VTE VOCATION, TECHNOLOGY & EDUCATION

REVIEW ARTICLE

Chinese technical and vocational education and training, skill formation, and national development: A systematic review of educational policies

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ABSTRACT

Vocational education and training have been widely found to be related to economic development. In China, a country with a collectivist ideology, this relationship is especially significant and is reflected in many vocational education policies. This study analyzed the relationship between national development and Chinese technical and vocational education and training (TVET) in a systematic review. The study screened 33 vocational education policies that depicted the government's expectation of promoting economic development. These policies were screened, coded, categorized, and connected based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis standards. Qualitative methods and the theoretical framework of Ashton and Green were used to analyze the policies. Six themes were generated to detail the Chinese TVET development form and its attempts to promote national development: the modern TVET system, school-based vocational education, the competency-oriented curriculum system, student incentives, employer incentives, and workplace-based skills training.

Key words: technical and vocational education and training, skill formation, national development

INTRODUCTION

Transforming Our World and the *Incheon Declaration: Education 2030* are two publications that recognize education as an important driver of the development and achievement of sustainable development goals (SDGs), such as industry and innovation, decent work and economic growth, and global peace and justice.[1,2] Moreover, technical and vocational education and training (TVET) is a central aspect of Goal 4 (Quality Education) of the SDGs and the *Incheon Declaration*.[2] Given that individual national development is part of global sustainable development, TVET plays a significant role in national development agendas across the world.

Since 2010, the central role of TVET has been recognized in China. A series of policies have been issued, such as the *Outline of the National Plan for Medium and Long-Term Education Reform and Development (2010-2020)*, *the Decision on Accelerating the Development of Modern Vocational Education*, *the Implementation Plan for National Vocational Education Reform*, and *the Opinions on Deepening the Reform of the Construction of Modern Vocational Education System*. They all drew a blueprint for the future development of the Chinese TVET system. As a result,

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Chinese vocational education is undergoing profound changes with, for example, a modern vocational education system framework that has already trained nearly 10 million skilled workers annually to support national development.[3]

However, some researchers in the TVET fields have argued that the too many recent policies may disturb educational practice, preventing teachers and schools from focusing on teaching students. Thus, it is necessary to examine the potential effects of the ongoing TVET policies in achieving these goals. In the present study, the vocational education policies in China over the past two decades were reviewed. The trends and specific strategies were analyzed in relation to national development, and Ashton and Green's high-skill formation conditions theory was used as an analysis framework. This paper thus provides feedback on China's vocational education policies and serves as a reference for future vocational education and national development. The research questions were as follows. Which concrete TVET development strategies has the Chinese state planned? Which elements have incentivized the Chinese government to reform TVET so profoundly? How can the new TVET strategies serve national development?

THEORETICAL FRAMEWORK AND THE CHINESE CONTEXT

Varieties of capitalism, national development, and TVET

According to Ashton and Green, any capitalist economy that wishes to build a nation and develop an economy based on high-skill work must meet six specific conditions: (1) the government's commitment to high-level skills education and training as well as innovative use of the productive system; (2) the existence of a national off-the-job training system combined with on-the-job training; (3) an education system focused on strong competencies in basic subjects; (4) workers' willingness to engage in high-skills training; (5) employers' willingness to create high-skill industries and help train workers; and (6) oversight of how skills training in the workplace is conducted.[4] Depending on the degree to which countries and economies are able and willing to meet these criteria, they will embark on either a high-skills or a low-skills route. Ashton and Green further argued that in countries with weak central governments, education tends to be in the hands of a variety of competing and independent entities. In contrast, strong central governments tend to take an active role in skills development and certification standards and create rules and institutions to achieve the desired results. Hence, there tends to be a correlation between governments actively directing nation-building and the development of a high-skills economy.

From the perspective of solving the problems of coordination among different stakeholders in firms, Hall and Soskice grouped national economies into two categories: liberal market economies (LMEs) and coordinated market economies (CMEs).[5] In LMEs, firms coordinate their activities primarily through hierarchies and competitive market arrangements to respond more aggressively to market forces.[6] However, LMEs often have higher levels of income inequality, lower levels of coordination between firms and labor, and even lower levels of workplace safety. Furthermore, industrialists rejected government oversight so that they could exploit workers, eventually leading to factionalism between skilled craft workers and expendable industrial workers, both of which reduced the desire to acquire higher skills. High unemployment eventually occurred, especially after World War II, as global competition began to increase.[7] On the other hand, in CMEs, coordination among firms depends more heavily on strategic interaction and other actors (labor and government) than on the market. While these CME firms may still compete with each other, their relationships tend to be built more upon collaboration. Moreover, as a result of the powerful influence of labor unions on equalizing wages at various firms in a given industry, this coordination among companies often means that they can offer strong trade-oriented education for their employees with little worry about poaching.

