

Suggestions for optimizing vocational education finance from an international comparative perspective

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Abstract. Since 2010, China's vocational education funding has shown sustained growth, with significant improvements in institutional conditions and Student-teacher ratios. However, the investment level remains only 39% of that in general higher education, while per-student funding growth lags behind. Secondary vocational education faces fiscal dependence exceeding 85%, with non-fiscal financing accounting for less than 15%. Regional disparities remain pronounced, with insufficient teaching staff in central and western regions, low proportions of dual-qualified teachers, and a single funding structure that weakens risk resilience. This paper focuses on optimizing China's vocational education fiscal mechanisms. By integrating industrial upgrading and the development needs of new productive forces, it analyzes current issues such as funding growth trends, investment gaps, and structural imbalances through literature review and international comparisons. Drawing on advanced funding mechanisms like Germany's "dual education", Japan's "industry-academia-government" collaboration, and Singapore's model, the study proposes optimization suggestions from three dimensions: funding supply, school-enterprise collaboration, and performance supervision. These recommendations aim to establish a vocational education fiscal system tailored to China's national conditions and efficient coordination, thereby supporting high-quality vocational education that serves socioeconomic development.

Keywords: vocational education finance, international comparison, funding mechanism, optimization path

1. Introduction

In response to industrial upgrading and the demands of new productive forces, vocational education—being the direct link between industries and markets—has become a vital source of talent and productivity. Since 1999, China has prioritized vocational education development, implementing policies to refine funding mechanisms for secondary and higher vocational education. These measures have established a government-led financial system where vocational education costs are shared by the state, families, and society, ensuring steady fiscal growth. However, there is still room for both the quantity and quality of vocational education investments. With the continuous emergence of new technologies and business models, vocational education must align more closely with industrial needs to cultivate high-quality skilled professionals for industrial upgrading. Optimizing investment structures and enhancing efficiency are crucial to better meet the demands of industrial transformation and socio-economic development.

Current domestic research on vocational education primarily acknowledges the growth of fiscal expenditure in China's vocational education sector, with more detailed studies focusing on its development—including fiscal expenditure ratios, growth rates, efficiency, institutional models, and regional disparities. At the international level, scholars like Wang and Chi have conducted in-depth analyses of vocational education fiscal systems in single-country cases such as Germany, Japan, and the United States [1]. Scholars including Zhou, Dai, and Yang have explored vocational education in diversified developed countries [2, 3]. Researchers like Yu and Zhang have also examined developing nations with advancing vocational education systems, such as ASEAN member states and Indonesia [4, 5]. However, the comparative focus remains predominantly on developed countries, which differ from China's vocational education context and foundation. Consequently, international comparative studies on vocational education remain insufficient, and research comparing China's mechanisms with those of other countries remains limited.

This study employs literature analysis and comparative research methods. By comparing domestic and international vocational education fiscal mechanisms and considering China's actual fiscal expenditure situation, it examines the current status, challenges, and development prospects of vocational education funding in China. The comparative analysis of global vocational education fiscal systems provides valuable insights for integrating international best practices. This approach offers significant reference value for exploring a vocational education fiscal development model tailored to China's national conditions, thereby enhancing vocational education's capacity to serve industrial development.

2. Comparison of international vocational education funding mechanisms

2.1. Germany

Germany's vocational education system is globally recognized as one of the most mature, having established a comprehensive dual-system framework that seamlessly integrates corporate training with academic education. Students acquire theoretical knowledge in vocational schools while receiving hands-on training in enterprises, creating an industry-academia integration mechanism that effectively cultivates skilled professionals and boosts youth employment rates [2]. Widely regarded as a model of vocational education, the "dual system" has been adopted by numerous countries as a successful approach. Post-pandemic, Germany's vocational education system continued to thrive despite market challenges, with increasing enrollment numbers and course offerings. In 2023, companies provided 34,000 additional training courses for dual-system students, totaling 562,600; training demand grew by 3.6% year-on-year to 515,600; new training contracts for dual-system students increased by 3.0% to 489,200; the number of applicants not participating in training rose by 16.3% to 26,400, while training quotas expanded rapidly—548,300 internal company training slots, a 3.5% year-on-year increase. Active participation from governments, businesses, and students has consistently strengthened the synergistic effects of the dual-system education model.

