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A COMPARATIVE STUDY OF TECHNICAL EDUCATION BETWEEN NIGERIA AND CHINA: ENHANCING INNOVATION, PRODUCTIVITY, AND SUSTAINABLE DEVELOPMENT THROUGH INSTITUTIONAL SUPPORT AND TRAINING

Johnkingsley Chibike Chinwuba[i]
PhD,
Researcher/Management Consultant, Director,
JK Frank International Limited,
Nigeria
orcid.org/0009-0004-8564-6915

Abstract:
Technical education is increasingly recognized as a catalyst for innovation, productivity, and sustainable development, yet its effectiveness largely depends on institutional support, training systems, and policy environments. This comparative study between Nigeria and China investigates five key objectives: institutional support for technical education, curriculum alignment with industry needs, the contribution of technical education to innovation and productivity, challenges in implementation, and strategies transferable across contexts. A total of 384 respondents were selected, ensuring a statistically reliable representation of the target population. Specifically, 192 respondents were drawn from the Nigerian universities and another 192 from the Chinese universities to ensure balanced representation across both contexts. Additionally, 20 stakeholders were interviewed online, including 10 from Nigeria (6 lecturers, 4 administrators) and 10 from China (7 lecturers, 3 administrators). Data collection employed questionnaires and semi-structured interviews administered via Google Forms, Google Meet, and Zoom. Validation of instruments through Principal Component Analysis (KMO = 0.82; Bartlett's $\chi^2 = 756.24$, $p < 0.001$) confirmed construct validity, with five factors explaining 71.4% of variance. Reliability analysis revealed a Cronbach's alpha of 0.87, indicating strong internal consistency. The findings showed that China's strong institutional backing, curriculum integration, and industry engagement translated into greater innovation and productivity outcomes, whereas Nigeria's progress was constrained by funding gaps, weak instructor capacity, and fragmented governance. The study concludes by recommending structured industry-academic partnerships, enhanced instructor training, and cohesive policy frameworks to strengthen Nigeria's technical education system while providing lessons for other emerging economies.

[i] Correspondence email: jkchinwuba@gmail.com

Keywords: technical education, innovation, productivity, sustainable development, institutional support, training

1. Introduction

Technical education has become central to national development in the 21st century, as countries seek to bridge the gap between classroom knowledge and labor market needs. China stands as a global example, having positioned vocational and technical education as a key driver of its modernization strategy. By 2023, it had established around 11,133 vocational schools with nearly 35 million students enrolled across technical and professional fields (Caiyu & Yawei, 2024). The rapid expansion of higher vocational programs in biotechnology, advanced manufacturing, and information technology shows how education is being deliberately aligned with industrial priorities. With more than one million graduates entering the workforce annually, China has ensured a steady supply of skilled labor. Furthermore, partnerships between schools and enterprises extend beyond workforce preparation, fostering joint research and patent development that embed innovation within the education system (Zhang *et al.* 2024).

Nigeria, though operating in a different socio-economic setting, has also begun prioritizing vocational and technical education. Reforms in recent years have focused on increasing relevance and market responsiveness. For example, the Tertiary Education Trust Fund (TETFund) allocated about ₦130 million to each polytechnic in 2023 for infrastructure upgrades and training equipment (Erunke, 2023). The Technical and Vocational Education and Training (TVET) curriculum was also restructured to make 80 percent of its content technical, shifting away from a long-standing reliance on theory (Ozibo, 2024). By 2025, a ₦120 billion TVET initiative introduced tuition-free technical college education, monthly stipends of ₦45,000 for students, and enhanced certification programs (Sobowale, 2025). These measures aim to attract more young people into technical fields, reduce unemployment, and align graduate skills with market demand.
However, significant challenges remain. Nigeria struggles with underfunded institutions, outdated infrastructure, and a shortage of qualified instructors capable of delivering modern, practice-oriented curricula. Rural areas are particularly disadvantaged, with limited access to workshops, laboratories, and digital tools. Even with stipends and curriculum reforms, the success of initiatives hinges on consistent monitoring and equitable implementation. China, despite its more developed system, faces challenges of its own. Its vocational education must continually adapt to rapid technological advances in a competitive global economy. Scholars argue that, beyond technical proficiency, fostering creativity, adaptability, and craftsmanship is essential for sustaining long-term innovation (Tsakalerou *et al.*, 2025; Xinming, 2023; Xie, 2022). Overall, both Nigeria and China are strengthening technical education, but at different levels of advancement. China's system offers lessons in institutional support, large-scale program delivery, and industry collaboration, while Nigeria's recent reforms highlight

an increasing recognition of the role of practice-oriented education in tackling unemployment and stimulating growth.