On the aforementioned point, it is important to assess which type of national plan China has embarked on. Luly argued that the categorization of national economies into LMEs and CMEs is not well suited for transition economies because it often overlooks the crucial factors influencing economic development, such as history, culture, politics, and geography.[6] Since the end of the 19th century, no solid economic model has been formed in China because economic development has always been in transition from old to new models, as required by shifts in politics. To better understand the Chinese situation and provide answers to this paper's major questions, we must begin with a look at which kinds of skill formation systems have traditionally been formed in China.

History of the Chinese TVET system

China has a long liberal education tradition dating back thousands of years and remaining unchanged until the end of the 19th century, when vocational education came into being.[8] However, the emergence of an organized TVET system is a far more recent event.[9,10] In terms of its historical trajectory, Chinese vocational education development can be divided into six main stages: (1) 1860-1911, introduction of industrial education; (2) 1911-1949, construction of a vocational school system;

(3) 1949-1966, expansion of technical education; (4) 1966-1976, destruction of the vocational education system; (5) 1978-1999, rebuilding of vocational education; and (6) since 1999, new developments and reforms of vocational education.

Introduction to industrial education

After the conclusion of the Second Opium War in 1860, to save the country from colonization, some early reformers, having realized that technological development and industrialization could potentially transform society and rejuvenate the Chinese nation, introduced Western-style schooling, which gradually developed into industrial education.[11,12] The Qing government eventually created a national system of industrial education as part of the 1902 education system reform, which included elementary, intermediate, and higher industrial schools. These schools offered modern Western technology and Western culture as their main programs and introduced capitalist ideas into the schools' administration.[13] The schools were instrumentalist and focused on helping technicians develop specific skills to serve the national need for military, industrial, and infrastructure development.

Construction of a vocational school system

In 1911, the Xinhai Revolution overthrew the government of the Qing Dynasty and founded the Republic of China, which modified the national economy into a capitalist model. When World War I broke out, capitalism developed quickly in China. To meet the urgent demand for highly skilled technical workers, American-style vocational education was introduced, and the Chinese Vocational Education Association was founded in 1917 to reform traditional education. In 1918, the first vocational school in China, the Chinese Vocational School, was opened in Shanghai.[13] In the 1922 education system reform, a vocational department was established at the secondary level, replacing the former industrial schools. However, after the Nanjing government's establishment in 1927, pragmatism in vocational education experienced a steady decline because the government wanted to emphasize native culture more strongly.[11]

Expansion of technical education

When the People's Republic of China was founded in 1949, social and economic reconstruction was the core task of the Chinese communists in managing the new nation, and vocational education had to be subsumed under this political goal.[14] The recovery period of the national economy took place especially from 1949 to 1952, and the main task of the education system was to develop new political attitudes. Building a completely new vocational education system that fully reflected the new social, political, and economic system and the needs of the population as soon as possible was put on the national agenda. The new communist country turned to the Soviet Union to learn from its comprehensive technical education experience, and a system of secondary technical schools and specialized schools was soon established.

Destruction of the vocational education system

However, since 1956, as a result of its deteriorating relationship with the Soviet Union, China embarked on the construction of a socialist society through self-exploration. Work-study programs were advocated and used as the main model of vocational education.[11] Mao Zedong proposed that all secondary technical schools and specialized schools try to run factories or farms, and students should work part-time and study part-time. Unfortunately, the initially established vocational education system was destroyed by the Cultural Revolution, which began in 1966 and lasted for almost 10 years.

Rebuilding of vocational education

As Deng Xiaoping's "Reform and Opening Up" policy began to be implemented, the Chinese economy during the 1980s and 1990s was gradually transformed from a planned economy to a market economy. As a result, vocational education was gradually connected more closely with societal needs. First, to satisfy the need for skilled workers to accelerate national economic development at the beginning of the 1980s, the government reformed the secondary education structure, and one-third of general secondary schools were designated to be transformed into vocational schools. Second, as the goal of developing a socialist market economy was declared at the beginning of the 1990s, TVET was regarded as the key element for achieving industrialization and modernization, so a vocational and technical education system with Chinese characteristics was to be constructed.[13] Third, the development of TVET began to move toward educational management through a legal framework, particularly after the vocational education law of 1996 was issued.

