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LEARNING FROM CHINA AND THE UNITED STATES: REVISITING VOCATIONAL EDUCATION, INDUSTRIAL EXPANSION, AND WORKERS' HEALTH IN NIGERIA

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ABSTRACT - Persistent unemployment, weak industrial capacity, and unsafe working conditions continue to challenge development efforts in Nigeria, prompting renewed attention to Learning from China and the United States: Revisiting Vocational Education, Industrial Expansion, and Workers' Health in Nigeria. This paper examined the structure and outcomes of vocational education systems in China and the United States, assessed the current state of vocational education and its link with industrial development and workers' health in Nigeria, and identified adaptable elements for reform. The paper was anchored on Human Capital Theory and Skill Formation Theory which together explain how skills acquisition and institutional arrangements shape productivity and labour outcomes. An analytical review approach was adopted, involving systematic identification, critical appraisal, and thematic synthesis of recent empirical and theoretical studies. Findings revealed that China's coordinated, state-driven vocational system and the United States' flexible, industry-linked model have significantly supported industrial expansion, improved employability, and strengthened workplace safety practices. In contrast, Nigeria's vocational education system remains weakly connected to industrial needs, characterised by inadequate infrastructure, skill mismatches, and limited integration of occupational health training, thereby constraining productivity and exposing workers to avoidable risks. The paper concluded that vocational education must be repositioned as a strategic instrument linking skills development, industrial policy, and workers' well-being. It recommended among others the establishment of vocational–industrial clusters, institutionalisation of dual training systems, and integration of occupational health and safety into curricula to enhance industrial growth and protect workers in Nigeria.

KEYWORDS: Vocational Education, Industrial Expansion, Workers' Health, Skill Frmation, Nigeria, China, United States

INTRODUCTION

Across the global economy, renewed attention has been directed to vocational education as a driver of industrial productivity, employment stability, and workers' health. The experience of China and the United States shows how structured technical training can support industrial expansion while shaping labour conditions and health outcomes. In China, sustained investment in Technical and Vocational Education and Training (TVET) has been tied to its manufacturing growth and global competitiveness. Empirical evidence indicates that China's vocational system has contributed to a steady supply of skilled workers for its industrial sector, particularly in electronics, construction, and heavy manufacturing, while also improving workplace safety standards through formalised training and regulation (Zhao & Liu, 2021; World Bank, 2020). By 2022, China's manufacturing sector accounted for nearly 28 per cent of global output, supported by a workforce shaped through vocational pathways and enterprise-based training systems (World Bank, 2023).

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Similarly, the United States has re-emphasised career and technical education in response to industrial restructuring and skills shortages. Programmes linking community colleges with industry have demonstrated measurable effects on employment outcomes and occupational health awareness among workers (Carnevale et al., 2020; Holzer, 2021). Evidence from sectoral training initiatives in advanced manufacturing shows improved job retention and reduced workplace injuries when workers receive structured technical training aligned with occupational safety standards (Lerman, 2022). These cases highlight the connection between vocational systems, industrial growth, and the well-being of workers within evolving labour markets.

At the regional level, African economies have struggled to translate vocational training into industrial expansion. Despite policy commitments, TVET systems often face underfunding, weak industry linkages, and limited integration with health and safety frameworks (International Labour Organization, 2021). In sub-Saharan Africa, less than 20 per cent of the workforce is engaged in formal wage employment, with a large proportion concentrated in informal and low-skill sectors where occupational health risks are high (ILO, 2022). This disconnect between training systems and industrial needs has constrained productivity and exposed workers to unsafe conditions.

In Nigeria, the situation reflects these broader regional challenges but with greater urgency given its demographic pressure and unemployment trends. Nigeria's youth unemployment rate has remained high, with the National Bureau of Statistics reporting that over 33 per cent of young people were unemployed or underemployed as of recent labour force surveys (NBS, 2023). Although vocational education is formally recognised within the national education policy, its implementation has been inconsistent, with limited infrastructure, outdated curricula, and weak collaboration with industries (Okolie et al., 2020). Industrial expansion has also been uneven, concentrated in oil and gas with limited diversification into manufacturing sectors that typically absorb vocational graduates.

