

FORGING SKILLED WORKERS IN CHINA: INSIGHTS FROM SINGAPORE, JAPAN, AND SOUTH KOREA

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Abstract: China has made notable strides in strengthening its industrial workforce, yet its vocational education and skills development system continues to face structural, institutional, and perceptual challenges. This article examines the critical obstacles within China's current framework, including regional disparities, social stigma, weak school–industry linkages, and fragmented certification mechanisms. To offer practical insights, the paper compares the vocational training systems of Singapore, Japan, and South Korea—three advanced Asian economies with robust strategies for cultivating skilled labor. By analyzing key features of the high-quality skill development systems for skilled workers in three of Asia's technological powerhouses—Singapore, Japan, and South Korea—this study aims to provide references and insights for China's path toward improving the quality of its high-skilled industrial worker system.

Keywords: High quality education; Skilled workers; Vocational education

1 INTRODUCTION

Vocational education and skills development are critical pillars for sustaining industrial competitiveness and economic modernization in today's rapidly evolving global economy. As China accelerates its transition from a labor-intensive manufacturing hub to an innovation-driven industrial powerhouse, the demand for a highly skilled and adaptable workforce—particularly at the high-end technical level—has become increasingly urgent. Despite ongoing efforts to expand and improve vocational training infrastructure, China continues to face a significant shortage of advanced skilled workers capable of supporting sophisticated manufacturing and emerging high-tech industries.

Over recent years, the Chinese government has introduced numerous policies and initiatives aimed at strengthening the industrial workforce, such as promoting “craftsman spirit” campaigns, establishing vocational education integration pilot programs, and enhancing technical worker certification systems. While these measures have contributed to some progress in building a more competent industrial labor force, challenges remain in terms of uneven regional development, insufficient industry-school collaboration, fragmented training standards, and persistent social stigma toward vocational careers. Addressing these multifaceted challenges is critical for China to achieve sustainable industrial upgrading and secure its position in the global value chain.

This paper explores these issues in depth, drawing lessons from the advanced vocational education systems of Singapore, Japan, and South Korea, and proposes targeted policy recommendations to further enhance China's capacity for cultivating a skilled, future-ready workforce aligned with its national development strategy.

2 CHALLENGES IN CHINA'S VOCATIONAL EDUCATION AND SKILLS DEVELOPMENT SYSTEM

While China has made steady progress in strengthening its industrial workforce, several fundamental issues remain unresolved within the current vocational training and skills development system.

2.1 Structural Imbalances and Enduring Stigma toward Vocational Education

Despite the expansion of higher education in China, traditional manufacturing enterprises continue to face acute shortages of skilled labor, especially in technical roles. According to the Ministry of Human Resources and Social Security, technical positions in manufacturing remained among the most underfilled occupations as of the fourth quarter of 2022[1].

In terms of workforce composition, China had around 200 million skilled workers by the end of 2020, comprising just 26% of the employed population. Among them, only 50 million (28%) were categorized as highly skilled, which is far below the 40–50% observed in countries like Germany and Japan.

Besides, regional disparities further complicate the issue. In economically advanced southeastern provinces, demand for skilled labor—especially in high-tech manufacturing industry—is robust. In contrast, less developed western regions display a “spindle-shaped” demand structure, with relatively weak needs for high-skilled personnel and limited support for talent development.

From a productivity perspective, the quality of the industrial workforce also falls short. According to the *2020 China Manufacturing Power Development Index Report*, labor productivity per manufacturing worker was USD 30,948—just one-fifth of the U.S. level, and around one-third of Japan and Germany's.

Underlying these structural and regional imbalances is a persistent cultural bias against vocational education. Influenced by traditional views that prioritize academic achievement (“those who excel should pursue officialdom”), many families view vocational tracks as second-best or even undesirable. A 2021 survey by the People’s Think Tank found that 64% of respondents believed vocational education led to low-quality jobs, and 53% considered it socially inferior. Only 45% were willing to choose vocational education for their children—and only if it clearly outperformed general education. This entrenched stigma was reflected in the 2022 WorldSkills Competition, where Lu Shuangying, an official from the Tianjin Association for Science and Technology, observed that vocational education is still widely perceived as low in technological content and lacking long-term prospects.