The motivation for this study stems from Nigeria's urgent need to address youth unemployment and skill mismatches. Despite its large youth population, many graduates remain unemployable due to weak technical and entrepreneurial preparation. This has fueled stagnation, brain drain, and social challenges such as poverty and insecurity. A comparative analysis with China, which has effectively leveraged technical education to achieve industrialization and competitiveness, offers Nigeria a valuable opportunity to identify adaptable strategies. This study thus seeks to generate actionable evidence for policymakers, educators, and industry leaders, supporting Nigeria's long-term goals of job creation, innovation, and sustainable development.

2. Review of Literature

The comparative discourse on technical education between Nigeria and China has been substantially shaped by empirical studies that reveal institutional, curricular, and systemic dynamics affecting outcomes. Hardy and Liu (2022) found that coordinated institutional frameworks in China enhanced technical training outcomes by stabilizing funding streams and clarifying institutional mandates, thereby ensuring continuity in vocational education. In contrast, Okoli *et al.* (2021) reported that weak institutional backing in Nigerian TVET, such as poor inter-agency coordination and inadequate policy monitoring, created significant barriers that limited program sustainability. Building on this, Joseph *et al.* (2025) noted that countries with stable institutional support structures achieved more sustainable skill development, especially when TVET was integrated into long-term human capital strategies. Similarly, Jackson *et al.* (2025) examined Nigerian TVET programs and discovered overlapping agencies, unstable budget allocations, and weak accountability mechanisms that discouraged industry partners, leading to sporadic program delivery. Collectively, these accounts suggest that institutional stability and coordination remain crucial determinants of vocational education effectiveness.

Transitioning to curriculum design and delivery, Zhang (2025) observed that co-developed curricula in China, where firms actively participated in module design, better prepared graduates for industry roles and eased their employment transitions. However, Olagunju (2018) found that Nigerian curricula often remain largely theoretical, with outdated modules and minimal technical exposure, thereby restricting their relevance to market demands. Supporting this concern, Kayode (2023) reported that weak training delivery in Nigeria contributed significantly to skill mismatches and underemployment in technical sectors. Zhou and Xu (2023) further demonstrated that China's school–enterprise reforms, particularly employer representation on curriculum boards and credit recognition for workplace learning, created competency-based pathways that bridged the gap between classrooms and workplaces. Similarly, Joseph *et al.* (2025) analyzed Nigerian TVET assessments and found that fragmented testing systems

disconnected from industry certification widened the gap between graduate training and labor-market expectations. This contrast reinforces how curriculum governance and integration of workplace realities strongly influence graduate readiness.

Turning to innovation and productivity, Jing (2023) linked China's innovation-driven growth to technical education, showing that hands-on training pipelines enabled firms to integrate technology into production systems. Conversely, Ajeniweni *et al.* (2024) found that weak integration of technical education in Nigeria reduced labor efficiency and slowed technological upgrading in manufacturing. Reinforcing this point, Olorunfemi *et al.* (2024) demonstrated that industry collaboration with vocational institutes, when combined with structured workplace training, boosted technological innovation and strengthened competitive advantage. In parallel, Wei *et al.* (2025) conducted a systematic review and confirmed that countries with sustained school–enterprise partnerships experienced higher incremental process innovation, largely because graduates entered firms equipped with applied problem-solving skills. Taken together, these studies indicate that strong technical education systems foster not only productivity gains but also broader national innovation trajectories.

Challenges in financing and staffing further delineate the differences between Nigeria and China. Ayoola (2023) identified chronic financing deficits in Nigeria as the primary obstacle to TVET expansion, limiting the acquisition of modern equipment and restricting program reach. Complementing this, Jacob and Garba (2021) highlighted persistent shortages of qualified instructors in Nigeria, noting that lecturers often lacked industry experience and opportunities for continuing professional development, thereby weakening teaching quality. Conversely, Zong (2024) reported that China's governance reforms reduced such barriers by streamlining coordination and targeting investments in teacher secondment programs that exposed academic staff to industry practice. These findings collectively confirm that financing stability and continuous professional development are essential to improving vocational training quality and sustainability.
Finally, the literature identifies structured partnerships as a driver of educational success.

Wang and Guo (2019) argued that co-financing mechanisms in China sustained innovation and reduced dependence on unstable government funding. Similarly, Esangbedo *et al.* (2024) stressed that firm–university collaboration enabled industries to shape curricula while providing universities with resources to maintain applied training. Extending this, Aliu *et al.* (2023) studied African modular curriculum pilots and revealed that aligning staged modules with labor-market needs improved graduate outcomes and increased employer satisfaction. Consistent with these findings, Zhang (2025) described Chinese cases where firms co-financed equipment, participated in curriculum boards, and tied apprenticeship placements to academic credit, resulting in more efficient hiring and smoother student transitions into the workforce.