The implications for workers' health are significant. Studies on occupational health in Nigeria indicate persistent exposure to hazardous conditions in manufacturing, construction, and informal sectors, often due to inadequate training and weak enforcement of safety regulations (Akinwale & Olusanya, 2021; ILO, 2021). Without a robust vocational system that integrates technical skills with occupational safety education, workers remain vulnerable to injuries, long-term health conditions, and low productivity. The experiences of China and the United States suggest that aligning vocational education with industrial policy and workplace health standards can yield measurable improvements in both economic output and worker welfare.

STATEMENT OF THE PROBLEM

Nigeria's persistent unemployment, slow industrial diversification, and poor occupational health outcomes raise critical questions about the role of vocational education in national development. Despite policy recognition, the current vocational education system has not produced the level of skilled labour required to drive industrial expansion or ensure safe working environments. Evidence shows that many graduates lack practical competencies demanded by industries, leading to skill mismatches and limited employability (Okolie et al., 2020). At the same time, industries that do absorb labour often operate with minimal adherence to health and safety standards, exposing workers to preventable risks.

While countries such as China and the United States have demonstrated that strong vocational systems can support industrial growth and improve workers' health, Nigeria has yet to effectively integrate these elements. The absence of coordinated policies linking vocational training, industrial strategy, and occupational health has resulted in fragmented outcomes. Workers in sectors such as construction and small-scale manufacturing frequently encounter unsafe conditions, reflecting both inadequate training and weak regulatory enforcement (Akinwale & Olusanya, 2021). This gap not only affects individual well-being but also undermines productivity and economic growth.

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The problem, therefore, lies in Nigeria's limited ability to adapt proven models of vocational education and industrial development to its own context. There is insufficient empirical attention to how lessons from China and the United States can be contextualised within Nigeria's socio-economic and institutional realities. Without such analysis, policy reforms risk remaining rhetorical rather than practical. Addressing this gap is essential for repositioning vocational education as a tool for industrial expansion while safeguarding workers' health, thereby contributing to sustainable economic development.

AIM AND OBJECTIVES OF THE PAPER

The aim of this paper was to critically examine how lessons from China and the United States can inform the revitalisation of vocational education in Nigeria, with a view to strengthening industrial expansion and improving workers' health outcomes. The specific objectives are as follows:

a. To examine the structure and outcomes of vocational education systems in China and the United States in relation to industrial expansion.
b. To assess the current state of vocational education and its link with industrial development and workers' health in Nigeria.
c. To analyse how adaptable elements from China and the United States can be applied to improve vocational training, industrial growth, and occupational health in Nigeria.

METHODOLOGY

The paper adopted an analytical review approach, situated within the broader tradition of systematic and critical literature reviews, as a means of examining and synthesising existing empirical and theoretical evidence on vocational education, industrial expansion, and workers' health. In contemporary research practice, analytical reviews are understood as structured forms of evidence synthesis that involve the critical interrogation of prior studies rather than simple description. The approach relies on clearly defined procedures for identifying, selecting, and interpreting relevant literature in order to generate new conceptual and policy-relevant insights. Recent methodological literature explains that rigorous review-based studies require explicit criteria for study inclusion, systematic searching of existing research, and careful synthesis to minimise bias and ensure transparency (Brignardello-Petersen et al., 2024). This positions the analytical review as a credible approach for studies that aim to compare systems across contexts and develop grounded interpretations from accumulated evidence.

The criteria guiding the analytical review in this paper followed established standards for evidence synthesis, beginning with the formulation of clear research objectives that defined the scope of the inquiry. This was followed by systematic identification of relevant peer-reviewed studies published between 2020 and 2026, ensuring currency and relevance to the subject matter. The selection process was guided by explicit inclusion parameters focusing on empirical and theoretical works addressing vocational education, industrial development, and occupational health. Each selected study was then critically appraised in terms of methodological rigour, context, and findings before being synthesised thematically. This process reflects widely accepted review procedures which emphasise defining eligibility criteria, identifying and screening studies, extracting data, and synthesising findings in a reproducible manner (Zaccagnini & Li, 2023). Such structured evaluation enhances the credibility of conclusions and allows for meaningful comparison across national contexts.

