. Furthermore, technology knowledge repositories provide a structured framework that facilitates diversified collaboration, including joint project partnerships, curriculum co-development, faculty professional development, employee training programs, and provision of technical services. By integrating these elements, the repositories create sustained momentum for school-enterprise cooperation, fostering long-term partnerships that continuously adapt to industrial evolution and technological advancement. Ultimately, this repository-based model not only strengthens the synergy between vocational education and industry but also contributes to building a resilient ecosystem for technological innovation, knowledge dissemination, and workforce development in emerging sectors.

2. The Internal Connection between Technological Innovation, Industrial Transformation and School-Enterprise Cooperation

2.1. Technological Innovation Drives Industrial Transformation

Since the beginning of China's reform and opening-up, the nation's industrial development has progressed through four major stages: mechanization, automation, digitalization, and the current era of intelligent manufacturing. In each stage, technological innovation has served as the primary driving force, reshaping production methods, organizational structures, and operational models. Technological advancement stimulates industrial evolution, which in turn generates new knowledge, processes, and technologies, forming novel production paradigms. This dynamic establishes a self-reinforcing cycle, in which continuous innovation accelerates industrial upgrading, improves production efficiency, and fosters the emergence of new sectors. Over time, such a cycle enhances national competitiveness and promotes sustainable economic growth.

Moreover, technological innovation encourages cross-disciplinary collaboration, enabling enterprises and research institutions to jointly develop and apply advanced technologies. The interaction between innovation and industrial transformation creates not only immediate improvements in production capabilities but also long-term momentum for emerging industries, including high-tech manufacturing, digital services, and intelligent systems. As industries become more technologically sophisticated, the demand for adaptive, multi-skilled talent rises, directly linking industrial transformation to the strategic objectives of vocational education.

2.2. Industrial Reform Promotes the Development of Vocational Education

Vocational education, as a system closely aligned with industrial development, primarily aims to cultivate technically skilled professionals capable of meeting frontline production demands. With technological innovation driving industrial transformation, enterprises increasingly require workers with higher technical proficiency, interdisciplinary knowledge, and problem-solving abilities. In response, vocational education has evolved from traditional secondary-level training to a comprehensive framework encompassing both secondary and higher vocational education.

This evolution enables institutions to deliver curricula that integrate theoretical knowledge with practical application, equipping students with the competencies necessary for emerging industries. The relationship between vocational education and industrial reform is reciprocal: industrial innovation stimulates educational adaptation,

while a steady supply of skilled professionals accelerates industrial upgrading. Through this mutually reinforcing loop, vocational education not only addresses immediate workforce needs but also anticipates future technological trends, providing a sustainable pipeline of talent to support ongoing industrial transformation. Additionally, vocational education has begun incorporating experiential learning, industry-led projects, and practical workshops into curricula, further strengthening the connection between academic training and evolving industrial requirements.

2.3. Industrial Transformation Gives Birth to a New Form of School-Enterprise Cooperation

Strengthening school-enterprise cooperation is a fundamental strategy for advancing vocational education [2]. With continuous technological innovation, the nature of such collaborations has undergone profound change. Initially centered on practical teaching and skill acquisition, modern school-enterprise cooperation has expanded into diversified models, including order-based training, work-study alternation, and modern apprenticeship systems. The rise of next-generation information technologies has accelerated industrial transformation, driving enterprises to seek multi-skilled technical professionals capable of operating across disciplines.

In this context, vocational education cooperation has entered a new era characterized by multi-stakeholder engagement, involving governments, industry organizations, educational institutions, research bodies, and upstream and downstream enterprises along the technology chain. Such partnerships foster innovative industry-education integration models that closely align educational outcomes with industrial needs [1].

Emerging cooperative models enable the cross-regional pooling of resources, promoting optimal industrial-educational layouts and efficient service coordination. By integrating diverse resources across geographic and organizational boundaries, these collaborations support the creation of new organizational forms that sustain development at the industry-wide level. Cross-regional integration enhances curriculum-industry matching, strengthens technical service delivery, and facilitates long-term collaborative networks that drive continuous innovation.

Furthermore, technology knowledge repositories and shared practical platforms play a critical role in these partnerships. They not only serve as repositories of accumulated expertise but also function as dynamic mechanisms for talent development, curriculum innovation, and knowledge dissemination. By providing structured frameworks for knowledge sharing and co-creation, these platforms ensure that vocational education remains responsive to industrial and technological changes. Ultimately, this new form of school-enterprise cooperation cultivates highly skilled, adaptable professionals who are capable of supporting industrial transformation, promoting continuous innovation, and sustaining long-term industry-education integration.