New developments and reforms of vocational education

At the turning point of the new century, the new market economy increased the need to improve vocational education and training systems in China.[15] As far as the organization of TVET is concerned, vocational training and higher vocational education were developed mainly in the first 10 years of the 21st century. In the 1990s, the Chinese government encouraged the development of multiple approaches to TVET, but in practice, school-based vocational education still dominated TVET, which could not train enough qualified workers for the economy. In the early 2000s, higher vocational education

became a significant contributor to higher education. Some researchers have argued that the emergence and development of higher vocational education in China have occurred within the context of neoliberal globalization, which emphasizes marketization, deregulation, and competition.[16–18] Under neoliberalism, China was striking a new balance between government interference and market participation. According to the national TVET policy, the government requires employers, industry, and social partners to participate actively in the TVET system.[19] From the 2010s until the present time, China has tried to improve the social reputation of TVET by highlighting its characteristics as an independent education type and establishing a higher level of vocational education institutions. Some specific policy requirements and measures have been proposed, such as the 1 + X certificate system, vocational education college entrance examination, vocational university, skill-oriented society construction, and municipal industry-education consortium.[20,21] This policy shift may be in response to the development of high and new technologies. The emergence of the core technologies of the Fourth Industrial Revolution, such as artificial intelligence and virtual reality, has made it imperative for vocational education to evolve toward more advanced and cutting-edge fields.

MATERIALS AND METHODS

Searching policy documents

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) standards to ensure the objectivity and transparency of the present study.[22] Figure 1 shows the process of the research method used in the study. The website of the Ministry of Education of the People's Republic of China (www.moe.gov.cn) was used to search for policies. We set the following pre-conditions before the search: (1) the file type of the search results was "public policy"; (2) the file format of the search results was "all"; and the time span was from January 1, 2004, to January 1, 2024. We used all the synonyms of "vocational education" as search terms (*i.e.*, "vocational training", "skills training", and "vocational education and training"). The search process yielded 1128 results in total. After the replicates were removed, 931 unique records remained.

Screening the titles

We read the titles of the 973 documents that we identified earlier for a preliminary screening of the policies. After the screening process, 142 policies were selected. The screening criteria used were as follows.

1. The policy types should be actions, plans, initiatives, and decisions containing actual requirements. Thus, policy types such as proclamations, announcements, reports, and statements were excluded.

2. Due to our research focus, the included policies should be general enough to be related to national development. Some specific policies were excluded because they could not provide enough information about the relationship between TVET reform and national development.

3. The departments that issued the included policies should be related to education. For example, the annual budget for vocational education issued by the Ministry of Finance was excluded.

Full-text assessment

Given that some general policies included in the aforementioned screening process were not closely connected to our research questions, another round of selection was conducted based on the assessment of the full text. We browsed the full text with the three research questions in mind. Only the 33 policies that could respond to our research questions were retained.

Analysis

The coding and analysis of the selected policies were carried out *via* thematic analysis based on grounded theory. We generally followed the process suggested by Braun and Clarke to code and generate themes, and we also used the idea of axial coding and selective coding in grounded theory to connect these themes and generate an explanatory model.[23–25]

Identifying analyzing units

We read through the selected policies and took note of our initial ideas. Then, we segmented the policies into analyzing units (*i.e.*, meaningful units composed of coherent continuous texts on a single theme).[26] In this paper, an analyzing unit is usually a paragraph with one policy requirement and its interpretation and implementation measures. Paragraphs that did not address the relationship between TVET and national development were not identified as analyzing units.

Labeling and coding

We first labeled the sentences and phrases in the analyzing units. Every single policy requirement, measurement, and suggestion was labeled as one code. An independent researcher was invited to code around 10% of our transcribed text to ensure coding consistency, and then different coding results between researchers were discussed and revised.

Generating themes

We identified connections and similarities between the codes *via* axial coding. The codes were categorized twice in a bottom-up way. Every round of categorizing was