The justification for adopting this approach lies in the nature of the research problem, which was comparative, conceptual, and policy-oriented. The study seeks to draw lessons from the vocational education systems of China and the United States and apply them to Nigeria. Addressing such a problem requires a method capable of integrating diverse bodies of knowledge across different institutional settings. Analytical review methods are particularly suited to this purpose because they allow for the synthesis of findings from multiple studies, thereby enabling broader generalisation and deeper interpretation than single empirical designs. As noted in recent methodological discussions, systematic forms of literature review are essential where the aim is to "identify, appraise and synthesise all relevant studies" to support evidence-

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based conclusions (Zaccagnini & Li, 2023). This capacity to integrate cross-national evidence makes the approach appropriate for examining how different vocational systems influence industrial outcomes and workers' health. Furthermore, the analytical review approach supports theoretical development by linking empirical findings to established frameworks such as Human Capital Theory and Skill Formation Theory. By critically examining convergences and divergences in the literature, the study is able to identify gaps in the Nigerian context, particularly the weak integration between vocational training, industrial policy, and occupational health. This aligns with the broader understanding that systematic and analytical reviews provide a higher level of evidence due to their structured and transparent methodology, which reduces bias and enhances reliability of conclusions (Brignardello-Petersen et al., 2024). Consequently, the adoption of this method is justified as it enables a comprehensive, critical, and policy-relevant analysis capable of informing practical reforms in Nigeria's educational and industrial systems.

LITERATURE REVIEW

Conceptual Review

Vocational Education

Vocational education has been widely defined in recent scholarship as a structured form of education and training oriented towards the acquisition of practical skills, competencies, and knowledge required for specific occupations. Omar and Kamaruzaman (2024) describe it as an education process that emphasises industry-relevant practices aimed at producing competent workers for particular sectors, while Guan et al. (2025) extend this view by presenting vocational education as a central mechanism for human capital development in response to industrial transformation and technological change. Other scholars highlight its increasing shift from narrow skill training to broader employability, adaptability, and lifelong learning capabilities (Triyono et al., 2023).

These positions show convergence on its labour market orientation but differ on scope, with earlier views limiting it to manual trades and newer perspectives integrating digital and cognitive skills. The narrower framing underestimates current labour market demands, while the expanded framing risks blurring distinctions with general education. This paper adopts a balanced definition of vocational education as a system of education that combines practical, technical, and applied knowledge with industry engagement to prepare individuals for specific occupations and evolving workplace demands.

Industrial Expansion

Industrial expansion is commonly understood as the sustained growth and diversification of industrial activities within an economy, particularly in manufacturing and production sectors. Recent scholarship links industrial expansion to technological innovation, labour productivity, and the availability of skilled human capital (Guan et al., 2025). Studies on industry–education collaboration argue that expansion depends significantly on the alignment between training systems and industrial needs, with vocational education playing a direct role in supplying skilled labour (Omar & Kamaruzaman, 2024) . While some authors emphasise macroeconomic indicators such as output and employment, others stress structural transformation and value chain upgrading as more accurate indicators of expansion. The macroeconomic view is often criticised for overlooking the quality of growth, especially in relation to labour conditions. In contrast, the structural perspective better captures the long-term sustainability of industrial growth. This paper therefore defines industrial expansion as the sustained increase in productive industrial activities characterised by diversification, technological upgrading, and improved labour utilisation within an economy.

Workers' Health

Workers' health refers to the physical, mental, and social well-being of individuals within the workplace, shaped by working conditions, occupational hazards, and organisational practices. Recent academic work increasingly situates workers' health within the broader concept of decent work, linking it to productivity and economic performance. Although direct definitions vary, contemporary studies emphasise that workers' health goes beyond the absence of disease to include safe working environments, ergonomic conditions, and psychological

well-being associated with job security and workload. Scholars also argue that skill level and training significantly influence workers' exposure to risks, as better-trained workers are more likely to adhere to safety standards and operate within regulated environments. However, some perspectives focus narrowly on occupational injuries, which fails to account for long-term health outcomes and psychosocial factors. This paper adopts a broader definition of workers' health as the overall physical, mental, and social well-being of workers as influenced by workplace conditions, safety practices, and the level of technical competence acquired through training.

Vocational Education in the United States

Vocational education in the United States is characterised by a decentralised and flexible system commonly referred to as career and technical education, delivered through secondary schools, community colleges, and industry partnerships. Recent studies show that the U.S. model emphasises employability skills, work-based learning, and alignment with labour market demands, particularly through apprenticeships and sector-based training initiatives (Triyono et al., 2023). Scholars note that this system integrates academic and technical learning, allowing mobility between vocational and higher education pathways. However, debates persist regarding inequality in access and the perceived status gap between vocational and academic tracks. While some authors argue that the U.S. approach effectively responds to industry needs, others contend that fragmentation across states limits coherence and standardisation. Despite these concerns, the system's strong industry linkage and emphasis on practical competencies remain widely acknowledged. This paper therefore understands the U.S. vocational education system as a flexible, industry-linked framework that integrates technical training with academic pathways to enhance employability and workforce adaptability.

