

ORIGINAL RESEARCH

Structure and agency: Examining Shenzhen Polytechnic University's skill formation system reform through an institutional lens

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Abstract

Shenzhen Polytechnic University (SZPU) has developed a distinctive skill formation system centered on the principle of "developing first-class programs in collaboration with top-tier companies". A systematic analysis of the characteristics and developmental trajectory of SZPU's skill formation system helps encapsulate China's experience in skills development, offers a distinct Chinese perspective within the international skill formation literature, and provides an opportunity to evaluate Western theories on skill formation while sharing China's insights with the international academic community. This paper proposes an analytical framework for examining the skill formation system exemplified by SZPU. Research on skill formation systems differs from traditional pedagogical studies of vocational education by adopting a comprehensive interdisciplinary approach that integrates theories and methods from political science, economics, and sociology. The literature on skill formation considers multiple factors, including economic development, industrial structure, technological change, institutional environments at the macro and meso levels, national competitiveness, geopolitics, labor markets, the relationship between vocational and higher education models, and issues of social inequality. The paper first examines theoretically the relationship between the general and the specific in analyzing SZPU's system. It then explores common variables affecting skill formation systems across countries at the macro and meso levels and highlights SZPU's distinctive variations. Finally, at the micro-organizational level, it argues that SZPU's agency—its capacity to navigate structural constraints and actively forge joint governance structures with industry partners—constitutes the decisive factor behind its successful institutional innovation in China's skill formation system.

Keywords

vocational and technical education, skill formation system, industry-education integration, industrial colleges, agency, Shenzhen Polytechnic University

INTRODUCTION

Shenzhen Polytechnic University (SZPU) has developed a unique skill formation system centered on "developing first-class vocational programs in collaboration with top-tier companies". This system is unmatched domestically and stands out even on the global stage.

SZPU's system exhibits three distinctive features in


responding to industrial upgrading in the current era of technological revolution.

Emphasis on skill formation for the servitization of production

Unlike traditional vocational education, which focuses primarily on the manufacturing, information technology (IT), or service industry sectors, SZPU emphasizes skills for the servitization of production. Its industrial colleges—

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jointly established with leading firms such as BYD, Huawei, Tencent, NetEase, Perfect World, and Yuto—leverage the competitive advantages these industry leaders have accumulated in their respective production-service domains.

The School of Automotive and Transportation, co-founded with BYD, focuses on skills supporting research and development (R & D) in new energy vehicles, underscoring BYD's leadership in the electric vehicle (EV) sector.

The School of Electronic and Communication Engineering, co-founded with Huawei, emphasizes skills tied to Huawei's full business ecosystem—including operating systems, industrial software, the industrial internet of things, and intelligent manufacturing—particularly as the company responds to U.S. sanctions.

The Gaming Program, co-developed with Perfect World and in collaboration with Tencent, NetEase, and Glacier, integrates the strengths of multiple industry leaders to create diverse pathways for talent development.

The Packaging Design Program, co-founded with Yuto, prioritizes industry standard-setting, representing a new strategy for upgrading skill formation in traditional manufacturing sectors that have undergone transformation.

Strengthening entrepreneurial skill formation in the knowledge economy

SZPU places strong emphasis on cultivating entrepreneurial capabilities. It hosts the School of Innovation and Entrepreneurship, which provides training to students across disciplines who wish to engage in innovation activities. Additionally, its Future Technology College represents a novel model of vocational education inspired by Silicon Valley's incubator system.

Unlike Silicon Valley incubators—whose participants typically enter with clearly defined product and business concepts after rigorous selection—SZPU's program combines foundational instruction, interdisciplinary learning, and guided entrepreneurial practice. Students progress through the entire entrepreneurial cycle, from market research and conceptualization of products or services to development of marketing strategies. The program thus integrates structured academic training with immersive experiential learning.

Forward-looking skill formation for emerging strategic industries

SZPU also adopts a proactive approach to skill formation in emerging strategic sectors. The university's industrial

colleges alone would suffice to place it at the forefront of vocational education in China, but its research institutes position it at the forefront of skills development for technological revolution.