2.1.1. Dual system

Germany operates under a dual-track system where both government and enterprises share the responsibility of student training costs. At the governmental level, funding is jointly allocated between central and local authorities (with specified ratios), with clear funding standards and oversight mechanisms. These resources primarily support the operational needs of vocational schools, including infrastructure construction and maintenance. On the corporate side, investments come in two forms: direct funding and indirect investments. Corporate contributions mainly cover practical training instructors' salaries, vocational training center establishment, and apprentice subsidies [6]. Large enterprises or consortiums often establish vocational

training centers that directly address corporate demands, implementing "order-based" training programs to cultivate students aligned with job requirements. This collaborative model not only ensures adequate training resources but also bridges skill development with market needs, enhancing vocational education's resilience in economic challenges. Furthermore, Germany's vocational training system emphasizes lifelong learning principles, encouraging companies to offer on-the-job training programs and empowering employees to improve job stability through continuous skill enhancement. These measures have solidified Germany's global leadership in vocational education.

2.1.2. Government participation

Since 2015, government spending has continued to grow, with per-student expenditure at vocational schools increasing to €6,695 during the same period, reflecting the German government's strong commitment to vocational education development. As a federal state, Germany's local vocational institutions are managed by state governments and receive funding from the central government, with costs shared between state governments and local educational authorities. In public vocational schools, state governments cover teacher salaries, while local authorities handle infrastructure construction and daily maintenance. Private vocational schools, operating under state vocational education regulations, receive funding from state governments through proportional allocations and special grants.

In terms of funding allocation, Germany's government funding mechanism emphasizes efficiency and performance feedback in fund utilization, primarily adopting two fiscal allocation management models: The first is a formula-based funding mechanism that ensures basic funding needs for vocational colleges while calculating teaching outcomes through a quantitative evaluation system, with institutions demonstrating outstanding performance receiving incremental funding. The second is a quality-oriented project funding model where colleges apply for government grants based on specific projects, with partial funds pre-allocated by the government and full payment made during implementation according to subsequent project results and predetermined quality targets. The scale and allocation scheme of German federal funding are jointly formulated by the Federal Institute for Education and relevant industry associations. During the use of vocational education funds, strict performance evaluation and cost accounting systems are implemented, with assessment results directly linked to the next year's federal funding quota. The performance-linked funding mechanism effectively stimulates internal motivation for vocational colleges to optimize resource allocation, prompting institutional management to proactively align with industrial upgrading demands. This approach avoids resource waste and inefficiency caused by government guarantees, continuously improves curriculum design and practical training conditions, ultimately forming a virtuous cycle between fund utilization efficiency and talent cultivation quality [7].

2.1.3. Investment in enterprise

Meanwhile, corporate investment, as a crucial component of the dual education system, further supplements government funding, alleviates fiscal pressure on public finances, effectively enhances students' practical skills and employability, and ensures comprehensive coverage of vocational education. Corporate investment includes both establishing vocational training institutions for students and providing subsidies for apprentices. At the enterprise training level, German companies can participate in vocational education through direct funding and pooled funding, covering the costs of updating practical training equipment and materials, ensuring that training content remains aligned with industry advancements [3]. Due to varying scales, large and medium-sized enterprises have greater labor demands and higher vocational training needs, while also having the capacity to undertake the construction, operation, and maintenance of vocational training institutions, typically adopting direct investment methods. In contrast, smaller enterprises may struggle to bear the costs of student vocational training institutions and can opt for pooled funding, where certain industries

conduct collective negotiations to establish regulations for financing practical training content in vocational education.