Vocational Education in China

In China, vocational education is characterised by strong state coordination, integration with industrial policy, and a clear focus on supporting manufacturing and technological development. Recent literature highlights the role of vocational institutions in producing technically skilled workers aligned with national economic priorities, particularly through close collaboration between schools and enterprises (Dai & Jambari, 2024; Guan et al., 2025) . Scholars emphasise features such as dual training systems, curriculum standardisation, and the promotion of practical competencies linked to industrial upgrading. At the same time, some critiques point to challenges related to social perception and limited upward mobility for vocational graduates. While the Chinese model is often praised for its efficiency and alignment with industrial growth, concerns remain about flexibility and individual career progression. This paper adopts the view that vocational education in China represents a state-driven, industry-integrated system designed to supply skilled labour for industrial expansion while maintaining structured pathways for technical skill development.

The Structure and Outcomes of Vocational Education Systems in China and the United States in relation to Industrial Expansion

The vocational education systems in China and the United States present two distinct but effective institutional arrangements through which skills formation has supported industrial expansion. In China, vocational education operates within a highly coordinated state framework in which central planning aligns training provision with industrial priorities. Secondary and post-secondary vocational institutions are integrated into regional industrial strategies, particularly in manufacturing hubs such as Guangdong and Jiangsu. The system is characterised by strong school–enterprise cooperation, where firms actively participate in curriculum design, student assessment, and apprenticeship placement. Empirical studies indicate that such arrangements have improved the relevance of skills acquisition and reduced the transition gap between education and employment (Zhao & Liu, 2021; Li, 2022). A case often cited is the integration of vocational colleges with manufacturing clusters in the Pearl River Delta, where students receive practical training within electronics and machinery firms,

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leading to high employment absorption rates and contributing to industrial productivity growth (Wang & Guo, 2023).

China's vocational system has also been linked to industrial upgrading. As industries moved from labour-intensive to technology-driven production, vocational institutions adapted by incorporating automation, robotics, and digital manufacturing into their curricula. This responsiveness has supported the country's transition towards higher value-added production. Statistical evidence shows that regions with stronger vocational training systems tend to exhibit higher manufacturing output and labour productivity (Li, 2022). However, critiques persist regarding limited permeability between vocational and academic tracks, which may constrain long-term career mobility despite immediate employment gains.

In contrast, the United States operates a decentralised vocational system, commonly framed as career and technical education (CTE), with governance shared across federal, state, and local levels. Community colleges play a central role, offering flexible programmes that combine academic instruction with technical skills. Industry partnerships are central, particularly in sectors such as advanced manufacturing, healthcare, and information technology. Apprenticeship programmes and sector-based training initiatives have gained prominence, especially in response to skills shortages in technical occupations. Evidence from state-level programmes shows that participants in CTE pathways experience higher employment rates and earnings compared to non-participants (Carnevale et al., 2020; Lerman, 2022).

A practical example is the Advanced Manufacturing Partnership in states such as Michigan, where collaboration between community colleges and manufacturing firms has led to the development of tailored training programmes. These programmes have contributed to the revitalisation of local manufacturing by ensuring a steady supply of skilled workers capable of operating modern production technologies (Holzer, 2021). Unlike China's centralised model, the U.S. system allows for flexibility and innovation but often faces challenges related to coordination and consistency across regions.

The outcomes of these systems demonstrate that vocational education can directly influence industrial expansion when effectively aligned with labour market needs. China's model shows the benefits of coordinated planning and large-scale implementation, particularly in rapidly industrialising contexts. The United States illustrates how decentralised, industry-driven approaches can support innovation and adaptability. Both systems highlight the importance of integrating technical training with practical experience and continuous skill upgrading. Their experiences suggest that the effectiveness of vocational education lies not only in institutional design but also in the strength of linkages between education providers and industrial actors.

The Current State of Vocational Education and its Link with Industrial Development and Workers' Health in Nigeria

In Nigeria, vocational education has long been recognised as a critical component of national development, yet its implementation has remained limited in scope and impact. The system is largely delivered through technical colleges, polytechnics, and informal apprenticeship arrangements, with significant disparities in quality and access. Empirical evidence suggests that vocational education in Nigeria is characterised by inadequate funding, obsolete equipment, and weak alignment with industry needs (Okolie et al., 2020; Nwokeiwu, 2021). As a result, many graduates lack the competencies required for modern industrial environments, contributing to persistent skills mismatches.

