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Article

Research on the Structural Changes and Optimization Paths of High-Quality Development of Vocational Education from the Perspective of New Quality Productive Forces

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Abstract: Technological transformation and industrial upgrading have given rise to new quality productive forces, reshaping job skills and talent cultivation standards and driving profound structural reform in vocational education. China's vocational education is shifting from scale expansion to quality improvement and innovation, yet shortfalls in adaptability remain in talent supply, college governance, industry-education collaboration, and quality evaluation. This paper conducts its research along four dimensions: changes in skill demand, organizational reshaping of vocational colleges, collaborative governance of industry and education, and reconstruction of the evaluation system. It sorts out the patterns of skill integration in the intelligent industry, analyzes the causes of organizational dislocation in vocational colleges and the paths for reshaping them, clarifies the rights, responsibilities, and motivational logic of the multiple actors in industry and education, and constructs a tiered evaluation system and development optimization paths for vocational education that are adapted to new quality productive forces, thereby providing a reference for empowering the high-quality development of vocational education through new quality productive forces.

Keywords: new quality productive forces; vocational education; high-quality development; industry-education integration; pathways

1. Introduction

The rapid iteration of digital intelligence and green low-carbon technologies has given rise to new quality productive forces, driven the systematic reconstruction of industrial production models, job structures, and skill standards, and imposed entirely new requirements on the cultivation of skilled talent. Centered on scientific and technological innovation, new quality productive forces are characterized by digitalization, intelligentization, greening, and innovation, and have fundamentally changed the logic of talent demand in traditional industries.

Vocational education provides key support for cultivating skilled talent, serving industrial upgrading, and consolidating the talent foundation of new quality productive forces. As industrial iteration accelerates, single hands-on skills are progressively being replaced, and comprehensive competencies that are interdisciplinary, innovative, digital, and green have become the core criteria for enterprise employment, leaving the traditional talent cultivation model of vocational education lagging behind [1].

At present, China's vocational education still suffers from structural problems such as slow iteration of the curriculum system, rigid college governance, shallow industry-education integration, and an outdated quality evaluation system, making it difficult to meet the requirements of high-quality development under new quality productive forces. Accordingly, following the logic of "demand change - organizational adaptation - collaborative empowerment - quality optimization," this paper systematically examines the real-world dilemmas in the structural transformation of vocational education and

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proposes optimization paths for high-quality development, providing a reference for the reform and innovation of vocational education in the new era.

2. Changes in Vocational Skill Demand and Reconstruction of the Talent Competence System Empowered by New Quality Productive Forces

2.1. Mechanism Analysis of Changes in Vocational Skill Demand under New Quality Productive Forces

In the standardized production system of traditional industry, the division of labor was finely delineated, job boundaries were fixed, and production processes were standardized, so vocational skills exhibited specialized, singular, and rigid characteristics. Vocational education carried out talent cultivation around fixed jobs and production procedures, forming a rigid cultivation model in which majors corresponded to jobs and skills matched procedures. At this stage, skill iteration cycles were long and renewal was slow, so practitioners could remain suited to job requirements over the long term by relying on stable, specialized operational skills, and professional competence was markedly instrumental and stable [2].

New quality productive forces have reconstructed the industrial production model. Industrial boundaries converge, production scenarios are diverse and dynamic, and production methods are flexible and customized, driving threefold changes in the vocational skill system. The first is the technology substitution effect: automated equipment and intelligent systems are progressively replacing repetitive, mechanical basic labor, so the application scenarios of traditional low-end operational skills keep shrinking and their market value keeps declining. The second is the technology compensation effect: intelligent production equipment is more precise and the systems are more complex, requiring practitioners to possess high-end skills such as data analysis, equipment commissioning, fault tracing, and process optimization so as to compensate for the precision shortcomings and efficiency limits of manual operation. The third is the skill integration effect: cross-boundary, interdisciplinary jobs continue to increase, a single professional skill can no longer cope with complex production scenarios, and comprehensive professional competence has become the core criterion for enterprise employment.