Although it remains uncommon for Chinese vocational institutions—and still rare even among universities—to establish high-tech research institutes with cutting-edge R & D capabilities, SZPU has done so successfully: The Integrated Circuit Research Institute, created in response to U.S. semiconductor sanctions, has developed four types of photoresist materials, achieved domestic substitution, and built a comprehensive training system covering every stage of photoresist production.

As China places unprecedented emphasis on transforming scientific research into productive technologies, feasibility studies and cost analyses have become critical. The Institute of Intelligence Science and Engineering collaborates with SZPU's industrial colleges to develop standardized training in these two areas for emerging production-service industries with significant future labor-market potential.

A systematic analysis of SZPU's development not only helps summarize China's experience and establish a Chinese contribution to the literature on skill formation but also provides an opportunity to evaluate Western theories and present China's insights globally. As Ou (2024) notes, "Integrating industry and education is essential for vocational training, and finding effective ways to achieve this integration remains a common challenge for all countries". SZPU has already demonstrated a viable path forward.

Compared with American community colleges, Nordic public training institutions, and the German vocational high-school tracking and apprenticeship systems, SZPU's model—built through curricula and project-based training in dual-entity industrial colleges—focuses on developing students' practical capabilities without the personal dependency and institutional binding characteristic of some European apprenticeship systems.

Whereas traditional Chinese vocational education primarily trained blue-collar workers for stable assembly-line employment, SZPU aims to cultivate talent for the dynamic production-service industry, where workers must continually acquire new skills. Moreover, SZPU strives to nurture entrepreneurial competencies for students who wish to launch ventures in the knowledge economy.

This raises two key questions: 1. What factors have driven the development of the SZPU model? 2. What implications

does this model hold for advancing theories of skill formation?

This paper addresses these questions by constructing an institutional analytical framework that integrates macro-structural, meso-institutional, and micro-organizational perspectives. After examining the relationship between the general and the specific in skill formation theory, it analyzes common variables influencing skill formation systems globally and SZPU's specific institutional variations. It concludes by arguing that SZPU's agency—its capacity to navigate, reinterpret, and transcend structural constraints—has been central to its successful innovation.

THE GENERAL AND THE SPECIFIC IN THE ANALYTICAL FRAMEWORK

Research on skill formation systems in developed countries has spanned more than four decades, with China entering this field relatively recently. Drawing on this body of literature, Chinese scholars have increasingly argued for moving beyond a single-disciplinary, pedagogy-centered approach and adopting a multidisciplinary analytical framework—particularly when examining issues such as industry-education integration and school-enterprise cooperation (Zhou *et al.*, 2024).

Western scholarship on skill formation systems emerged in the 1980s. By the late 1990s and early 2000s, with the rise of the varieties of capitalism paradigm in comparative political economy, scholars increasingly focused on skill formation, classifying different national systems as institutional components of broader political-economic configurations (Yang & Xun, 2019). The existing literature includes both historical analyses of how medieval European guild legacies continue to shape contemporary skill formation systems (Wang X., 2020) and examinations of how skill formation systems intersect with diverse institutional spheres: Mechanisms of social stratification, labor market organization, gender politics and training inequalities, divergent trajectories of welfare-state and social-policy reform, and even differences in electoral and party systems (Thelen, 2011; Xu, 2010).

Despite the richness of this scholarship, it is evident that these theories—largely derived from Western historical experiences—cannot be applied mechanically to explain China's skill formation system.

Developing an analytical framework that both reflects China's national conditions and enables productive dialog with international scholarship requires grappling with the relationship between general theories and country-specific

variations. This paper proposes an institutional framework comprising two components.

First, drawing on historical institutionalism, it treats the major determinants of skill formation systems as general independent variables with broad, cross-national relevance. Building on this foundation, it examines how these common variables manifest in *specific* historical conditions—particularly those of Shenzhen—where SZPU's contemporary skill formation system emerged during rapid industrialization and technological transformation.

Second, drawing on organizational institutionalism, the framework highlights the importance of cognition and agency in shaping organizational behavior. SZPU is conceptualized as a key intermediary variable: An organizational actor capable of interpreting structural constraints, formulating innovative responses, and actively reshaping institutional arrangements. This perspective directs analytical attention to how SZPU perceives the challenges posed by shifting structural conditions and how it creatively resolves conflicts of interest among stakeholders in industry-education integration by building joint governance structures with corporate partners. This organizational agency is central to SZPU's successful institutional innovation.