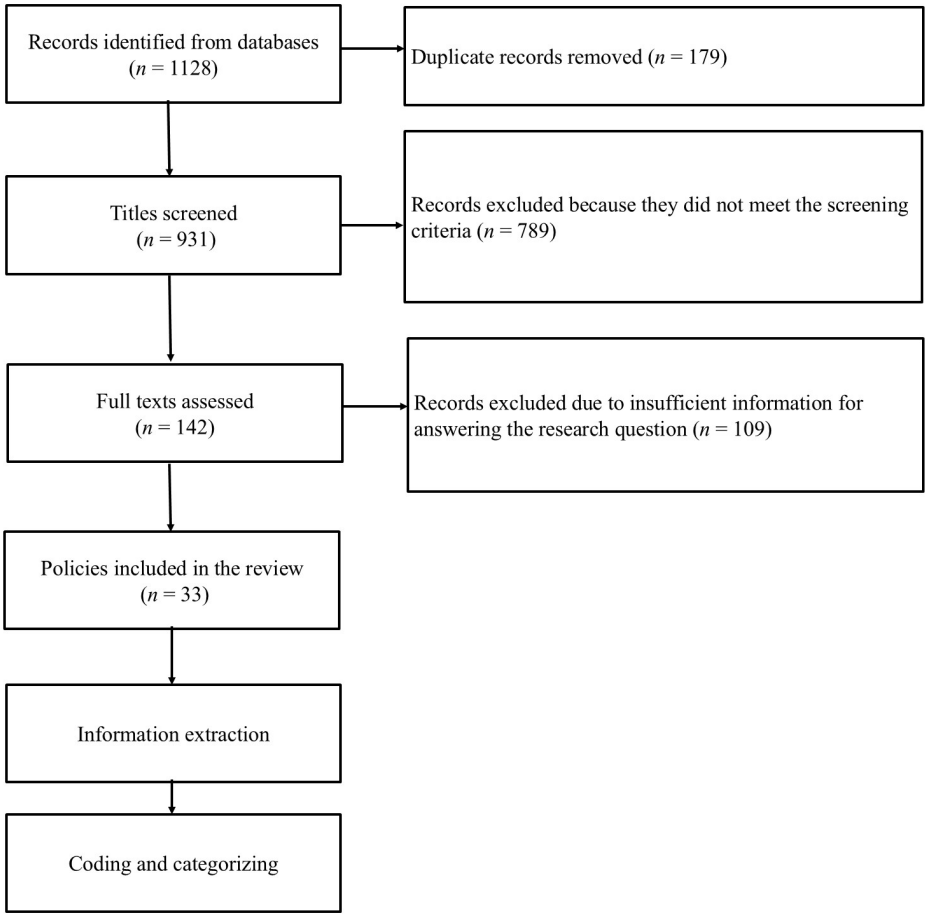

Figure 1. Research procedure through different phases of the review.

conducted based on the similarities of the different codes, and Ashton and Green's theocratic framework was also used to generate categories. Finally, six main themes were generated.

FINDINGS

This paper analyzes the recent Chinese TVET developments from the perspective of the high-skill formation framework proposed by Ashton and Green. The policies in the last two decades have been categorized into six themes that detail the Chinese policy orientation of TVET in the future. The relationships among the six themes and their impacts on national development are illustrated in Figure 2. The plus and minus symbols indicate the positive and negative effects, respectively.

The Chinese government's commitment to developing a modern TVET system

As Ashton and Green hypothesized, it is hard to build a skill formation system without a solid educational base. To construct a modern vocational education system, the Chinese government has issued a series of policies in the past several years to improve its vocational education system.[4] Concrete policies such as *the Outline of the National Plan for Medium and Long-Term Education Reform and Development (2010-2020)*, *the Decision on Accelerating the Development of Modern Vocational Education*, *the Modern Vocational Education System Construction Plan (2014-2020)*, and the *Opinions on Deepening the Reform of the Construction of Modern Vocational Education System* make the design of the modern vocational education system more detailed and specific.[20,27–29] Overall, the term "modern vocational education system" includes the following: (1) vocational school education and vocational training; (2) primary, secondary, and higher education levels; (3) universities of applied science providing bachelor's degrees; (4) connections between secondary and higher levels and between vocational education and general education; (5) new strategies, such as modern apprenticeships, career clusters, and new training programs for skilled farmers; and (6) lifelong education and an education system with Chinese characteristics. The latter four have been the main task and direction of Chinese TVET reform in the past several years and will remain so in the near future.

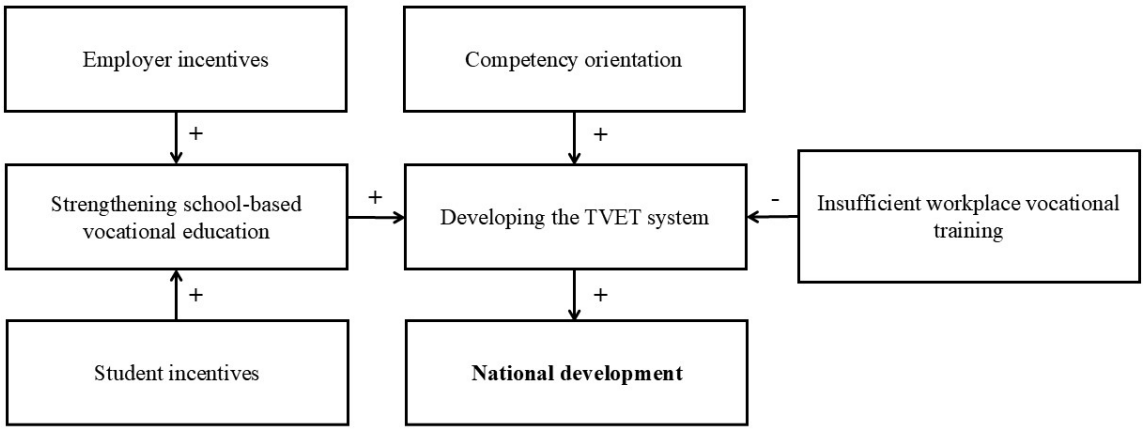

Figure 2. Relationships among the six policy themes and their impacts on national development. TVET, technical and vocational education and training.