In summary, against the backdrop of new quality productive forces, the development of vocational skills exhibits four major trends. Skill iteration cycles have been greatly compressed, making lifelong learning an essential attribute for practitioners [3]. Cross-boundary industrial integration has broken down disciplinary barriers, making interdisciplinary skills the core competitiveness of talent. The production model has shifted from large-scale replication to innovative customization, so technological innovation and problem-solving ability have replaced traditional operational skills as core competencies. As the "dual carbon" goals are implemented in depth, green and low-carbon production has become a rigid industry standard, and green literacy has been incorporated into the basic competence system of vocational talent.

2.2. Core Competence Dimensions of Skilled Talent Adapted to New Quality Productive Forces

Drawing on job data statistics for emerging industries and on industrial transformation practice, the core competence system of skilled talent from the perspective of new quality productive forces comprises four coupled dimensions, namely digital collaboration literacy, complex problem-solving ability, green and low-carbon practice literacy, and lifelong innovation and iteration literacy, which together constitute the core cultivation standards for vocational talent in the new era.

First, digital collaboration literacy. Digitalization is the underlying foundation of new quality productive forces, with digital technology fully covering the entire process of production, management, R&D, and collaboration. Industrial jobs now show a markedly stronger demand for capabilities such as big data analysis, intelligent equipment operation and maintenance, digital collaboration, and digital risk control. Compared with conventional basic computer operation, the new digital literacy places greater emphasis

on digital thinking, human-machine collaboration, and cross-scenario adaptability, requiring practitioners to rely on digital platforms to complete data collection, analysis and assessment, process optimization, and collaboration across actors, so as to suit new production scenarios such as digital workshops, smart factories, and cloud-based collaboration.

Second, complex problem-solving ability. Flexible and personalized new production models have greatly increased the uncertainty of production scenarios, and non-standardized, complex production problems keep multiplying. The orientation of enterprise employment has shifted from the execution of a single procedure to comprehensive capabilities such as scenario assessment, fault tracing, process optimization, and emergency response, requiring practitioners to dynamically adapt to complex production scenarios, independently optimize production processes, and solve various technical problems. This is the core competitive advantage of high-end skilled talent.

Third, green and low-carbon practice literacy. Greening is the core orientation of the high-quality development of new quality productive forces, and the "dual carbon" goals are driving green and low-carbon transformation across all industries, making energy conservation and consumption reduction, low-carbon operation and maintenance, and resource recycling rigid norms of industrial development. This requires vocational talent to possess systematic awareness of green production, standardized low-carbon operational skills, and strict environmental compliance awareness, so as to implement green production standards across the entire production process and balance production efficiency with ecological benefits.

Fourth, lifelong innovation and iteration literacy. Scientific and technological innovation is the core driving force of new quality productive forces. As industrial processes, production equipment, and technical standards iterate continuously, the vocational skill system remains in a state of dynamic reconstruction. Practitioners therefore need to embrace the concept of lifelong learning and to possess the ability to learn independently, update their technology, and innovate processes, so that they can quickly adapt to new technologies, new equipment, and new production scenarios, continuously optimize their own competence structure, and meet the needs of dynamic industrial upgrading.

2.3. Dynamic Matching Mechanism between Differentiated Skills and the Factors of New Quality Productive Forces

Analysis using an evolutionary game model shows that at different stages of industrial technology iteration, enterprise demand for talent exhibits differentiated characteristics. In the initial stage of technology iteration, when the technology system of an emerging industry is not yet mature and job standards are not yet settled, enterprises prefer interdisciplinary talent with strong learning ability and broad knowledge coverage, and their reliance on traditional single specialized skills declines markedly. In the mature stage of technology iteration, when the industrial production model tends to stabilize and the technology system is gradually perfected, talent capabilities in digital application, technological innovation, and the handling of complex problems become the key variables for raising production efficiency.

The heterogeneity of practitioners' skills directly determines the matching efficiency between human capital and the factors of new quality productive forces. Talent with digital, interdisciplinary, and innovative competencies can be efficiently matched with intelligent technology, digital resources, and innovation factors, effectively promoting quality and efficiency improvement and technological upgrading in industry [4]. By contrast, traditional practitioners with a single skill structure and rigid capabilities will suffer from factor mismatch and insufficient adaptation, and will gradually find it difficult to meet the development needs of new industries. This dynamic matching mechanism clarifies the talent cultivation specifications of vocational education against the backdrop

of new quality productive forces and provides the core logical basis for the supply-side structural reform of vocational education.