Scholars in non-Western developing countries have long confronted tensions between Western social science theories—often presented as universal—and their own national realities. Even within Western academia, many acknowledge that institutions are historically embedded and cannot be understood as context-free universal models. In China, this tension has sometimes produced two polarized tendencies: 1. Mechanical transplantation, where Western theories derived from particular historical experiences are treated as universally valid, often leading to flawed policy applications; and 2. Excessive exceptionalism, whereby scholars reject engagement with Western theories altogether and focus solely on the uniqueness of China's historical experience.

Both tendencies obscure the fact that China shares many of the same structural challenges of industrialization encountered by other countries—and that even Marxism, despite its canonical status in China, originally emerged from Western intellectual traditions.

This paper argues that building a "global community with a shared future" requires acknowledging the existence of shared human cognition and, consequently, shared social scientific concerns. Across all countries, skill formation systems confront common issues like the relationship between skills development, economic growth, and indus-

trial restructuring; the influence of institutional environments on stakeholder interactions; the balance of power among actors in skill formation systems; and the diverse outcomes produced when actors respond differently to similar structural conditions.

In this sense, whether in vocational education or in broader domains of politics, economics, culture, and society, national particularities often reflect specific variations of common theoretical variables shaped by distinct temporal and spatial conditions. This duality has two key implications for our analysis: Theories derived from one country's historical experience can offer meaningful insights to others; and these theories have inherent limits when applied directly to different contexts because they originate from particularized variants of these shared variables.

The tension between the general and the specific, and between universal theories and local practices, is thus intrinsic not only to the study of skill formation but also to social science research as a whole.

Below, the basic propositions of historical institutionalism are outlined and then applied to analyze the common variables influencing skill formation systems and their specific manifestations in Shenzhen.

THE PERSPECTIVE OF HISTORICAL INSTITUTIONALISM

Historical institutionalism is rooted in the classical political economy of Adam Smith, the historical materialism of Karl Marx, and Max Weber's comparative institutional analysis. It posits that institutions are embedded in historical contexts, with diverse national experiences giving rise to distinct formal and informal rules, each governed by its own internal logic. These differences not only produce significant organizational variation among otherwise comparable actors across countries but also shape their preferences and objectives (Campbell, 2004). Every institution reflects specific political, economic, social, cultural, and ideological conditions; the rules of any institution embody the interests of dominant actors at the time of its formation and throughout its evolution.

From this perspective, the limited applicability of many Western social science theories in non-Western contexts arises largely from the assumptions underlying neoclassical economics and rational choice theory. These approaches treat rationality and interests as abstract, a priori, and independent of specific institutional environments, paying insufficient attention to the historical origins of preferences. When such theories generalize institutional arrangements

derived from Western historical experience as universally applicable, they may achieve greater abstraction but also risk generating conflict and misinterpretation when applied to countries with divergent institutional histories.

Historical institutionalism thus holds that vocational education systems, like all national skill formation systems, confront a set of common structural challenges that give theories addressing them a certain degree of universality. Yet each country's specific institutional configuration—shaped by its economic structure, political institutions, education system, labor market, mechanisms of social stratification, and particularly the balance of power among key actors—remains unique. When scholars conceptualize one country's experience without attending to its institutional and historical specificity, they risk treating particular practices as universal laws. If such theories are applied too rigidly in practice, they inevitably generate problems. For this reason, theories developed in one national context must be applied with caution in another; their limitations must be recognized and direct transplantation avoided.

Industrial policy and economic structural transformation

Shenzhen epitomizes the trajectory of China's manufacturing development, compressing into 40 years a process that took 80 to 150 years in many other countries (Wang, 2020). It has evolved from a base for processing imported materials to the hardware hub of the "world's factory", and more recently into China's leading center of technological innovation. These transformations have profoundly reshaped the city's demand for human capital. Because of the unparalleled pace of Shenzhen's economic growth and industrial upgrading, it is not comparable to most other Chinese cities. By global standards, Shenzhen not only ranks alongside developed economies but surpasses many in several domains, with its rapidly growing production-service industry serving as a clear example (Wu, 2025).