3. The Connotation of Technical Knowledge Base and Its Positioning in School-Enterprise Cooperation

3.1. The Connotation of the School-Enterprise Cooperative Technology Knowledge Base

As industries continue to undergo rapid transformation, knowledge and technologies evolve at an unprecedented pace. To effectively respond to these changes, it is essential to systematically collect, organize, codify, and structure emerging technologies and knowledge, thereby establishing a vocational education technical knowledge repository. Such a repository functions as an integrated database, consolidating enterprise technical resources, expert expertise, technical standards, and innovative achievements into a unified framework.

The technical knowledge contained within the knowledge base primarily originates from three sources: first, innovative technologies, processes, and standards developed by research institutions and upstream enterprises within the technology chain; second, applied technologies derived from real production projects and typical case studies

provided by downstream enterprises; and third, systematic foundational knowledge and technical expertise delivered by vocational colleges. Establishing a school-enterprise collaborative technology repository is therefore a comprehensive and systematic project. It requires expanding collaboration across the entire industrial chain, researching effective pathways for technology transfer, and categorizing industries according to upstream and downstream segments within the technology chain. Consequently, collaboration partners in school-enterprise cooperation are no longer limited to individual enterprises but evolve into a cross-industry stakeholder community.

In vocational education collaborations, technology knowledge transfer extends beyond simple information transmission, encompassing the transformation and integration of different knowledge entities [3]. By integrating technical knowledge resources from vocational colleges, enterprises, and third-party organizations, it is possible to construct a systematic "Technical Knowledge Base" characterized by industry-education integration. This is achieved through a cyclical process involving selection, absorption, integration, transformation, enhancement, and innovation. The knowledge base is further strengthened by establishing school-enterprise collaboration platforms that facilitate the open sharing of resources and promote continuous innovation.

3.2. The Positioning of Technical Knowledge Base in School-Enterprise Cooperation

Industrial development and technological innovation have fundamentally reshaped models of school-enterprise cooperation. At its core, vocational partnership represents the transfer and practical application of knowledge and technology between educational institutions and industry. The effective transformation of technical expertise into practical, actionable knowledge has thus become a key determinant of the quality and sustainability of collaboration.

Vocational education should leverage technical knowledge as a strategic bridge to foster deeper partnerships between industry and academia. By establishing new collaborative frameworks centered on technical knowledge repositories, educational institutions and enterprises can achieve effective integration of industrial technologies with academic expertise. This approach facilitates resource synergies and complementary advantages, promoting comprehensive cooperation across areas such as technological innovation, talent development, curriculum design, and vocational training programs.

As school-enterprise collaboration deepens, the technical knowledge repository evolves dynamically, forming an upward-spiraling technical knowledge chain that continuously generates mutual benefits for both vocational education and industry. Serving as a communication and coordination platform, the repository enhances information exchange, resource sharing, and collaborative decision-making, thereby stimulating the intrinsic driving forces of cooperation. Through the sustained utilization of this repository, collaborative capabilities between schools and enterprises are strengthened, supporting coordinated development between vocational education and industrial sectors, and fostering a resilient ecosystem capable of responding to continuous technological and industrial transformation.

4. Establish a Long-Term Mechanism for School-Enterprise Cooperation Based on Technical Knowledge Base

4.1. School-Enterprise Collaboration Model Based on Technical Knowledge Base

Figure 1 illustrates a school-enterprise collaboration model centered on a technical knowledge base. This model is supported by the creation of a new organizational form for school-industry integration, built upon a shared regional platform for industry-education collaboration, and anchored by a cloud-based technical knowledge base sharing platform. Collectively, these elements form an ecosystem that integrates vocational education with industrial development, enabling coordinated growth across education, research, and production.

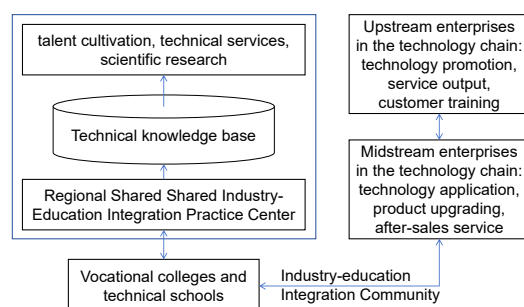


Figure 1. Model of university-enterprise cooperation based on technical knowledge base.