3. Manifestations, Causes, and Reshaping Paths of Organizational Dislocation in Vocational Colleges from the Perspective of New Quality Productive Forces

3.1. Prominent Manifestations of Organizational Structural Dislocation in Vocational Colleges

At present, the organizational dislocation of vocational colleges is concentrated in three areas, namely program development, college-enterprise cooperation, and the integration of science and education, and it is generally characterized by pronounced organizational rigidity, lagging industrial responsiveness, and insufficient collaborative effectiveness.

First, the dynamic adjustment mechanism for programs is rigid and industrial adaptation lags. Most vocational colleges base their program offerings on the traditional industrial division of labor, and disciplinary and programmatic barriers are deeply entrenched, making it impossible to accommodate the cross-boundary, integrated job characteristics of emerging industries. Cumbersome bureaucratic approval processes and long adjustment cycles cause industrial technological upgrading and college program renewal to fall out of step, producing the structural contradiction of "industries iterating while programs remain fixed." At the same time, talent cultivation plans, curriculum systems, and practical training content are updated slowly, and the supply of digital, green, and innovation-oriented courses is insufficient, making it difficult to support the cultivation of new interdisciplinary talent.

Second, college-enterprise cooperation remains at a shallow level and the benefit-sharing mechanism is absent. At present, most college-enterprise cooperation is confined to basic links such as student internships, employment placement, and basic practical training, and a deep collaborative mechanism featuring shared benefits, shared risks, and shared outcomes has yet to be built. The college-enterprise management departments of vocational colleges have limited authority and weak capacity for resource coordination; enterprises lack the motivation to participate in program development, curriculum design, teacher training, and research tackling; and the rights and responsibilities of colleges and enterprises are ambiguous while resource exchange is asymmetric. As a result, industry-education integration becomes a mere formality and two-way empowerment is difficult to achieve.

Finally, the science-education integration system is fragmented and innovation empowerment is insufficient. New quality productive forces require vocational education to fulfill the dual functions of talent cultivation and technological innovation and to achieve deep integration of teaching, research, and industrial services. At present, however, the teaching, research, and practical training departments of vocational colleges are separated from one another and operate independently, lacking a coordinating mechanism. Teaching is divorced from research and talent cultivation from industrial innovation; the channels for transforming the research outcomes of teachers and students are obstructed; and the value of research in empowering talent cultivation and supporting industrial upgrading has not been effectively released.

3.2. Deep Institutional Causes of Organizational Structural Dislocation in Vocational Colleges

The root cause of the various structural dislocations in vocational colleges is the organizational inertia accumulated over the long term under traditional administrative bureaucratic governance. During the stage of scaled development of vocational education, a bureaucratic model with clear hierarchical norms and well-defined rights and responsibilities could stabilize institutional order and raise management efficiency. In the new stage of rapid industrial iteration, however, the institutional drawbacks of bureaucracy have become increasingly prominent. First, rigid control, oriented primarily toward stability and compliance, weakens the motivation of colleges for reform and innovation and produces slow responses to market changes and technological iteration, reflecting insufficient organizational resilience. Second, departmentalized governance

creates multiple barriers in resources, disciplines, and management, resulting in weak cross-domain collaboration that does not match the cross-boundary integration characteristic of emerging industries. Third, institutional evaluation focuses on administrative assessment indicators and is divorced from actual industrial development and job requirements, further aggravating the structural mismatch between talent supply and demand.

3.3. Reshaping Paths for the Governance Structure of Vocational Colleges Based on Organizational Agility

Organizational agility is the core capability for breaking organizational inertia in colleges and achieving precise alignment between institutional governance and industrial strategy. Grounded in organizational resilience theory, vocational colleges can promote flexible and modular upgrading of their organizational structures through flattening reform, the creation of interdisciplinary organizational units, and the improvement of collaborative mechanisms.