Corporate participation in vocational education extends beyond supporting students' career development, including providing labor subsidies during training. The German Federal Vocational Education Act explicitly requires companies to offer allowances to apprentices receiving vocational training, ensuring their right to compensation. Apprentice remuneration constitutes a crucial component of corporate investment in vocational education. Trainees are entitled to receive appropriate and annually increasing compensation from their training companies, recognizing productive work during corporate training while ensuring sufficient training of young qualified technicians. The law also mandates that at least 25% of compensation must be paid in cash and establishes minimum allowances for apprentices. Specific remuneration standards across industries and companies can be determined through two mechanisms: contractual agreements and collective training allowances. Contractual agreements typically apply to personalized contracts between individual companies and apprentices, while collective training allowances represent unified standards negotiated through industry-wide collective bargaining. This dual mechanism ensures flexibility in remuneration systems, respecting corporate autonomy while maintaining industry-wide fairness.

2.2. East Asian country—Japan

Japanese vocational education is derived from the traditional education in East Asia, rooted in the local unique administrative structure and social tradition, and is representative in East Asia. Its funding and management mechanism integrates the characteristics of government leading, market participation and social coordination, forming a relatively mature and flexible resource mobilization mode and an immediate resource feedback mechanism.

2.2.1. Basic system of vocational education in Japan

Japanese vocational schools can be divided into three types: national, public and private.

In terms of government funding, the Japanese government plays a dominant role in providing vocational education funds for public and national schools. Through clear legal provisions and institutional designs, it ensures stable growth and precise allocation of fiscal grants [1]. For national vocational institutions, their operating funds are primarily covered by the central government through the "Special Accounting System for National Schools," which requires all institutional revenues to be managed under unified special accounting. The central government allocates educational operational funds, infrastructure funds, and research funds based on comprehensive evaluation indicators such as institutional scale, teaching quality, academic standards, and revenue-generating capabilities. Notably, educational operational funds are independently managed by institutions, ensuring operational autonomy and flexibility. Public vocational institutions are mainly funded by local governments. To address regional disparities in educational resources caused by economic development differences, Japan implements a dual safeguard system through "national fiscal subsidies" and "local tax contributions." The central government directly provides special grant funds to local governments, while also allocating a proportion of local tax revenues to supplement vocational education funding. This effectively narrows the operational gaps between public vocational institutions across regions and promotes educational equity.

In terms of private fundraising, Japan has established a diversified funding mechanism through legal safeguards and policy incentives, effectively mobilizing social participation in vocational education financing. Private vocational institutions, a vital component of Japan's vocational education system, primarily rely on tuition fees—including per-class fees, equipment usage charges, and registration costs. Although their tuition rates are significantly higher than those of national and public institutions, these schools attract a large number

of students through high-quality teaching resources, flexible program offerings, and strong market alignment [8]. Additionally, income generation has become an increasingly important revenue source, encompassing income from commercialization of research achievements and operational services. By converting research outcomes into productive assets, conducting social training programs, and providing technical services, these institutions not only enhance their self-sustaining capabilities but also promote the deep integration of teaching and practical application.

Meanwhile, to support the development of private vocational education, Japan enacted the Private School Promotion and Assistance Act, encouraging the establishment of private school promotion foundations. These foundations provide financial support to private institutions through various means such as subsidies, long-term low-interest loans, and tax reductions, thereby fostering a complementary and mutually beneficial development pattern between public and private vocational colleges

2.2.2. Strict and standardized fund evaluation mechanism

The Japanese vocational education funding mechanism is distinguished by its well-established third-party evaluation system and performance assessment framework, which enhances the scientific rigor, fairness, and efficiency of fund allocation and utilization. The School Education Act mandates that all vocational institutions undergo third-party evaluations, with the results serving as key references for government funding and policy support. This institutional approach ensures a direct correlation between funding allocation and the quality of talent development.

As independent professional organizations, third-party evaluation agencies operate free from government and institutional interference. Their assessment framework covers multiple dimensions including teaching quality, faculty competence, program offerings, student employment rates, research commercialization, and social service capabilities, with equal emphasis on quantitative data analysis and qualitative indicator evaluation. The process adheres to principles of openness and transparency, with results publicly disclosed for public oversight. For national and public institutions, evaluation outcomes directly determine annual funding allocations. Those failing assessments face reduced funding and are required to implement corrective measures within specified timelines.