Over the past three decades, driven by the information revolution and the rise of global production systems, Shenzhen has mirrored advanced economies in experiencing a major shift toward the servitization of production. This shift encompasses three distinct scenarios.

Manufacturing as a Service (MaaS)

Also known as outsourcing, MaaS involves component suppliers providing manufacturing capabilities to brand-name firms through long-term purchase agreements or pay-per-order arrangements. This model allows brand-name manufacturers to rely on suppliers' diverse resources and expertise rather than investing in their own facilities. Many high-tech companies have increasingly prioritized R & D,

branding, and marketing while outsourcing component production entirely. MaaS provides firms with flexibility by enabling rapid adjustment of order quantities in response to market fluctuations. It also reduces costs by minimizing investment in equipment and personnel while enabling companies to access advanced production expertise worldwide. For this model to function, suppliers must continually upgrade their manufacturing technologies, while brand-name manufacturers still require strong human capital to maintain supply-chain management and coordinate complex production networks (Carsey, 2025).

Servitization of manufacturing

Servitization of manufacturing refers to a shift in manufacturers' profit models from one-time product sales to a portfolio of services related to product use. Initially rooted in after-sales services, this model has expanded as products have become increasingly equipped with sensors, generating detailed usage data. With equipment digitization and widespread adoption of the industrial internet of things, manufacturers now provide advanced solutions such as pay-as-you-go contracts and integrated service bundles. Some manufacturers even retain equipment ownership and lease it to customers. This structure generates stable revenue streams while providing manufacturers with direct insight into product usage, which accelerates product iteration and deepens customer relationships (Mazaheri, 2023).

Service industries in manufacturing

Service industries in manufacturing encompass all services that support the production process, whether internal to the manufacturer or outsourced to third-party providers. It differs from MaaS in the type of services involved and from servitization in its emphasis on production-support functions rather than profit generation. These services include product design and engineering, quality control and testing, equipment maintenance and repair, technical support, logistics, warehousing, employee training, and supply-chain management (Mazaheri, 2023).

Shenzhen's industrial upgrading and transformation reflect, in microcosm, China's broader economic trajectory since the reform and opening period. As China's first Special Economic Zone, Shenzhen has consistently led the nation's industrial restructuring and now demonstrates global competitiveness in emerging strategic industries, such as new energy vehicles, drones, gaming, robotics, and intelligent manufacturing. In terms of innovation, it may be rivaled only by Silicon Valley in the United States (Wen & Wang, 2025). The resulting economic growth has substantially increased government revenue, enabling strong municipal support for SZPU. Meanwhile, leading Shenzhen-based companies tend to retain their core R & D

and principal business operations in the city while relocating labor-intensive production activities elsewhere.

Founded in 1993, SZPU has developed alongside Shenzhen's evolving industrial structure, consistently supplying human capital to meet local needs. The expansion of the production-service sector over the past decade has heightened demand for workers with strong creative and problem-solving abilities, a trend amplified as companies increasingly integrate artificial intelligence (AI) into manufacturing. SZPU's industrial colleges, jointly established with leading enterprises, reflect these emerging skill demands. Shenzhen's requirements for human capital in high-tech and new-tech industries thus differ markedly from those of less-developed Chinese cities and even from cities in advanced economies such as those in Europe and Japan, where traditional manufacturing sectors—such as internal-combustion automobile production—remain central. Consequently, Western theories of skill formation rooted in traditional manufacturing contexts are insufficient for explaining the rapid, innovation-driven evolution of Shenzhen's skill formation system.

The accelerating effect of the U.S.-China tech conflict

If industrial upgrading and transformation constitute a general factor affecting skill formation, then in the case of Shenzhen, geopolitics represents a specific variable that has profoundly shaped the city's industrial restructuring over the past eight years.

U.S. sanctions against Chinese technology companies have expanded from 5G to AI. These measures include: Restricting chip exports to sever China's access to high-end computing power; limiting exports of chip-making equipment and critical components to slow semiconductor development; imposing controls on advanced chip-design software; and restricting services related to the chip trade, indirectly hindering Chinese firms' access to computing resources (Yang *et al.*, 2024).