First, advance the flattening reform of the organizational structure. Redundant administrative levels should be streamlined, and authority over program development, curriculum reform, college-enterprise cooperation, and practical training management should be delegated to secondary-level schools and departments, thereby weakening rigid administrative control. A dedicated task force for industrial demand response should be established to maintain regular contact with industry associations and leading enterprises, dynamically capture information on the iteration of industrial technologies and job standards, and promptly fine-tune the program system, course content, and practical training projects, thus narrowing the time gap and information gap between industrial upgrading and college reform and shifting the institutional orientation from administrative adaptation to industrial adaptation.

Second, build a cross-disciplinary divisional organizational model. The traditional segmented pattern of single programs and single schools or departments should be broken, and cross-program, cross-disciplinary industrial divisions should be established around emerging industrial clusters such as digital intelligent manufacturing, green energy, and digital services. These divisions should coordinate and integrate faculty, practical training, and research resources; focus on the needs of cross-boundary jobs to develop interdisciplinary courses, cultivate interdisciplinary talent, and carry out industrial technology research; and adapt to dynamic industrial formats through flexible, modular organization.

Third, improve the governance mechanisms for science-education integration and college-enterprise collaboration. A dedicated management center for industry-education integration and science-education innovation should be established to coordinate the entire chain of teaching, research, practical training, and college-enterprise cooperation and to build a contractual mechanism for shared benefits, transformation of outcomes, and shared risks between colleges and enterprises. Enterprise technical standards, production cases, and R&D resources should be deeply integrated into the entire process of talent cultivation, while the industrialization of colleges' innovation outcomes should be accelerated, thereby achieving a two-way improvement in both the quality of talent cultivation and the effectiveness of industrial services.

4. Governance Innovation in Industry-Education Integration and High-Quality Development Paths for Vocational Education Oriented to New Quality Productive Forces

4.1. Governance Logic of Multiple Actors in Industry-Education Integration and the Mechanism for Activating Collaborative Momentum

Government, vocational colleges, and industry enterprises form the core community of interests in industry-education integration, and the three parties differ markedly in resource endowments, functional positioning, and interest demands [5]. The government assumes the macro-level functions of institutional supply, policy support, resource

coordination, and market regulation; vocational colleges focus on talent cultivation, basic research, and social technical services, providing talent and intellectual support for industrial upgrading; and enterprises possess cutting-edge technology, production scenarios, and R&D resources, leading industrial technological iteration and changes in market demand. The differences in objectives, uneven resources, and ambiguous rights and responsibilities among the three parties are the core causes of the shallow and formalized nature of industry-education integration.

From the perspective of new institutional economics, excessively high institutional transaction costs are the key bottleneck constraining deep industry-education integration, and they mainly comprise three types of cost. The first is information search cost: two-way information barriers between colleges and enterprises are prominent, since colleges are unfamiliar with enterprise technological iteration and real job requirements while enterprises do not understand the patterns of talent cultivation or the research strengths of vocational education, resulting in low efficiency in matching supply and demand. The second is negotiation and supervision cost: there is currently no unified system for the division of rights and responsibilities, benefit distribution, or risk sharing, so the costs of consultation and process supervision among multiple actors are relatively high. The third is opportunism cost: because enterprise participation in talent cultivation and research entails large investment, long cycles, and uncertain returns, enterprises tend to choose passive, shallow participation in the absence of incentive mechanisms, making long-term stable cooperation difficult to form.

The key to activating the momentum for collaborative innovation in industry and education lies in clarifying governance boundaries and reducing institutional transaction costs. A tiered governance structure should be built in which the government exercises macro-control, the market allocates resources, and colleges and enterprises play the leading role. The government should narrow the scope of administrative intervention and focus on top-level institutional design, policy incentives, and the building of public platforms, so as to break down cross-departmental institutional barriers. The decisive role of the market in resource allocation should be brought into full play, and, guided by industrial technological innovation and job demand, colleges and enterprises should be steered toward independent connection and deep collaboration. At the same time, market-based incentive policies such as tax and fee reductions, fiscal subsidies, and performance-based profit sharing should be improved so as to close the loop between enterprise input and returns, enabling enterprises to obtain talent, technology, and policy dividends and driving them to move from passive cooperation to active participation in industry-education integration.