Therefore, addressing structural labor mismatches and reshaping public perception of technical careers must become a strategic priority. Policy solutions should not only focus on expanding vocational education capacity but also aim to elevate the status of skilled labor, making it an attractive and respected career path in China’s evolving industrial economy.

2.2 Institutional Constraints and Fragmented Industry–Education Linkages

Despite rapid expansion, China’s vocational education system faces significant institutional constraints that impede effective development of the industrial workforce. Vocational colleges account for just over half of higher education institutions; however, formal vocational schools contribute relatively little to training industrial workers. Empirical data reveal that the majority of skilled workers (67.1%) acquire skills through enterprise-based training, whereas only a small fraction (9.8%) receive formal vocational education[2]. Moreover, the uneven regional distribution of vocational education—concentrated in economically developed eastern provinces—exacerbates existing disparities, leaving central, western, and northeastern regions underserved. Insufficient fiscal investment further undermines system quality, with secondary and tertiary vocational education receiving approximately 10% of total educational funding as of 2022, constraining improvements in teaching infrastructure, faculty development, and curriculum innovation [3].

Furthermore, weak institutional coordination and fragmented governance limit the alignment between vocational education outputs and labor market needs. Vertical educational mobility pathways remain underdeveloped, restricting vocational graduates’ opportunities for advancement. Collaboration between educational institutions and industry often lacks depth, generally limited to short-term internships or sporadic training sessions. Unlike integrated dual-track systems exemplified by Germany, Chinese enterprises seldom engage substantively in curriculum design, competency standards, or faculty training, thus diminishing vocational education’s relevance and responsiveness to evolving industrial demands. Addressing these institutional shortcomings is imperative to cultivating a workforce equipped for the complexities of modern manufacturing.

2.3 Reforming Assessment and Certification Mechanisms

An effective assessment and certification system constitutes a cornerstone for incentivizing skill acquisition and facilitating career progression among industrial workers. Presently, career pathways in manufacturing are largely bifurcated into managerial and technical tracks, with limited lateral mobility, constraining skill diversification and advancement. Certification coverage is inadequate; only 36% of technical workers possess valid government-issued certifications, while a majority remain uncertified, limiting formal recognition of competencies [2]. Key challenges include ambiguous certification authorities, inconsistent standards, and limited reciprocity among certificates, undermining their credibility and acceptance by employers. Rapidly emerging industries and occupations further complicate certification frameworks; for instance, the 2021 National Occupational Qualification Catalog encompasses merely 72 occupations, leaving many new roles without formal certification. Moreover, existing incentive structures for recognizing and rewarding high-performing skilled workers—through financial awards or professional honors—are insufficiently robust, which impedes talent retention and motivation.

3 VOCATIONAL EDUCATION AND SKILLS DEVELOPMENT OF SINGAPORE, JAPAN, AND SOUTH KOREA

3.1 Vocational Education and Skills Training System in Singapore

Despite its small size and limited natural resources, Singapore has maintained a leading position in Asia in terms of per capita GDP. According to the 2021 Bloomberg Innovation Index, Singapore ranked second globally and third worldwide in manufacturing capability, highlighting its strong role in global manufacturing [4]. The manufacturing sector’s value-added has consistently accounted for about 20% of GDP, and Singapore’s outstanding vocational education system is widely recognized as a core driver of its economic and social progress.

3.1.1 Forward-looking vocational education philosophy

Singapore aligns its vocational and technical education closely with evolving economic strategies, updated roughly every decade, to ensure workforce skills remain in step with global technological trends. Since the 1980s, multiple national initiatives—such as the National Computerization Programme, IT2000 Smart Island plan, and SkillsFuture—have emphasized boosting digital literacy and workforce adaptability. Institutions like Nanyang Polytechnic regularly conduct market demand research before launching new programs and monitor outcomes to ensure education remains relevant and effective [5].