The main reason that the Chinese government is embarking on constructing a modern vocational education system is that the contradiction between the demands for higher-level skills and the existing lower-level vocational education programs continues to persist. With the economic situation transforming, the industrial structure requires upgrading from low-value-added products, poor efficiency, and high energy consumption to high-value-added products, high efficiency, and low energy consumption.[30] In addition, some of the newly proposed national strategies require reform of the Chinese TVET system. For example, the Made in China 2025 strategy was implemented in 2015, and the Digital China Construction strategy was proposed in 2023. They both expect Chinese manufacturers to seek innovation-driven strategies, apply smart technology, and pursue green and high-level development, and want to turn China into a manufacturer of quality rather than quantity by 2025.[31] Therefore, many more creative and highly skilled workers are needed. However, the traditional Chinese vocational education system cannot educate qualified technical workers, especially advanced technicians, for a competitive labor market.[32]

It was reported that by the end of 2015, the framework of the Chinese modern vocational education system had been constructed, and by the end of 2025, the Chinese modern vocational education system should have been completely established.[3,33] It should not only include the complete levels of elementary, secondary, and higher vocational education but also extend higher vocational education from associate to bachelor's degrees. The different levels of vocational education are becoming increasingly connected, and vocational and academic education are becoming increasingly integrated. In this way, TVET is playing an increasingly important role in cultivating a highly skilled technical workforce for Chinese economic development. First, the development of universities of applied science will provide higher-skilled workers for advanced manufacturing, increasing the value-added and green aspects of products.[34,35] Second, the connection between secondary and higher vocational education and the integration between vocational and academic education will give students more opportunities to choose their careers and further-education fields, which can lead to the employment of more vocational education students in future technical occupations. Third, new programs, such as modern apprenticeships and career clusters, will make TVET more effective in training skilled workers for the workplace.

Strengthening school-based vocational education

Off-the-job education and training is another significant condition for developing a highly skilled workforce for national development. As early as 2012, both secondary and higher vocational education in China made up nearly half of their respective levels, making the system the biggest vocational education system in the world. In 2014, there were 119,000 secondary vocational schools and 1327 higher vocational colleges in China, which recruited 45% and 46.9%, respectively, of all the students enrolling in secondary and higher education.[3,36] In addition, the *Decision on Accelerating the Development of Modern Vocational Education* requires that more than 600 academic universities be transformed into universities of applied science, and the *Implementation Plan for National Vocational Education Reform* requires the establishment of vocational universities, a new form of university situated at the intersection of an academic university and a vocational college.[28,37] These policies together expanded the scale of off-the-job vocational education even further.

Since 2000, the Chinese government has promoted the

development of vocational schools and colleges through political intervention, ensuring that half of all current full-time education will be vocational school education. Lately, the strategy of developing universities of applied science has mainly been attributed to the demands of economic development, labor market structure changes, and the poor quality of local universities. However, challenges remain. Rapidly increasing enrollments lead to large class sizes, which, in turn, compel instructors to revert to traditional rote learning of facts rather than task-oriented training. Many universities aspire to bask in the prestige of being comprehensive rather than focusing on workforce development. Parents also support this trend by continuing to push their children toward academic programs in top colleges.[37,38] Thus, school-based vocational education is the core of the Chinese modern vocational education system. It affects Chinese national development in the following ways.

1. In each of the past few years, school-based vocational education produced nearly 10 million skilled technical workers annually for the economy. These graduates can apply what they learned in schools to the production processes in industry, helping employers make a profit and promoting the economic development of the country.

2. Workers who graduated from vocational schools and colleges can complete work tasks and solve practical problems much more easily than those who did not receive any formal education. Problem-solving and task completion are crucial to gains in productivity.

3. If employers later provide on-the-job training and human resource development interventions, educated workers can learn better and quicker using the theoretical knowledge they have learned in school, saving employers both money and time.

4. Most of the students in Chinese vocational schools and colleges are considered the "losers" of academic education, and without the opportunity to attend a vocational school, they will struggle to become productive citizens. Vocational schools provide a second opportunity for young students to complete their education, find gainful employment, and be less in danger of delinquency.

Competency-oriented curriculum system

The increasingly competitive global knowledge economy places increasing importance on language, science, mathematics, and information technology competence for both individual and national development because such competencies are essential for workers to further develop their work-based skills.[4] Vocational schools and colleges in China expect to develop students' academic competencies through a general education curriculum that includes moral education, language arts, mathematics, history, sports, art, information technology, and innovation and entrepreneurship courses, which are called basic education courses or common basic courses.[39] In recent years, the Chinese government has made efforts to reinforce the teaching of academic education in vocational schools and colleges. The Ministry of Education into technical courses to cultivate comprehensive cultural, scientific, and sustainable development competencies in students. However, moral education is given precedence among all general education subjects to develop in students a desirable worldview that emphasizes Chinese values and social characteristics. The *Implementation Plan for National Vocational Education Reform* also demands conducting the vocational education college entrance examination and the 1 + X certificate system, which requires vocational school students to possess both cultural quality and vocational skills, providing students with a foundation for sustainable development and encouraging students in vocational colleges to obtain both academic certificates and multiple vocational skill level certificates.[21]