4.2. Construction of a High-Quality Evaluation System for Vocational Education Adapted to New Quality Productive Forces

In contrast to the traditional scale-oriented quantitative evaluation model, this paper follows the principles of scientific validity, systematicity, adaptability, and operability and, grounded in the digital, intelligent, green, and innovative characteristics of new quality productive forces, constructs a multi-level evaluation system comprising four first-level indicators and twelve second-level indicators through multiple rounds of expert consultation and indicator weight measurement. The first is talent cultivation adaptability, covering program structure, core competencies, employment quality, and talent iteration capability, which measures the level of matching between talent supply and demand. The second is the conversion rate of key technologies, including the implementation of college-enterprise cooperation, the transformation of research outcomes, empowerment through process improvement, and the incubation of innovative talent, which characterizes the effectiveness of industrial innovation empowerment. The third is the flexibility of organizational governance, covering dynamic program adjustment, agile organizational response, science-education integration governance, and college-enterprise collaborative governance, which evaluates the industrial adaptability of colleges. The fourth is the degree of guarantee for educational development, including policy support, resource

allocation, quality control, and faculty development, which consolidates the foundation for the development of vocational education.

A simulated assessment based on national public data shows that the service provided by China's vocational education to the development of new quality productive forces exhibits pronounced regional divergence [6]. In core industrial regions such as the Yangtze River Delta and the Pearl River Delta, the vocational education governance system is mature, industry-education integration is deep, and talent adaptability is high, so these regions can effectively support the development of emerging industrial clusters. The central region has a large scale of vocational education, but program iteration is slow, science-education integration is weak, and enterprises lack the motivation to participate, leaving prominent shortcomings in supply-demand adaptability. The western region is constrained by a weak industrial base, insufficient resource allocation, and lagging governance models, so its digital and green transformation lags and its overall capacity to serve new quality productive forces is relatively weak. Across the country, common problems persist, including lagging iteration of the talent cultivation system, insufficient flexible governance in colleges, a lack of market-based industry-education incentives, and an imperfect qualitative evaluation system.

4.3. Multi-Level Collaborative Optimization Paths for the High-Quality Development of Vocational Education

In light of regional development differences and common institutional shortcomings, a three-tier policy system linking the macro, meso, and micro levels should be constructed to systematically advance the high-quality development of vocational education.

At the macro level, top-level policy coordination should be strengthened. Specialized policies and institutions should be improved and multi-departmental policy barriers removed in key areas such as the cultivation of new-quality talent, deep industry-education integration, science-education integration, and the digital and green transformation of vocational education. Market-based industry-education incentive mechanisms should be improved, high-quality evaluation standards for vocational education adapted to new quality productive forces should be established, and vocational education should be guided from extensive development based on scale expansion toward intensive development based on quality empowerment.

At the meso level, the differentiated regional layout should be optimized. Region-specific policies should be implemented. Core industrial regions in the east should focus on high-end innovation empowerment, deepen collaborative innovation between industry and education, and cultivate high-end interdisciplinary innovative talent. The central region should focus on quality improvement and efficiency enhancement, accelerate the iterative upgrading of programs and courses, and shore up weaknesses in science-education integration. The western region should focus on raising basic capacity, strengthen preferential policy and resource allocation, improve the digital infrastructure for running schools, and consolidate the foundation for transformation. Cross-regional platforms for resource sharing and industry-education collaboration should be established to promote the diffusion of high-quality resources toward lower levels and narrow regional development gaps.

At the micro level, the foundation of talent cultivation in colleges should be consolidated. Flattening and modular reform of organizational structures should continue, and mechanisms for dynamic response to industrial demand and dynamic program adjustment should be established. The curriculum system should be optimized in digital, green, and innovation-oriented directions to meet the competency needs of new-type talent. The construction of industrial colleges and collaborative innovation centers should be deepened, and mechanisms for benefit sharing and outcome transformation between colleges and enterprises should be improved. A routine mechanism for quality self-inspection and rectification should be established to continuously improve the quality of talent cultivation, governance effectiveness, and capacity for industrial services.

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