Since 2018, these escalating sanctions have exerted profound and distinctive influences on Shenzhen's industrial upgrading. They have accelerated the city's transformation from the world's hardware manufacturing hub into a leading center of high-tech innovation in China and globally. The sweeping changes in the industrial structure have had a direct and transformative impact on SZPU's institutional strategy. Industries targeted by U.S. sanctions—such as semiconductors, intelligent manufacturing, drones, and new energy vehicles—have experienced rapid growth, prompting the creation of new sectors that previously did not exist. Leading firms like Huawei, once restricted to their

core commercial domains, have expanded aggressively into industrial software, chip design, the industrial internet of things, operating systems, and autonomous driving.

Before the onset of trade and technology conflicts, China's "world factory" model relied heavily on foreign direct investment and a strategy of exchanging market access for technology transfer. This development pattern produced major structural problems, such as persistent dependence on foreign technologies and markets, and deep disconnections among industries, universities, and research institutions. Many domestic companies, lacking resilience, dismantled their in-house R & D and product-development platforms, undermining the domestic innovation ecosystem and losing the institutional foundations necessary for technological learning.

The U.S.-China tech war aims to decouple China from Western scientific research and technological systems. This decoupling shuts down critical channels for accessing foreign science and technology, posing severe challenges to industrial upgrading and long-term economic growth. Faced with this situation, China has been compelled to develop indigenous innovation systems, build independent platforms for knowledge accumulation, and secure supply chains (Feng & Ji, 2021).

The tech war has also profoundly influenced Shenzhen's vocational education, especially SZPU. The rapid growth of emerging strategic industries—such as chips, semiconductors, and new energy vehicles—has strengthened SZPU's collaborations with industrial leaders, including BYD, and accelerated the establishment of new research institutes. Huawei's sanctions-induced strategic pivot has directly reshaped SZPU's skill formation system, which has evolved to support Huawei's entire technology ecosystem. As a result, the research paradigm of skill formation—grounded in interdisciplinary macro- and meso-level analysis—has acquired heightened geopolitical relevance.

Changes in the models and philosophies of higher education

Geopolitics has also triggered widespread reflection and reform within China's higher education and research systems since the onset of the U.S.-China tech war. As national security becomes a key lens for evaluating supply chains, long-standing weaknesses in Chinese higher education—its exam-oriented curricula and its publication-driven scientific research model—have become central targets for reform. To enhance international competitiveness, universities have begun emphasizing practical skills, problem-solving abilities, and the translation of academic research into real-world technological

productivity.

From 1952 to the late 1990s, China's higher education system followed the Soviet model, consisting of a small number of comprehensive universities and a large number of specialized colleges (Zhang, 2014). Under the planned economy, these specialized colleges were directly administered by sector-specific ministries, ensuring tight alignment between academic training and industry needs. Students gained practical experience through internships in ministry-affiliated enterprises and were typically placed within the same sectors after graduation. Yet the system's narrow specialization limited students' academic breadth and constrained institutions' ability to respond to emerging interdisciplinary challenges.

After the higher-education expansion of the late 1990s, China shifted toward the American model of liberal arts education (Shen, 2018). However, many Chinese universities have adopted only the superficial features of this model. University administrations prioritized efficiency and quantitative evaluation metrics, striving for comprehensive status regardless of institutional strengths. This resulted in a homogenized higher-education landscape: Thousands of universities offering identical programs and specialized institutions losing opportunities for targeted development. Although research output and citation rates rose significantly, research became increasingly publication-oriented, with limited concern for practical application. Curricula remained detached from real-world contexts, leaving students focused primarily on examinations. Employers consistently complained about graduates with high expectations but inadequate practical skills. Hiring practices further reinforced academic credentialism by emphasizing elite university backgrounds (Liu, 2015).

The tech war has dramatically accelerated reforms within China's higher education system. Confronted with an unprecedented crisis, the skill formation system has been forced to address long-standing structural weaknesses. Universities now face pressures from multiple directions: A renewed shift toward specialized colleges on one hand, and the establishment of new R & D institutions on the other.