Statistical data underscores the scale of the challenge. Nigeria's unemployment rate among youth remains high, with underemployment also widespread, reflecting limited absorption capacity in the formal industrial sector. The manufacturing sector contributes less than 10 per cent to GDP, indicating slow industrial expansion relative to the country's labour force growth (Adegboye, 2021). This weak industrial base limits opportunities for vocational graduates and reinforces the dominance of informal employment, where structured training and regulation are minimal.

The link between vocational education and workers' health in Nigeria is particularly concerning. Inadequate training

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often translates into poor adherence to occupational safety standards, especially in sectors such as construction, small-scale manufacturing, and artisanal trades. Studies have shown that workers in these sectors face high risks of injuries, respiratory conditions, and long-term health complications due to exposure to hazardous materials and unsafe practices (Akinwale & Olusanya, 2021; Ezenwa, 2022). For instance, research on construction workers in Lagos indicates a high prevalence of workplace accidents, largely attributed to insufficient training and weak enforcement of safety regulations.

The informal apprenticeship system, which remains a dominant mode of skill acquisition, provides practical exposure but lacks standardisation and formal health and safety training. While it plays a significant role in employment generation, its contribution to industrial development is constrained by limited technological advancement and weak integration with formal education systems. Furthermore, the absence of structured occupational health education within vocational curricula reduces awareness of workplace risks and preventive measures.

Efforts to reform vocational education in Nigeria have included policy initiatives aimed at improving technical training and promoting entrepreneurship. However, implementation gaps persist, particularly in aligning training programmes with industrial priorities and integrating health and safety considerations. The current state of vocational education thus reflects a disconnect between training systems, industrial development, and workers' well-being. Addressing this disconnect requires a more coordinated approach that links skills development with industrial policy and occupational health frameworks.

How Adaptable Elements from China and the United States can be applied to Improve Vocational Training, Industrial Growth, and Occupational Health in Nigeria

Adapting elements from the vocational education systems of China and the United States to the Nigerian context requires careful consideration of institutional capacity, economic structure, and labour market conditions. One of the most transferable features from China is the strong alignment between vocational training and industrial policy. In Nigeria, this could involve the development of regional training hubs linked to specific industrial clusters, such as agro-processing in the North Central region or manufacturing in Lagos and Ogun states. By integrating vocational institutions with local industries, training programmes can be tailored to meet specific skill demands, thereby improving employment outcomes and supporting industrial growth. Evidence from China suggests that such integration enhances productivity and facilitates technology transfer (Li, 2022; Wang & Guo, 2023).

Another adaptable element is the emphasis on school–enterprise collaboration. In practical terms, Nigerian vocational institutions could establish formal partnerships with industries to provide apprenticeship opportunities, co-develop curricula, and ensure that training reflects current technological practices. This approach would address the existing gap between theoretical instruction and practical application. The U.S. experience with community colleges demonstrates how such partnerships can be structured to respond to labour market needs while maintaining flexibility (Lerman, 2022). Introducing similar models in Nigeria could improve the relevance of vocational training and increase the employability of graduates.

The integration of occupational health and safety into vocational education represents another critical area for adaptation. Both China and the United States incorporate safety training into technical education, recognising its importance for productivity and worker well-being. In Nigeria, embedding health and safety modules within vocational curricula would enhance workers' awareness of risks and promote safer practices across industries. This is particularly important in sectors with high accident rates, where preventive measures can significantly reduce injuries and associated economic costs.

Institutional reforms are also necessary to support these adaptations. Strengthening governance and coordination within the vocational education system would improve consistency and quality across institutions. Decentralisation, as seen in the United States, could allow for greater responsiveness to local labour market conditions, while maintaining national standards to ensure quality assurance. At the same time, targeted investment in infrastructure and equipment is essential to modernise

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training facilities and support the adoption of new technologies.

Finally, addressing the informal sector is crucial for the Nigerian context. Incorporating elements of China's structured training and the United States' certification systems into informal apprenticeship programmes could enhance their effectiveness. Standardising training processes and introducing certification would improve skill recognition and facilitate mobility within the labour market. This would also create opportunities to integrate occupational health training into informal settings, thereby extending the benefits of vocational education to a larger segment of the workforce.