3.1.2 Practice-oriented education model

Vocational training heavily involves partnerships between schools and industry. Students learn foundational theory in school and then gain practical experience through internships or on-the-job training. Singapore Polytechnic and Nanyang Polytechnic collaborate with global companies including Oracle, Google Cloud, and HCL Technologies to provide targeted practical training. Meanwhile, their teaching models emphasize “learning by doing,” such as CDIO and Problem-Based Learning (PBL), with initiatives like “teaching factories” simulating real industrial environments to prepare students for the workforce.

3.1.3 Diverse funding and support mechanisms

The Singapore government has established multi-faceted funding programs like the SkillsFuture Jubilee Fund, which pools contributions from employers, unions, and the government to support training across different career stages. Students, early-career professionals, mid-career workers, and seniors all benefit from tailored training subsidies, personalized career development plans, and flexible learning opportunities. Vulnerable groups such as low-income, long-term unemployed, and disabled individuals may receive subsidies covering up to 95% of course fees. Additionally, the National Centre of Excellence for Workplace Learning (NACE), a partnership between SkillsFuture Singapore and Nanyang Polytechnic, offers consulting and skill development services to enterprises, significantly improving productivity, employee retention, and innovation capacity, thus accelerating industrial transformation [6].

3.1.4 Emphasis on experienced faculty and a unified skills qualification framework

Vocational instructors in Singapore typically possess extensive industry experience; approximately 80% have worked in relevant sectors before teaching. The government promotes a culture of lifelong learning among educators, providing paid study leave and diverse professional development programs tailored to varying career stages and teaching challenges. In terms of skill qualification, Singapore’s Workforce Skills Qualifications (WSQ) framework, developed by the Workforce Development Agency (WDA), certifies skills based on demonstrated competencies and work experience rather than academic degrees. The system includes certifications for generic skills, industry-specific skills, and formal qualifications, issuing standardized credentials at multiple levels. To date, WSQ has developed skill standards across 31 industries, gaining widespread recognition and facilitating workforce mobility and employer confidence through clear, competency-based validation [7].

3.2 Vocational Education and Skills Training in Japan

Since the 1990s, Japan has undertaken significant reforms in vocational education to meet the demands of a rapidly changing economy and a technologically advanced manufacturing sector. The system has gradually developed into a multi-layered and relatively mature framework that integrates formal schooling, enterprise training, and public policy support.

Two primary models characterize Japan’s institutional vocational education. The first is a school-enterprise dual system in which students attend vocational colleges or specialized training institutions for two to five years, focusing on theoretical knowledge and hands-on training. A large portion of the curriculum—sometimes over a third—is allocated to practical instruction, often delivered in partnership with enterprises. Upon graduation, students may receive vocational certifications or qualify for national skill examinations. The second model involves short-term vocational programs—typically one to three years—organized by public vocational development centers in collaboration with businesses[8]. These programs focus on quickly equipping learners with job-ready skills, followed by competency assessments that determine employment eligibility [9].

In addition to school-based learning, enterprise-led training is widespread. Companies commonly provide orientation sessions, structured on-the-job training, and off-site instruction to develop employee competencies. Furthermore, self-development programs—such as internal study groups and voluntary seminars—encourage lifelong learning. Many firms design training modules according to job role and seniority level, actively investing in talent development to improve operational performance.

Public vocational training in Japan functions as a form of social security and labor market adjustment. It supports three key groups: unemployed persons, current workers needing upskilling, and school graduates seeking job preparation. Government-funded programs for the unemployed may last up to one year and include stipends or transportation allowances [10]. Employed individuals can enroll in part-time evening or weekend courses, while recent graduates are offered comprehensive training designed to increase their competitiveness in the labor market.