In early 2025, the Communist Party of China (CPC) Central Committee and the State Council released the *Outline of the Plan for Building China into a Leading Nation in Education (2024-2035)*. The plan introduces a three-tier classification for universities—research-oriented, application-oriented, and skills-oriented—to promote institutional diversity and strengthen differentiated development. Engineering is given special strategic importance. The plan calls for the expansion of new engineering programs; greater integration

of science and engineering; deeper connections among engineering fields; cross-disciplinary collaboration between medicine and engineering; and enhanced interaction between agriculture and engineering. It also calls for the establishment of National Outstanding Engineer Colleges and National Innovation Platforms for Industry-Education Integration (Xinhua News Agency, 2025). These macro-level transformations have provided the broader institutional context for SZPU's ongoing reform of vocational education, explored in the sections that follow.

THE INSTITUTIONAL FRAMEWORK OF VOCATIONAL EDUCATION IN CHINA

The core of SZPU's reform lies in the establishment of dual-entity industrial colleges jointly built with leading companies across various industries. This institutional innovation has enabled SZPU to overcome long-standing administrative constraints on vocational education, transforming the university from a passive recipient of external directives into an active driver of systemic change. SZPU's role stands in stark contrast to the depiction of vocational institutions in Western skill-formation literature, where such institutions are often portrayed as structurally subordinate to corporate or state actors. It also distinguishes SZPU from most domestic vocational institutions in China.

In Europe, the structure of vocational education is strongly influenced by party politics and the degree of industrial-level corporate coordination. These factors shape the channels of vocational training, the balance between industry-general and company-specific skills, and the extent of government subsidies (Liu & Kuang, 2024). Nordic countries—similar to China in relying more heavily on schools than on firms—tend to emphasize the cultivation of broadly applicable industry-general skills rather than company-specific skills (Li & Mu, 2021). European scholarship typically attributes such arrangements to centralized multi-party corporatist systems, in which peak business associations and labor unions jointly participate in national economic policymaking, including the supervision and certification of vocational education.

Compared with Europe, the Chinese skill formation system is marked by a far more prominent government role. The state exercises decisive influence over curriculum catalogs, teaching standards, textbook development, teacher certification, quality evaluation criteria, and institutional assessment. For public vocational institutions, the magnitude of government financial support directly affects basic operations (Sun, 2023). In contrast, Chinese companies and industry associations play a more limited role. Because they belong to different administrative

systems, coordination between enterprises and vocational institutions is often constrained. The government—rarely providing direct funding for school-enterprise cooperation—can encourage participation but cannot require it. Furthermore, because companies can recruit from the large pool of university graduates entering the labor market each year, firms with weak demand for specialized skills have little incentive to participate in cooperative training programs. As a result, inadequate incentives remain a key reason for the frequent failure of vocational-industry collaboration in China.

SZPU's reform succeeded precisely because it redefined these structural incentives. Rather than waiting for companies to initiate cooperation, SZPU proactively positioned itself as a co-creator of industry-relevant training. More importantly, it invented the organizational form of the dual-entity industrial college, an institutional arrangement that binds the interests of the university and its corporate partners through joint governance. These industrial colleges co-develop curricula and teaching materials; engineers from partner companies teach at SZPU; SZPU faculty lead students in company-based project work; and firms provide extensive internship opportunities. As a result, graduates are often hired directly by these companies upon completion of their studies. Although this model creates coordination effects similar to those found in European systems, it does so through entirely different mechanisms rooted in China's institutional environment.

Labor market and the mechanism of social stratification

In developing a new skill formation model, SZPU has had to confront not only the structural challenges facing vocational institutions nationwide but also several issues unique to the Shenzhen context. Since the reform and opening period, Shenzhen has been one of China's fastest-growing cities. Industrial upgrading has not only transformed occupational structures and generated substantial income gains for residents but has also profoundly influenced the career expectations and job preferences of local vocational students.

As part of its reform, SZPU shifted its mission from training blue-collar workers for assembly-line positions to cultivating talent capable of working in production-service industries that demand greater technological sophistication and creative problem-solving. The School of Automotive and Transportation, co-founded with BYD, explicitly trains students for R & D assistant positions—jobs that offer higher pay and better working environments, thereby increasing student motivation. SZPU has also established the Tech X Institute, an incubator-style platform for

students aspiring to start their own businesses.