In terms of internal fund management, Japanese vocational institutions have established a refined cost accounting system and financial oversight mechanism. National and public institutions strictly control fund inflows and outflows in accordance with the "Special Accounting System for National Schools" and local fiscal management requirements. Special funds such as education funds, infrastructure funds, and research funds are earmarked for specific purposes and must not be diverted for other uses. Private institutions, on the other hand, maintain independent accounting systems to separate school operation funds from corporate income and operational funds, ensuring that all income from operational activities is fully allocated to school development. They also undergo multi-level supervision from private school review committees, internal auditors, and evaluation boards to guarantee compliance and efficiency in fund utilization.

2.2.3. Deep integration of Industry-Academia-Government collaboration mechanism

The "Industry-Academia-Government" collaborative development model is an important trend of Japanese vocational education funding mechanism. The government, enterprises and colleges have formed a close cooperative relationship in terms of funding input, resource sharing and talent training, so as to ensure that the vocational education funding can accurately meet the industrial demand and realize the seamless connection between talent training and market employment.

At the governmental level, Japan has established a bridge for industry-academia-government collaboration through policy guidance and financial support. The central education authority formulates vocational education development plans and the "Guidelines for Learning Guidance," defining training objectives and

quality standards. It also encourages school-enterprise partnerships through fiscal allocations and research funding. Local education committees coordinate regional vocational education alliances by aligning with local industries, facilitating resource sharing and complementary strengths.

At the corporate level, enterprises, as direct beneficiaries of vocational education, actively participate in funding and talent development. Japanese companies support student training by providing practical training funds and equipment, covering internship allowances, and engaging in curriculum design and teaching methodologies. Additionally, major corporations further enhance vocational education funding through initiatives like establishing scholarships and supporting research projects, thereby assisting institutions in cultivating talents that meet industry demands.

At the institutional level, vocational colleges actively align with the needs of enterprises and the government, optimizing fund allocation to enhance talent development quality. These institutions prioritize investments in key areas such as practical training base construction, faculty development, and curriculum reform, utilizing government grants, corporate sponsorships, and self-generated revenue. Notably, most vocational schools in Japan are private institutions, with the majority of students enrolled in such schools. Compared to public institutions, private schools operate with greater flexibility, enabling direct market integration in both teaching and practice. Private institutions flexibly adjust their program offerings based on market demands, using tuition income and government subsidies to attract top-tier faculty, upgrade teaching facilities, and strengthen their competitive edge [9].

2.3. Singapore

Singapore, as an important country in the development of vocational education, has developed vocational education together with its own economy and society. It has inherited the basic framework of the traditional British education system, and fully learned the core essence of the German "dual system", and gradually developed the vocational education system with its own characteristics and high efficiency.

As a city-state, Singapore's government demonstrates exceptional coordination in allocating educational resources, with vocational education funding primarily sourced from government allocations. The Polytechnic Institute and the Institute of Technology, serving as the core institutions of Singapore's vocational education system, are statutory bodies under the Ministry of Education. The government covers all infrastructure costs, including campus construction and practical training facilities, while daily operations are partially funded by tuition revenue [10]. This substantial government investment ensures the public welfare nature of vocational education, alleviates financial burdens on students and families, and enables more students to access equitable access to high-quality vocational education resources.

At the corporate level, as direct beneficiaries of vocational education, enterprises actively contribute to funding and resource allocation. Singapore's vocational institutions generally outperform their corporate counterparts in practical training facilities, a result of both government financial support and deep corporate involvement. By donating advanced production equipment, sharing technical standards, and even co-establishing technology training centers and teaching enterprises with partner institutions, these schools create authentic learning environments. With declining local student enrollment, institutions can leverage their well-funded resources to provide on-the-job training for corporate employees, with companies repaying the training costs to support these educational initiatives.

At the institutional level, vocational colleges optimize funding allocation by aligning with industry demands, channeling government grants, tuition revenues, and corporate partnerships into core disciplines [11]. Faculty members, predominantly seasoned industry professionals, must regularly return to enterprises for skill upgrades. The government provides dedicated funding for teaching competency training, ensuring

curriculum alignment with job requirements. Through continuous course adjustments based on industry feedback, these investments directly translate into enhanced teaching quality, maximizing financial efficiency.