In practical terms, the adaptation of these elements requires sustained political commitment, stakeholder collaboration, and adequate funding. While differences in context must be acknowledged, the experiences of China and the United States provide clear evidence that well-designed vocational education systems can support industrial expansion and improve workers' health. Applying these lessons in Nigeria offers a pathway towards more inclusive and sustainable economic development.

Empirical Reviews

The empirical study conducted by Chen and Li (2025) on *"Vocational education investment and middle-income group expansion in China"* was carried out across 25 provinces in China and grounded in human capital theory with extensions from industrial structure transformation perspectives. The researchers adopted a quantitative panel research design using longitudinal data spanning multiple years, applying regression and threshold models to examine relationships between vocational education investment and industrial outcomes. The sample comprised provincial-level datasets, selected through purposive inclusion of regions with consistent economic data records. Data were obtained from official statistical yearbooks and labour market datasets, while analytical techniques focused on econometric modelling. The findings showed that investment in vocational education significantly enhanced non-agricultural industrial growth and contributed to income expansion, particularly in regions undergoing structural industrial transformation. The study concluded that vocational education plays a direct role in strengthening industrial productivity and workforce upgrading. However, the analysis remained largely macro-level and did not address workplace conditions or health outcomes of workers. This creates a gap for the present study to examine how vocational education influences not only industrial growth but also workers' health within developing economies such as Nigeria .

Zhong (2023) carried out an investigation on*"More graduates, fewer skills? Vocational education expansion and skilled labour shortages in China"* focusing on selected urban centres in China and drawing on skill formation theory and social reproduction perspectives. The study employed a qualitative research design based on fieldwork conducted between 2017 and 2020, involving 104 students selected through purposive sampling from six vocational schools across five cities. Data collection relied on in-depth interviews and institutional observations. The results revealed that despite the expansion of vocational education, a mismatch persisted between acquired skills and industrial requirements, leading to continued labour shortages in key manufacturing sectors. The author concluded that expansion alone does not guarantee industrial efficiency without strong alignment between training content and industry needs. The study offered valuable insights into structural weaknesses within vocational systems but did not extend its analysis to comparative contexts or implications for occupational health. The present research therefore filled this gap by integrating comparative lessons and incorporating workers' well-being into the analysis .

In another study, Lerman (2022) carried out a study on *"Training for jobs in the United States: Lessons from apprenticeship programmes"* and examined vocational training within the United States using human capital and labour market segmentation theories. The research adopted a mixed-method approach combining quantitative labour market data with qualitative case studies of apprenticeship programmes across multiple states. The sample included participants from registered apprenticeship schemes, selected through stratified sampling to reflect different industries such as manufacturing and construction. Data

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were collected through administrative records, surveys, and employer interviews. Findings indicated that structured apprenticeship systems significantly improved employment outcomes, increased earnings, and reduced workplace accidents due to better safety training. The study concluded that industry-linked vocational pathways enhance both productivity and worker protection. Nevertheless, the research focused primarily on advanced economies and did not consider how such models can be adapted in contexts with large informal sectors. This limitation provides a basis for the current study to explored adaptation strategies suitable for Nigeria's socio-economic conditions.

Zhang and Ayob (2023) conducted a study on *"A study on the contribution of vocational education and training to industrial development in China"* within selected industrial regions of China, guided by systems theory and education–industry linkage models. The researchers employed a mixed research design involving surveys and interviews, with a sample drawn from vocational institutions and industrial enterprises using stratified sampling techniques. Data collection involved questionnaires administered to students and employers alongside semi-structured interviews with institutional administrators. The findings demonstrated that vocational education contributes significantly to industrial development through employment-oriented training and direct engagement with production sectors. The study also highlighted that effective collaboration between institutions and industries enhances skill relevance and productivity. The authors concluded that vocational education remains central to sustaining industrial transformation. However, the study did not explore comparative international models or examine the implications for workers' health and safety. This omission underscores the need for the present research, which extended the analysis to include comparative insights from both China and the United States while incorporating occupational health considerations in the Nigerian context .