4.1.1. Organizational Guarantee: Building a New Form of Industry-Education Integration

A robust ecosystem for school-enterprise collaboration requires the establishment of innovative organizational structures grounded in technology knowledge bases. Platforms such as vocational education consortiums and industry-specific integration communities form the backbone of these organizational frameworks, enabling sustained and structured cooperation across education and industry. By expanding the collaborative network to encompass entire industrial sectors, a highly interconnected system emerges that links schools, enterprises, research institutions, and industry organizations.

This ecosystem not only facilitates continuous exchange and sharing of technical knowledge but also provides structural safeguards for collaborative initiatives, ensuring clear governance, defined roles, and accountability mechanisms. Additionally, it fosters adaptive capacity, allowing the organization to respond to rapid technological advances and evolving industrial demands. Through these mechanisms, the organizational structure supports not only the operational efficiency of school-enterprise cooperation but also the modernization and strategic development of vocational education, creating a resilient foundation for long-term partnerships.

4.1.2. Regional Shared Platform for Industry-Education Integration

Establishing a regional platform aligned with emerging industrial trends enables the seamless integration of practical training, vocational education, real-world production, and technical support. Such platforms act as centralized hubs for coordinating resources, promoting inter-institutional collaboration, and addressing critical operational challenges faced by enterprises through joint problem-solving and innovation.

Beyond resource coordination, these platforms play a pivotal role in cultivating high-skilled professionals who meet the evolving technical and managerial demands of high-growth sectors. They allow for the implementation of standardized training protocols, shared access to laboratory and production facilities, and collaborative project-based learning opportunities. The strategic impact of these regional platforms extends to driving regional industrial development, optimizing workforce readiness, and contributing to socio-economic progress by enhancing competitiveness, innovation capacity, and employment quality [1].

4.1.3. Core Component: Cloud-Based Technology Knowledge Base Sharing Platform

At the heart of this collaboration framework lies a cloud-based technical knowledge base sharing platform. Leveraging the capabilities of the regional industry-education integration infrastructure, this platform integrates innovative and applied technologies from both upstream and downstream enterprises with the technical and knowledge systems of educational institutions. It enables efficient knowledge exchange, technology transfer, and collaborative problem-solving between academia and industry.

The platform provides a robust technical infrastructure for talent development, research, and industrial services, supporting practical training programs, collaborative

innovation projects, and applied research initiatives. By enabling real-time updates, dynamic resource sharing, and traceable knowledge flows, it ensures that educational curricula remain aligned with industrial needs while enterprises gain timely access to cutting-edge academic insights. Furthermore, this cloud-based platform promotes transparency, scalability, and sustainability in knowledge management, enhancing the overall quality, relevance, and responsiveness of vocational education programs in a rapidly evolving technological landscape.

4.2. Establishing a Long-Term Mechanism for School-Enterprise Cooperation

By constructing a technical knowledge repository through school-enterprise collaboration, vocational colleges can elevate their role within the industrial technology chain. These institutions not only supply enterprises with highly qualified, job-aligned talent but also deliver value-added services that strengthen ties with industry. This approach ensures alignment between technological capabilities and industrial requirements. Achieving this objective requires systematic evaluation across multiple dimensions, as detailed below.

4.2.1. Organizational Guarantee

A sustainable and resilient collaborative mechanism requires the integration of government agencies, industry bodies, enterprises, and educational institutions to facilitate cross-regional resource coordination and sharing. Such a structure ensures that high-quality industry-education resources converge across geographic areas and institutional levels, creating a unified ecosystem that supports consistent and scalable collaboration.

By fostering multi-stakeholder cooperation, the framework ensures that talent cultivation is precisely aligned with industrial needs, from technical competencies to managerial capabilities. It also establishes clear governance structures, defined responsibilities, and accountability mechanisms, which collectively enable seamless service delivery and sustained operational effectiveness. Furthermore, this organizational guarantee strengthens the capacity of vocational education to adapt to technological advancements, respond to industrial transformations, and establish a long-term, strategic model for school-enterprise integration that is both flexible and enduring [4].