What are the results of the aforementioned governmental efforts? Has the academic content produced the basic competencies required for national economic development? Optimism on this front appears to be premature. As there was not much in-house vocational school education in ancient times, modern vocational schools had to learn from the experiences of general academic schools. Even after Deng Xiaoping's 1978 call for reform and opening up, the curriculum structure in vocational schools has been very similar to that in general schools.[40] The academic content and teaching methods in particular were simply copied from the latter. A similar situation could be observed in higher vocational colleges after their numbers began to grow in the 1990s, teaching methods were simply copied from general academic universities. Because both academic content and teaching methods in vocational education have the hallmarks of academic education, it is a challenge for vocational education to teach the applied academic competencies demanded by the workplace, which is one of the reasons why the Chinese government promotes academic curriculum integration with technical coursework. It will take time for Chinese vocational education to improve and develop academic courses with vocational education characteristics. In terms of moral education, ideological and political education seems to have little success because it does not appeal to students and thus presents another challenge for China in achieving socialist modernization.[41,42] The sense of organizational identification with one's employers is still underdeveloped among many workers. Forty-two percent of vocational college graduates in 2014 left their occupations after less

than six months, which was higher than the rate for general universities, although the post-graduation employment rate was higher among vocational graduates.[43–45] This inability of companies to retain workers has become a significant obstacle on the path toward national development.

Offering students incentives to participate in TVET

According to the theory of skill formation systems, both current and prospective workers must be committed to the goal of skill formation. In China, current workers have certain motivations to participate in vocational training, such as the need for professional development, an interest in lifelong learning, and external expectations.[46] However, few young students are willing to choose the TVET route, but half of them now have to attend vocational schools/colleges because there are not enough academic schools/colleges.[47] Therefore, even after they have enrolled in vocational schools and colleges, they are still not interested in studying.[48] This attitude can be attributed to Chinese parents who consider vocational education inferior to academic education and do not want to send their children to vocational schools and colleges.[49] Eventually, their children's willingness to attend vocational schools/colleges diminishes, and they instead prefer to study for college entrance exams in hopes of winning one of the limited number of slots in a limited number of academic institutions. Therefore, most of the students enrolled in vocational schools/colleges are there because they have no other choices, which leads to a negative attitude toward learning and study.

In a knowledge economy, highly skilled workers are the key human capital that drives national economic development. However, in China, the shortage of highly skilled workers may make it difficult to sustain high economic growth rates in the future.[50] The government has consequently tried to take measures to enhance the attractiveness of vocational education. One way has been to fund secondary vocational education and make it free for all students. In 2009, free secondary vocational education began with agriculture programs for students from economically disadvantaged families. Since the fall semester of 2012, free vocational education has been extended to all students from rural areas, urban students interested in agriculture, and poor families.[51] Agriculture students and those from economically disadvantaged families are also eligible to receive an additional annual subsidy of 1500 CNY.[52] To improve the motivation of vocational students to apply themselves to their studies, the government has tried to provide more opportunities for them to continue their education. Thanks to the implementation of the free secondary vocational education policy, 91.5% of students in Chinese vocational schools could get free education by the end of 2015, and 40% were eligible for the national subsidy. In addition, the latest revision of the *Vocational Education Law of the Republic of China* issued in 2022 proposes strengthening vocational education for vulnerable groups, such as workers transitioning to new positions, those reentering the workforce, people with disabilities, veterans, and unemployed women. The government aims to attract vulnerable groups to engage in vocational education to improve their living conditions.[53]

Despite the aforementioned incentives, it has proven difficult to enhance the image of vocational education, and even the free tuition policy could not encourage enough students to consider vocational education, most likely because of the traditional negative attitude toward it, the poor quality of instruction, and inadequate supervision.[54] Prior researchers argued that only the relatively few economically disadvantaged students were enticed by the free tuition policy, so the key way to overcome the obstacle of secondary vocational education development is to ensure the availability of sufficient well-paying jobs.[55]

Chinese vocational education has a long way to go to effectively support national development by addressing the shortage of highly skilled technical workers.[56] Across all industry sectors, only 4% of all workers are classified as highly skilled, and workers also need to develop the ability to deal with repeated and ongoing change.[57] The government has called for further educational reform that focuses on preparing people for work to support continued economic and national development, especially in high-skill technology occupations. Such support from the top echelons of power is due to the close links between political stability, government power, and economic development.[58] Education then becomes the cornerstone of national development because progress cannot happen without a well-trained workforce.