These efforts directly address the academic-credential discrimination deeply embedded in China's labor market. This discrimination is closely tied to the hierarchical classification system in Chinese education, which allocates resources disproportionately to higher-ranking institutions. In an effort to boost China's global educational competitiveness under resource constraints, governments at all levels have concentrated funding on top-tier institutions. This unequal distribution intensifies competition among universities and reinforces credential-based screening by employers.

Employers increasingly rely on academic pedigree—first preferring graduates from elite universities, then from elite bachelor's programs, and eventually only from full-time, four-year undergraduate programs (Yan, 2024). Despite Ministry of Education guidelines issued in 2013 prohibiting practices that limit recruitment to "985" and "211" universities, such discrimination persists. As Xiong Bingqi (as cited in Yan, 2024) observes, credentialism has become a systemic problem tolerated by society at large. Its cultural roots can be traced to Confucian ideals—"those who excel in learning should serve in government"—and the long tradition of the imperial examination system.

In recent years, influenced by the German model, China introduced a dual-track system separating regular high schools and vocational high schools. However, this reform overlooked fundamental differences between the two countries—especially those pertaining to social stratification and vocational-education institutions. In Germany, companies, industries, and industry associations exert a strong influence over vocational training, and individual companies shape program curricula. The apprenticeship system is sustained by institutional features such as strong labor unions and collective bargaining, which help ensure that blue-collar workers—even without a college degree—are not severely disadvantaged relative to university graduates. More than 50% of German high-school students choose the vocational track. Companies willingly invest in vocational trainees because apprenticeships serve as a low-risk recruitment mechanism. Furthermore, university graduates and vocational graduates do not compete for the same positions, as wages and occupations are clearly linked to educational track.

In China, the situation is fundamentally different. The gross enrollment rate for higher education reached 57.7% in 2021 (Wang P., 2022), while secondary vocational schools remain underfunded with insufficiently trained faculty and inadequate facilities. Bachelor's degree holders enjoy

significant labor-market advantages: They obtain higher-quality jobs when fortunate, and when not, they can still compete directly with vocational graduates for lower-skilled positions. As a result, credential inflation persists, and parents in economically advanced regions overwhelmingly guide their children toward regular high schools and university entrance exams (He & Wang, 2022). Companies further reinforce this divide by offering higher starting salaries to full-time bachelor's graduates than to vocational graduates. Under such incentives, few students willingly choose the vocational track.

Persistent challenges and policy responses

Despite SZPU's reforms, challenges remain. As a public institution funded primarily by the municipal government, SZPU must prioritize admissions from Shenzhen and then from Guangdong. Yet many local students—despite receiving relevant training—are reluctant to work in factory-based positions. Consequently, local employers still struggle to recruit sufficient workers. Similarly, high-performing students admitted to the competitive Tech X Institute are often reluctant to pursue entrepreneurship. Addressing these issues would require more flexible municipal policies. If SZPU were permitted to recruit more students from less-developed regions, it could supply sufficient talent to Shenzhen's production-service industries while contributing to regional development. Likewise, if the Tech X Institute could recruit entrepreneurial-minded students nationwide—similar to Silicon Valley's incubator selection model—Shenzhen would gain a stronger talent base to support AI-driven manufacturing transformations.

In 2025, the *Outline of the Plan for Building China into a Leading Nation in Education (2024-2035)* proposed two fundamental measures to relieve students' and parents' anxiety over school selection. First, it seeks to strengthen articulation between vocational secondary schools and higher vocational institutions, encouraging application-oriented universities to expand undergraduate-level vocational programs. Second, it aims to ensure equal treatment for graduates of vocational and regular institutions in areas such as household registration, job opportunities, recruitment, career evaluation, and promotion. These measures address both institutional equity and upward educational mobility.