3. Suggestions for the optimization of China's vocational education finance

The optimization of the financial system of vocational education in China needs to shift from the single scale growth thinking to a system that pays attention to structure, efficiency and sustainability. The key is to straighten out the relationship between government, market, school and enterprise, and to form a funding governance ecology with shared responsibility, compatible incentive and dynamic adjustment.

First, the central government should substantially increase special transfer payments for vocational education, prioritizing underdeveloped regions in central and western China and rural areas. This will address the shortfall in local fiscal capacity, clarify the responsibility ratio between central and local governments in vocational education funding, and implement differentiated regional matching policies for financially challenged areas to narrow the gap in vocational education resources across regions and between urban and rural areas [7]. Additionally, the expenditure structure of vocational education funds should be adjusted to focus on three core areas: training base construction, cultivation of dual-qualified teachers, and development of in-demand majors. Special funds for teacher training could be established to support vocational school teachers in enterprise internships and industry training. Enterprises are also encouraged to employ technical experts as campus instructors with corresponding salary subsidies.

Secondly, enterprises and vocational colleges should be encouraged to jointly establish training bases, implement order-based training programs, and accept student internships, with financial subsidies linked to cooperation outcomes. Industry associations should be encouraged to lead efforts in organizing small and medium-sized enterprises to participate in vocational education through fundraising, sharing costs for training equipment procurement and facility construction to achieve resource sharing and cost-sharing [8]. Funds for school-enterprise collaboration should prioritize improving training conditions and practical teaching, ensuring direct funding reaches the frontlines of talent development. This supports the joint establishment of shared training bases with teaching, production, and R&D functions, where the government provides matching funds for base construction and operational revenues are reinvested into vocational education according to agreed ratios. Enterprises are encouraged to integrate production workshops and R&D centers with vocational training programs, with the government compensating enterprises for training positions and equipment provided. Through policy guidance, a long-term stable interest-sharing mechanism between schools and enterprises should be established to stimulate enterprises' intrinsic motivation for participating in vocational education.

Finally, drawing on Japan's third-party evaluation system and Germany's performance-based funding model, we propose establishing a comprehensive financial performance evaluation framework for vocational education. This framework should encompass multiple dimensions including funding allocation, operational efficiency, educational quality, and societal impact. Quantitative indicators would cover the rationality of expenditure structures, utilization rates of practical training facilities, student employment rates, and the quality of skilled talent supply, while qualitative indicators would address regional development balance and program structure alignment [9]. Independent third-party evaluation agencies could be engaged to conduct assessments, with a performance feedback mechanism established to ensure objectivity and fairness. The evaluation results should serve as a key basis for allocating vocational education funding.

4. Conclusion

This paper examines China's vocational education financing landscape, drawing on the expertise of Germany, Japan, and Singapore in diversified funding models, industry-education integration, and performance evaluation systems. It analyzes their proven methodologies for securing vocational education budgets, fostering school-enterprise partnerships, and implementing performance monitoring. Through localized adaptations of international best practices, the study proposes a fiscal framework featuring coordinated central-local funding, shared financial responsibility between schools and enterprises, and a scientifically designed closed-loop supervision system. Future research should focus on optimizing expenditure structures and fund utilization efficiency to better align vocational education funding with industrial demands, thereby providing robust support for cultivating skilled professionals and driving industrial upgrading.

However, this study has certain limitations. Firstly, while the international comparison sample covers representative countries in Europe, America, East Asia, and Southeast Asia, it does not include developing countries with vocational education development stages similar to China's. Further research is needed to analyze the applicability of experiences from countries with different development levels. Secondly, the study primarily relies on literature analysis and comparative research, lacking field survey data on the financial operations of vocational colleges in China. The feasibility and implementation effects of optimization suggestions have not been quantitatively verified. Future research could expand the scope of international comparisons, increase studies on vocational education financial mechanisms in developing countries, and distill more universal and localized experiences. By employing empirical methods such as questionnaires and case studies, combined with field survey data from institutions, the relevance and operability of financial optimization suggestions could be further enhanced.

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