4.2.2. Collaborative Dynamics

Corporate-educational partnerships are designed to optimize benefits for all participants by leveraging the complementary strengths of each stakeholder. Under the guidance of government policies, these collaborations utilize the coordination capabilities of industry associations and the resource aggregation advantages of vocational institutions. By actively engaging upstream and downstream enterprises across the industrial technology chain and employing shared, industry-integrated platforms, stakeholders can construct cloud-based technical knowledge repositories that facilitate the systematic transfer of knowledge.

These knowledge repositories support value-added processes, collaborative problem-solving, and joint talent development programs. They enable real-time access to technological updates, practical applications, and research outcomes, ensuring that vocational education remains responsive to industry evolution. The dynamic interaction among stakeholders fosters innovation, strengthens industry-academic linkages, and promotes the development of multi-skilled professionals. Ultimately, these coordinated initiatives contribute to regional economic growth, industrial competitiveness, and the advancement of a cohesive, innovation-driven ecosystem spanning education, research, and industrial production.

4.2.3. Benefit Sharing

Effective school-enterprise collaboration depends on all parties deriving tangible benefits from the technology knowledge base while recognizing their respective roles within the ecosystem [5]. Mutual benefit fosters active engagement, incentivizing stakeholders to participate in the accumulation, transformation, and innovation of knowledge. Key mechanisms include:

- 1) Collaborative mechanism: Ensure all stakeholders within the technology chain work collectively to maximize the potential of technical knowledge bases [6].
- 2) Sharing mechanism: Implement structured management for collaborative knowledge development and cross-application, clarifying responsibilities, rights, and obligations while standardizing processes and criteria for knowledge integration [5].
- 3) Intellectual property protection: Develop measures for protecting, transforming, and transferring intellectual property to safeguard stakeholders' interests during collaboration.
- 4) Incentive mechanisms: Maintain and expand the knowledge base by leveraging professional teachers and enterprise technical experts through comprehensive incentives, including dual-post appointments and performance-based rewards.

4.2.4. Effect Evaluation

A multi-level, systematic evaluation framework should combine self-assessment by stakeholders with third-party evaluations of school-enterprise collaboration. This provides an evidence-based foundation for continuous improvement, ensuring that the collaboration remains effective, adaptive, and aligned with industrial and educational objectives.

4.2.5. Feedback and Continuous Improvement

Establishing a comprehensive feedback mechanism is crucial for evaluating collaboration effectiveness, addressing issues promptly, and continuously enhancing efficiency. Cyclical feedback and iterative improvement enable deeper integration of industry, academia, and research, ensuring that school-enterprise cooperation evolves in response to technological and industrial changes. This dynamic approach fosters mutually beneficial development for both educational institutions and enterprises, creating a sustainable ecosystem for innovation, knowledge transfer, and talent cultivation.

5. Conclusions

High-quality school-enterprise collaboration serves as a critical driver for the integration of vocational education with industrial development. In the context of modern vocational education, fostering such collaboration requires continuous adaptation to evolving industry trends, technological innovations, and national policy directives. This study emphasizes the pivotal role of technical knowledge in school-enterprise partnerships, proposing a novel collaborative model centered on the construction and application of technical knowledge repositories.

By systematically establishing technical knowledge bases, vocational colleges and enterprises can facilitate effective technology transfer, promote the integration of industrial expertise with academic instruction, and enhance the overall capacity for talent development. The study further identifies key dimensions necessary for sustaining long-term collaboration, including robust organizational support, collaborative incentive mechanisms, equitable benefit-sharing arrangements, comprehensive outcome evaluation, and iterative feedback and improvement processes.

Beyond immediate educational and industrial outcomes, the implementation of knowledge-based collaborative frameworks contributes to the formation of resilient

ecosystems that link schools, enterprises, and regional industry networks. Such ecosystems enable continuous innovation, improve the adaptability and employability of vocational graduates, and strengthen the alignment between vocational curricula and the evolving demands of industries. Moreover, the insights gained from this model provide practical guidance for policy-makers, educators, and enterprise managers seeking to establish sustainable, high-quality school-enterprise partnerships that can respond dynamically to technological progress and industrial transformation.

Ultimately, the integration of technical knowledge repositories within vocational education collaboration not only enhances the effectiveness and efficiency of school-enterprise interactions but also lays the foundation for long-term, mutually beneficial development between educational institutions and industrial sectors. This approach supports the strategic objectives of modern vocational education and offers a replicable framework for promoting innovative, technology-driven partnerships that drive both talent cultivation and industrial advancement.

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