A recent trend in China involves promoting integration between vocational and general education through the creation of "comprehensive high schools" (Cai, 2024). Nevertheless, education authorities and vocational-education practitioners continue to support the dual-track structure, advocating for permanent differentiation at the secondary level. In contrast, scholars from non-education

disciplines increasingly oppose early track separation, using interdisciplinary approaches to examine vocational skill formation from broader macro- and meso-level perspectives. They argue that premature separation between general and vocational education produces artificial inequality, constrains social mobility, and limits student development (Song & Pan, 2022). This ongoing debate will deepen China's understanding of the social functions and institutional significance of vocational education.

CONCLUSION: STRUCTURE OR AGENCY—AN INTERMEDIATE VARIABLE BEHIND INNOVATION

From a comparative perspective, the most valuable lesson offered by SZPU's reform lies in its demonstration that a vocational education institution can itself become a major driver of reform in a national skill formation system. In other words, SZPU shows that agency, rather than structure alone, can play a decisive role in institutional change.

In the Western literature on skill formation, vocational education institutions are generally portrayed as actors with limited autonomy, unable to determine their own developmental direction. Studies of European skill formation systems emphasize the division of labor among companies, trade associations, and the government. These studies categorize European systems into four types—liberal, segmented, collective, and state-led—based on the degree of corporate participation and the extent of public policy commitment to vocational training. Among these, collective skill formation systems are understood as the product of political negotiation among four actors: The government, employers, employer associations, and individuals. The politics of skill formation centers on four key issues: 1. The distribution of responsibility for vocational training among the major actors; 2. the division of financial commitments; 3. the balance between corporate autonomy and public oversight; and 4. the relationship between vocational education and the general education system (Busemeyer & Trampusch, 2012).

Because much of this scholarship is rooted in political science, economics, and political economy, vocational education institutions are often treated as instrumental and passive recipients of decisions made by more powerful structural actors.

However, organizational institutionalism suggests that the success or failure of institutional change depends to a significant extent on the agency of actors. The long-standing debate in social science between structure and agency reflects two contrasting positions: Structural theories

emphasize that human behavior is shaped by economic conditions, cultural norms, habits, traditions, and ideology; agency-centered approaches argue that individuals and organizations retain the capacity to transcend these constraints, respond creatively to challenges, and pursue transformative goals.

Within organizational institutionalism, agency arises from cognition. In the context of skill formation system reform, the primary difficulty lies in aligning the interests of schools and companies participating in industry-education collaboration. A major reason for the failure of school-enterprise cooperation is the mutual misunderstanding of what "cooperation" entails (Yin & Cheng, 2021). Vocational institutions tend to assume that schools and companies possess fundamentally different attributes: The former provide public services by educating students, while the latter pursue profit and organizational growth. When the ownership and management of collaborative projects are unclear, it becomes exceedingly difficult for the two types of organizations to collaborate effectively. Consequently, many industries believe that graduates trained under existing vocational models do not meet their human-capital needs (Chen, 2016).

These challenges stem largely from vocational institutions' tendency to view cooperation solely through a pedagogical lens without situating their collaboration with firms within a broader set of institutional relationships. Pedagogically speaking, schools and companies belong to entirely different organizational fields. When both sides define their interests according to the assumptions of their respective fields—often influenced by the rational-actor model in economics—they rarely attempt to identify institutional arrangements that could accommodate the interests of both parties.

Organizational institutionalism, in contrast, highlights how active social construction can reshape actors' cognition and foster mutually beneficial solutions. Culture is seen as a "toolbox": When actors define their goals and strategies, they draw upon cultural and institutional resources available in their environment (Swidler, 1986, as cited in Gao, 2008). SZPU skillfully leveraged the Chinese cultural tradition that emphasizes "win-win" solutions. By reframing the meaning of cooperation and redefining the interests of participating actors, SZPU successfully constructed the institutional innovation of dual-entity industrial colleges.

Through this process of cognitive reframing and institutional design, SZPU was able to rely on top-tier industry leaders to build first-class vocational programs—demonstrating that the agency of a single organization can have

transformative power within a national skill formation system.

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Not applicable.

Declaration of conflicting interests

Gao B is the Co-Editor-in-Chief of the journal. The article was subject to the standard procedures of the journal, with peer review handled independently of the editor and the affiliated research groups.

Generative AI use declaration

None declared.

Data availability statement

All data has been included in this paper.

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