To respond to future challenges, the Japanese government released its Human Resource Development for Society 5.0 white paper in 2018, highlighting the need for stronger integration between education and industry. The strategy emphasizes the incorporation of AI, data science, and other advanced technologies into vocational education and encourages collaboration between enterprises and educational institutions.

3.3 Vocational Education and Skills Training in South Korea

Once seen as a less prestigious path, vocational education in Korea is now an increasingly competitive option [11].

According to Ministry of Education in Korea, Meister High Schools report employment rates exceeding 70%, signaling growing public confidence in vocational pathways.

The Korean VET system is characterized by a multi-stakeholder governance model involving government ministries, schools, enterprises, students, and families. Policy efforts focus on expanding vocational courses in general education,

increasing access to junior colleges, and promoting hybrid apprenticeship models that integrate classroom learning with enterprise-based practical experience. Many companies also operate affiliated schools or provide direct training support, enhancing the relevance of instruction.

To ensure the robust development of vocational education, the government provides strong policy guarantees and financial support. For instance, the Industrial Education Promotion Act mandates compulsory on-site internships for vocational school students through industry cooperation. The 2018 Basic Plan for Vocational Education and Training allows workers to flexibly select different work and training pathways according to their career stages, enabling them to either enroll directly in vocational colleges or gain work experience before pursuing further vocational study. South Korea has also implemented a national vocational skills education and training leave system, expanding eligibility for paid training leave under labor insurance coverage. The government allocates approximately 2 billion won annually to support tuition, facilities, and program development costs for vocational training courses. These preferential policies have addressed development bottlenecks in the vocational education sector and significantly enhanced its appeal [12]. Additionally, to further incentivize skill development, South Korea has introduced the “Grand Master of Korea” program since 1986, recognizing exceptional technicians with financial awards and annual stipends. Technical workers honored as “Grand Masters” receive a one-time award of 20 million won, followed by an annual stipend ranging from 2.15 million to 4.05 million won. This initiative reinforces a cultural respect for skilled labor and encourages technical excellence within the workforce.

4 KEY LESSONS FROM ASIA FOR ENHANCING CHINA’S SKILLED WORKFORCE

4.1 Enhancing Strategic Support and the Social Prestige of Vocational Education

Countries such as Singapore, Japan, and South Korea once faced widespread social stigma surrounding vocational and technical education, with many families hesitant to view such pathways as viable career options. Over time, however, sustained government campaigns, policy innovations, targeted financial investments, and transparent employment outcomes have contributed to a gradual shift in public perception. Vocational education is increasingly regarded not as a fallback for low academic performers but as a legitimate and respected pathway to professional success.

According to the White Paper on the Development of Vocational Education in China, recent data the employment rates among graduates of secondary and higher vocational institutions have been consistently increased. Furthermore, over 70% of these graduates secure jobs closely aligned with their fields of study. Within six months of graduation, average earnings for vocational graduates surpass national per capita disposable income levels, suggesting growing competitiveness and relevance of vocational training.

To further improve public perception, efforts may focus on strengthening cross-ministerial coordination in line with national policy directives, while also cultivating recognizable institutional brands within the vocational sector. Additionally, elevating the visibility of skilled professionals through national honors—such as the Model Worker or Science and Technology Awards—can help foster a culture that values technical expertise and hands-on innovation.

4.2 Promoting Articulated Pathways and Credential Portability

Singapore, Japan, and South Korea have developed vocational systems that feature both vertical and horizontal integration, enabling smooth transitions between general and technical education. These articulated frameworks support academic progression and career advancement, offering students increased flexibility and mobility.

Singapore’s model stands out for its permeability. Students enrolled in vocational programs may, based on their academic performance, transfer to polytechnics or even universities without sitting for additional standardized exams. Such credit recognition mechanisms not only facilitate upward mobility but also motivate students to pursue excellence within technical domains.

In the Chinese context, there is increasing recognition of the need to establish clearer articulation between secondary vocational schools, higher vocational institutions, and undergraduate programs. Frameworks that allow for mutual recognition of academic credits and vocational qualifications could help build more coherent pathways. Aligning vocational credentialing with degree-level recognition would also enhance the professional identity and long-term development of skilled workers.