Offering employers incentives to participate in TVET

Ashton and Green also expected major employers to be committed to high-skill formation because some important skills are difficult to impart in the classroom and cannot be developed without the workplace. Furthermore, the cost of training on the job is usually lower than that of training in school because employers can better match the skills that employees need to possess to their product palette.[4] Chinese enterprises have a long history of offering job training to new employees. However, as the establishment of the socialist market economy system progressed, large companies gradually loosened their relationships with industrial vocational schools, which were left to be

supported by local governments, preferring to conduct in-house vocational training because vocational schools could not train qualified workers effectively and in a timely manner.

Ashton and Green further noted that one of the ways to make employers more committed to skill formation is through state intervention, which has been practiced in Singapore, where state capitalism has succeeded in contributing to national economic development.[4] The success of state capitalism in Singapore can possibly be duplicated in other developing and emerging economies, including China.[59] State intervention could be an effective approach to incentivizing Chinese employers to participate in TVET. Realizing the lack of cooperation between employers and vocational schools and colleges, the Chinese government has taken several measures to bring the two sides together. First, to encourage employers to participate in school-based vocational education, the China State Council announced that industrial enterprises could get certain forms of financial support if they do this.[28] For example, the expenses that employers incur while accepting student interns will be tax deductible, and companies that collaborate with vocational schools or colleges will receive additional subsidies. Furthermore, the government provided two primary avenues for employers to engage in TVET. One is to promote and operate vocational education using groups of stakeholders, such as the government, industry associations, employers, and vocational schools and colleges.[60] The collective operation of TVET can make use of all the resources that the different parties have to offer and can coordinate the relationships among the partners.

Another way for enterprises to participate in vocational education is through modern apprenticeship, which was initiated by the Ministry of Education in 2014.[29] Different from the German apprenticeship model or Britain's current apprenticeship, modern apprenticeship in China is a program for full-time students in vocational schools and colleges that includes an agreement between vocational schools and industrial employers and regulates the responsibilities of both schools and companies. Since the start of the 2020s, the Chinese government has been committed to promoting school-enterprise cooperation from a more macro perspective. *The Opinions on Deepening the Reform of the Modern Vocational Education System* released in 2022 proposed to explore new models for the construction of provincial modern vocational education systems and has initiated pilots for creating municipal industry-education consortiums and integration communities.[20]

Oversight of skills training in the workplace

Under government leadership, the joint vocational education administration and modern apprenticeship are collaborative agreements among vocational schools and colleges, industrial enterprises, and other partners that regulate employers' obligation to become part of school-based vocational education. By the end of 2014, 1048 vocational education administration groups had been formed, covering about 8330 vocational schools and colleges, 23,500 enterprises, 1630 government departments, 1680 industrial associations, and 1450 other organizations.[61] With the establishment of these vocational education groups, industry-education integration and school-enterprise cooperation were deepened, the power of vocational schools and colleges was strengthened, and urban-rural development was promoted, all of which helped train skilled workers for national economic development. In addition, the government was able to coordinate the reform efforts and apply the results elsewhere. Schools were able to negotiate with industry to upgrade facilities and expand teacher qualifications, and enterprises were able to obtain the highly skilled workers they needed through training. Such benefits encouraged all participants to maintain close cooperation with each other.[62]

In terms of modern apprenticeship, many models, such as teaching-learning-doing integration, industry-specific schools, the school-enterprise dual system, and career clusters, have been practiced in vocational schools and colleges, all of which encourage industrial enterprises to participate in the whole TVET process and help resolve the problem of separating theory from practice, knowledge from skill, and learning from work. Some of the remaining challenges with enterprise participation are grounded in the fear that taking on apprentices will lead to additional costs or loss of productivity or that trainees may have access to information deemed "confidential" that the industry is trying to keep from competitors. Other than government subsidies paid directly to enterprises, the most effective way to encourage industry to participate in TVET is to develop close relationships between industry and schools, where enterprises can choose the model they prefer, participate in program and curriculum development, and determine the scope of apprenticeship activities.[63]

However, there are still many problems in the relationship between industrial employers and vocational education. Risler and Zhao cautioned that a term such as "school-enterprise cooperation" is inherently vague and does not lend itself to an automatic agreement on its extent and commitments.[64] Issues to be clarified include the types of employer organizations that become part of the system and their roles, the financial commitments of the different entities, the exact services each partner

must provide, and the level of influence the government is willing to grant enterprises on program and curriculum development in state schools and colleges. Another role that the government can assume in this process is to pass appropriate and specific legislation and use its expertise to help others negotiate deals that provide stability and certainty.

CONCLUSION

Vocational education and training in China have responded to the demands of national development to some extent, and institutions for high-skill formation are gradually being put in place. As economic transformation and industrial modernization have become the new status quo, the Chinese government has issued a number of regulations to promote vocational education and training development, and some achievements have been made. From the point of view of high-skill formation, the following six points apply.