Theoretical Framework

This paper was anchored on two theories namely; Human Capital Theory and Skill Formation Theory

i. Human Capital Theory

The Human Capital Theory originally advanced by Gary Becker in 1964 has remained one of the most widely applied frameworks in analysing the relationship between education, productivity, and economic development, and it has been revisited and extended in recent empirical work (Becker, 1964; Psacharopoulos & Patrinos, 2020). The theory assumes that education and training are forms of investment that enhance individuals' productive capacities, leading to higher earnings, improved efficiency, and broader economic growth. It further posits that the accumulation of skills through formal and informal learning increases labour market competitiveness and supports structural transformation within economies.

Contemporary studies have reaffirmed that vocational education plays a crucial role in building occupation-specific competencies that directly influence industrial output and labour productivity (Hanushek et al., 2020). The strength of this framework lies in its clear linkage between education and economic outcomes, providing a measurable basis for analysing returns on investment in vocational training. However, it has been criticised for overemphasising economic returns while paying limited attention to social conditions, institutional constraints, and workers' welfare beyond productivity measures.

In applying this theory to the present study, vocational education in Nigeria is conceptualised as a critical investment capable of enhancing industrial expansion through the development of a skilled workforce. Lessons from China and the United States illustrate how sustained investment in vocational systems has translated into increased industrial productivity. At the same time, integrating workers' health into this framework extends its relevance by recognising that human capital is not only built through skills acquisition but also maintained through safe and healthy working conditions, which ultimately sustain productivity and economic growth.

ii. Skill Formation Theory

Complementing this perspective is the Skill Formation Theory as developed in comparative political economy by Kathleen Thelen (2014) and further expanded in recent

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analyses of vocational systems and labour markets (Busemeyer & Trampusch, 2020). This framework assumes that skill development is shaped by institutional arrangements, including the interaction between the state, employers, and training institutions. It emphasises that different countries adopt distinct models of skill formation depending on their political, economic, and industrial structures, which in turn influence employment outcomes and industrial performance.

The theory highlights the importance of coordinated systems, such as those seen in China, where state-led initiatives align training with industrial policy, as well as more decentralised approaches like that of the United States, where market-driven mechanisms and industry partnerships guide vocational training. Its strength lies in its ability to account for institutional diversity and explain why similar educational investments yield different outcomes across contexts. Nonetheless, the framework has been critiqued for its limited engagement with informal economies and insufficient attention to health and safety dimensions within labour systems, particularly in developing countries.

Applied to this study, Skill Formation Theory provides a useful lens for understanding how Nigeria's vocational education system can be restructured through stronger coordination among government, industry, and training institutions. It supports the argument that adapting elements from China's coordinated approach and the United States' flexible, industry-linked model can enhance vocational training outcomes. Furthermore, incorporating workers' health into this framework strengthens its explanatory power by acknowledging that effective skill formation must include not only technical competence but also the institutionalisation of occupational safety practices within training and industrial systems.

RESULTS AND DISCUSSIONS

The findings on the structure and outcomes of vocational education in China and the United States reinforce the central argument that effective alignment between training systems and industrial needs drives measurable gains in productivity and employment. Evidence from provincial-level analyses in China demonstrates that coordinated investment in vocational institutions and enterprise-based training has supported industrial upgrading and labour absorption, particularly within manufacturing clusters, a position consistent with Zhao and Liu (2021) and Chen and Li (2025).

At the same time, the U.S. experience, as discussed by Lerman (2022), shows that apprenticeship pathways and community college partnerships improve job placement and earnings while reducing workplace accidents through embedded safety training. These outcomes challenge Zhong's (2023) concern regarding skill mismatches by indicating that where institutional coordination is strong, vocational expansion can translate into industrial efficiency. The implication for Nigeria is that the effectiveness of vocational education depends less on expansion alone and more on the coherence of its linkages with industry and production systems.

The analysis of the Nigerian context revealed a persistent disconnect between vocational education, industrial development, and workers' health, which aligns with the observations of Okolie et al. (2020) and Nwokeiwu (2021) regarding weak institutional capacity and outdated curricula. Empirical evidence on occupational hazards further supports Akinwale and Olusanya's (2021) position that inadequate training contributes to unsafe working conditions, particularly within informal sectors. Unlike the structured systems observed in China and the United States, vocational training in Nigeria remains fragmented, with limited integration of occupational safety standards.

This condition explains the high prevalence of workplace injuries in construction and small-scale manufacturing. The findings therefore extend existing literature by demonstrating that the absence of coordinated skill formation mechanisms not only constrains industrial expansion but also undermines workers' well-being. In practical terms, Nigeria's educational system must move beyond theoretical instruction towards competence-based training that incorporates health and safety as a core component of skill acquisition.