4.3 Building a Future-Oriented and Practice-Driven Lifelong Learning System

High-quality vocational development increasingly depends on lifelong learning systems that respond to rapid technological change and evolving labor market demands. One critical dimension involves school-enterprise collaboration. Drawing from international experiences, particularly the dual-track models in Singapore, Japan, and South Korea, a system in which theoretical learning is anchored in schools and practical training is embedded in enterprises has proven effective in producing work-ready graduates.

Another strategic priority lies in aligning curricula with future skills needs. This includes closely monitoring technological developments—both globally and domestically—and adapting educational content accordingly. The integration of digital tools, such as AI and internet-based platforms, can further modernize instruction. Singapore’s “Teaching Factory” initiative offers a compelling example, as it enables students to train on real industrial equipment in simulated environments, narrowing the gap between training and work.

Additionally, national platforms for skill enhancement, including technical competitions, may be expanded. Competitions that encourage "learning through contests and training through practice" can reinforce a culture of continuous learning and technical mastery.

4.4 Fostering a Multi-Level, Multi-Actor Vocational Ecosystem

A well-functioning vocational system requires coordinated participation from multiple stakeholders. International models highlight the importance of clearly delineating roles across government agencies, schools, enterprises, and civil society. At the institutional level, strong vocational colleges anchored in specialized technical education are foundational, while broader social engagement in vocational development should be encouraged.

The revised Vocational Education Law underscores the strategic role of enterprises in operating and supporting vocational institutions. Similar to international practices—such as government subsidies for enterprise-led education in Japan and Korea, or Germany's legally embedded training frameworks—private actors can play a central role in expanding capacity and enhancing responsiveness. Leveraging market mechanisms to incentivize enterprise participation through tax incentives, credit mechanisms, or co-financing models may further enhance investment and innovation within the sector.

4.5 Strengthening Skills Recognition and Career Incentives

Refining the evaluation system for skilled workers remains critical. Current challenges include the lack of a fully established grading system, limited upward mobility, and weak alignment between skills and compensation. The experience of piloting the "New Eight-Level" vocational skills framework offers a valuable opportunity to address these gaps and promote scalable models.

At the same time, evaluation practices may benefit from a more employer-driven, market-responsive model. Empowering enterprises and industry associations to lead in skills assessment—under a "who hires, evaluates" principle—can improve relevance and accountability.

Moreover, establishing a skill-based promotion system, parallel to technical and managerial tracks, may better reflect the value of hands-on expertise. Recognition systems, including national commendations and international honors such as WorldSkills medals, can further elevate the visibility and motivation of the skilled workforce.

4.6 Expanding Internationalization and Global Competence among Skilled Workers

In an era of global interdependence, skilled workers with an international outlook are increasingly vital. Countries such as Singapore have proactively introduced foreign training curricula, international teaching resources, and multinational cooperation platforms to cultivate globally competent talent.

Looking ahead, efforts to internationalize vocational education may include clarifying long-term development strategies, benchmarking global standards, and participating in international mutual recognition frameworks. Hosting international conferences and competitions, developing flagship Sino-foreign partnerships, and expanding participation in global vocational education networks can further strengthen China's voice and visibility in the global skills arena.

Additionally, adopting open talent introduction policies and selectively incorporating advanced pedagogies from leading international institutions may enhance local capacity. Over time, building a distinctive Chinese vocational education brand—defined by excellence, innovation, and global relevance—could help elevate both domestic standards and international influence.

5 CONCLUSION

In summary, the vocational education systems in developed Asian nations like Singapore, Japan, and South Korea are characterized by articulated educational pathways, diverse schooling systems, a philosophy of lifelong learning, collaboration between government and industry, and an emphasis on practicality and industry-education integration. These elements have served as catalysts for their successful industrial worker training and education systems.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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