1. The Chinese government has been committed to developing a high-level skills education and training system. Responding to the need for economic transformation and industrial modernization, the Chinese State Council and the Ministry of Education have published a series of documents to stimulate the development of TVET, especially in constructing the modern vocational education system. Finally, a modern vocational education system framework has been formed, which has already trained nearly 10 million skilled workers per year to support national development.

2. Off-the-job vocational education has received much more attention. To meet the demand for a technical workforce for economic development and the need to have students enroll in secondary and higher vocational schools, the Chinese government supports the development of vocational schools, colleges, and universities of applied science and ensures that off-the-job vocational education comprises half of the time students spend in the classroom. Employees are expected to deal with complicated work tasks effectively by applying the theoretical knowledge they have learned in school.

3. In Chinese vocational schools and colleges, academic skills are expected to be learned through a general education curriculum, including moral education, language arts, mathematics, history, sports, art, information technology, and innovation and entrepreneurship courses. In recent years, the Chinese government has reinforced the reform of academic courses due to the demand for comprehensive competencies in the knowledge economy. However, the effectiveness of this approach is undetermined, which remains one of the obstacles to national development.

4. As a result of students' reluctance to participate in vocational education, the Chinese government has taken measures to enhance the attractiveness of vocational education, such as offering free secondary vocational education. Besides tuition waivers and eligibility for a national subsidy, students in vocational schools have the opportunity to study and continue their education. However, this policy did not increase student interest in vocational education.

5. Government intervention plans, such as joint TVET administration and modern apprenticeships to encourage the participation of employers, were supposed to coordinate the relationship between vocational schools/colleges and enterprises, and especially codify employers' obligation to participate in school-based vocational education. However, enterprises remain reluctant to do this because regulatory certainty remains spotty and insufficient.

6. Regulatory and legal certainty is crucial to employers. Strides have been made in codifying the obligations for employers entering into collaborative agreements with vocational schools and colleges.

Implications

According to the aforementioned conclusions, three practical implications were proposed for policymakers to polish the current policies and further improve future practices in Chinese TVET systems.

First, considering TVET's poor reputation and attraction, students' low willingness to enroll in TVET schools can be said to be a result of culture and history. Mere policy incentives in educational fields may fail to improve the reputation and attraction of TVET in China. A combination of policies for improving the treatment of skilled workers, shaping social values toward technical work, implementing vocational enlightenment education in primary schools, and enhancing social propaganda toward TVET is necessary.

Second, regarding the most popular topic in the Chinese TVET field—industry-education integration—the Chinese government has already issued some policies on promoting collaboration between TVET schools and enterprises. However, according to the results of the present study, the current policies are vague and cannot sufficiently encourage enterprises to participate in vocational education. Thus, the complexity of the relationships between TVET schools and enterprises requires further clarification of the rights and responsibilities of both sides in the form of a strict legal

framework and system of regulations. In addition, workplace-based vocational training should be carefully designed to make it more beneficial for both students and employers.

Third, a stronger and more deliberate connection between the TVET system and socioeconomic needs should be established. Although we found a clear national-oriented policy system in China, where the TVET system is designed for economic development, the relationship is designed at the top level, and how it should be implemented is not clear. To bridge this gap in the Chinese TVET policy system, detailed connections should be built, such as aligning the school specialty with industry, connecting the curriculum content and professional standards, matching the teaching process with the production process, and providing an academic diploma and professional certification.

Limitations and suggestions for further research

One main limitation of the present study was that it did not evaluate the effects of the ongoing Chinese policies on TVET. As it was a review study, it generalized the aims, measures, and values of the relevant policies in the last two decades. However, we could not evaluate these policies due to insufficient empirical data. We expect future studies to focus on comparing policy requirements and their implementation to provide practical implications for future educational practices.

Another limitation of the present study was the research method used. We introduced the systematic review methods and the PRISMA standards to improve the reliability and validity of the screening process, although the analysis process was relatively plain. Through thematic analysis, we generated six themes of Chinese TVET policy trends. However, more detailed questions cannot be explored with the thematic analysis method, such as the effects of policies, the synergic relationships among different policies, and the frequencies of policies emphasized by the government. Thus, future studies may try different methods, such as grounded theory, mixed methods, correlation analysis, and the structural equation model, to reveal the relationships and changes in educational policies in the last decades.

DECLARATIONS

Author contributions

Chen P: Conceptualization, Writing—Original draft, Writing—Review and Editing. Schmidtke C: Conceptualization, Writing—Reviewing and Editing. Jin X: Data curation, Mthodology, Writing—Reviewing and Editing. All authors have read and approved the final version of the manuscript.

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Ethical approval

Not applicable.

Conflict of interest

The author has no conflicts of interest to declare.

Data availability statement

Data used to support the findings of this study are available from the corresponding author upon request.

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