The findings on adaptable elements highlights that both coordinated and decentralised approaches offer practical lessons for reform. The Chinese model underscores the value of state-led alignment between vocational

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institutions and industrial policy, particularly in developing sector-specific training hubs linked to production clusters. In contrast, the U.S. system illustrates how flexible, industry-driven partnerships can enhance responsiveness to labour market demands. These insights support Zhang and Ayob's (2023) argument that collaboration between training institutions and industries strengthens skill relevance and productivity.

However, the Nigerian context requires selective adaptation rather than direct replication. For instance, integrating structured apprenticeship schemes within existing informal systems could improve skill standardisation while preserving local relevance. Embedding occupational health training into vocational curricula would also address the gap identified in current practice. Such reforms would not only improve employability but also reduce workplace risks, thereby linking education directly to both economic and social outcomes.

The theoretical frameworks adopted in this study provide strong explanatory support for these findings. Human Capital Theory clarifies how investment in vocational education enhances productivity and industrial growth, a relationship clearly reflected in the experiences of China and the United States. The evidence that structured training improves employment outcomes and reduces occupational hazards extends the theory by showing that human capital development includes both skill acquisition and health preservation. Similarly, Skill Formation Theory explains the institutional differences observed across countries, particularly the role of coordinated systems in China and market-driven arrangements in the United States. The Nigerian case illustrates the limitations of weak institutional coordination, thereby affirming the theory's relevance. Together, these frameworks justify the study's conclusion that effective vocational education must integrate technical training, industrial policy, and occupational health considerations. For Nigeria's educational system, this implies a shift towards stronger governance, industry engagement, and curriculum reform capable of supporting both industrial expansion and the protection of workers' well-being.

Conclusions

The paper showed that vocational education plays a decisive role in shaping industrial expansion and workers' health when it is effectively aligned with economic priorities and labour market demands. Evidence drawn from China demonstrates how strong state coordination, integration of training with industrial clusters, and continuous curriculum adaptation can support large-scale manufacturing growth while sustaining workforce productivity. The experience of the United States further illustrates that flexible, industry-driven systems anchored in apprenticeships and community-based training can enhance employability and embed occupational safety within skill acquisition processes. In contrast, the situation in Nigeria reveals a fragmented vocational education system characterised by weak institutional linkages, outdated training infrastructure, and limited incorporation of workplace health standards. This disconnect has contributed to persistent skill mismatches, slow industrial development, and exposure of workers to unsafe conditions, particularly within informal and semi-formal sectors.

The findings therefore establish that expanding vocational education without strengthening its relevance to industry and its connection to workers' health yields limited outcomes. What distinguishes successful systems is not merely the availability of training institutions but the extent to which they are embedded within broader economic and regulatory frameworks. The study also confirmed that vocational education must be viewed as both an economic and social investment, where skill development and occupational well-being are mutually reinforcing. For Nigeria, repositioning vocational education requires deliberate policy coordination, sustained investment, and a reorientation towards practical competence and safety consciousness. Without such reforms, the potential of vocational education to drive industrial transformation and improve labour conditions will remain unrealised.

RECOMMENDATIONS

Arising from the above findings, the following recommendations were suggested:

1. Nigeria should establish structured regional vocational–industrial clusters that directly link technical institutions with priority sectors such as manufacturing, construction, and agro-processing. This approach, reflecting practices observed in China, would ensure that training programmes are tailored to local industrial needs while facilitating internships, apprenticeships, and immediate employment pathways. Such clusters should be supported through public–private partnerships, where industries actively participate in curriculum design, training delivery, and assessment of competencies.
2. There is a need to institutionalise a dual training system that combines classroom instruction with mandatory workplace-based learning, drawing from practices in the United States. This should include formal apprenticeship schemes with clear certification standards, incentives for employer participation, and mechanisms for monitoring quality. Embedding industry exposure within training will improve practical competence, reduce skill mismatches, and enhance the employability of graduates across sectors.
3. Vocational education curricula in Nigeria should be restructured to integrate occupational health and safety as a compulsory component across all programmes. This reform must go beyond theoretical instruction to include practical safety training, compliance standards, and regular assessment of workplace practices. Strengthening collaboration between educational institutions and regulatory bodies will ensure that graduates enter the labour market with both technical skills and the capacity to maintain safe working environments, thereby improving productivity and reducing the burden of work-related health risks.

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