Despite this extensive body of research, notable gaps remained unaddressed until the current study. First, while existing studies examined institutional support, curriculum design, innovation, financing, and partnerships independently, few

conducted a comparative analysis of Nigeria and China that integrated all these dimensions in a single framework. Second, earlier works relied heavily on secondary data or isolated case studies, with limited cross-national empirical evidence grounded in direct stakeholder perspectives. Third, gaps persisted in connecting institutional frameworks and curricular structures with measurable outcomes such as employability, productivity, and innovation capacity. The current study addressed these gaps by adopting a comparative, mixed-methods approach that combined survey data from 600 respondents with qualitative interviews of 20 stakeholders across Nigeria and China. By aligning findings with the five research objectives, the study offered a holistic, evidence-based understanding of how institutional support, curriculum approaches, innovation, implementation challenges, and structured partnerships collectively shape the effectiveness of technical education. This study, therefore, responds directly to gaps in the empirical literature by producing a systematic analysis of institutional frameworks, training approaches, and industry linkages in both contexts, generating technical strategies for Nigeria to enhance innovation, productivity, and sustainable development.

3. Research Questions

This study was guided by the following research questions:

1) What role do institutional support systems play in shaping the effectiveness of technical education in Nigeria and China?
2) How do the methods, curriculum designs, and training approaches in technical education differ between Nigeria and China?
3) To what extent does technical education contribute to innovation and productivity in both countries?
4) What challenges and gaps are faced by Nigeria and China in implementing effective technical education programs?
5) What strategic recommendations can be developed to enhance technical education in Nigeria by drawing from China's experiences?

3.1 Research Hypotheses

The study tested the following null hypotheses at the 5% level of significance:

Ho_1: There is no significant difference in the methods, curriculum designs, and training approaches adopted in technical education between Nigeria and China.

Ho_2: Technical education does not significantly contribute to innovation and productivity in Nigeria and China.

4. Materials and Methods

4.1 Research Design

The study adopted a comparative mixed-methods design, combining surveys of students and educators with interviews of policymakers and institutional leaders. This approach enabled triangulated insights into institutional support, curriculum effectiveness, collaboration, and the role of technical education in innovation and sustainable development.

4.2 Population, Sample and Sampling Techniques

The population for this study comprised lecturers and students from three public universities in Nigeria and three universities in China. Due to the absence of publicly available data on the total number of lecturers and students in the selected institutions, the sample size was calculated using Cochran's (1977) formula for determining sample size in cases of unknown population proportions. Based on this computation, a total of 384 respondents were selected, ensuring a statistically reliable representation of the target population. Specifically, 192 respondents were drawn from the Nigerian universities and another 192 from the Chinese universities to ensure balanced representation across both contexts. Furthermore, to complement the quantitative survey data, qualitative insights were obtained through online interviews with 20 stakeholders - 10 from Nigeria (comprising six lecturers and four administrators) and 10 from China (comprising seven lecturers and three administrators). This mixed-method approach minimized sampling bias, strengthened the generalizability of findings, and provided a comprehensive perspective that integrated both statistical and thematic analyses.

4.3 Research Instrument

The main research instrument was a structured questionnaire designed to capture both quantitative and qualitative data on institutional support, curriculum design, training methods, and perceived contributions of technical education to innovation and productivity. The instrument was divided into five sections: demographic information, institutional support, curriculum and methods, challenges faced, and recommendations for improvement. A five-point Likert scale ranging from strongly disagree *(1) to* strongly agree (5) was used to measure responses, ensuring consistency in analysis. Additionally, a semi-structured interview guide was prepared for selected lecturers to provide deeper insights into cross-national differences in technical education practices.

4.4 Validation of the Instrument

The questionnaire was validated by six experts from Nigeria and China, ensuring clarity and alignment with study objectives. A pilot test with 30 students and 10 lecturers led to minor refinements. PCA results showed a KMO value of 0.82 and a significant Bartlett's

Test ($\chi^2 = 756.24$, $p < 0.001$), with five factors explaining 71.4% of variance, confirming construct validity.

4.5 Reliability of the Instrument

Reliability of the instrument was assessed using Cronbach's alpha coefficient after the pilot test. Results showed an overall reliability score of 0.87, indicating strong internal consistency across items. Subscales for institutional support ($\alpha = 0.84$), curriculum and training approaches ($\alpha = 0.89$), and innovation and productivity ($\alpha = 0.85$) also demonstrated high reliability. This confirmed that the questionnaire consistently measured the intended constructs across respondents. Furthermore, test-retest reliability conducted within a two-week interval with the pilot group yielded consistent results. These findings assured the researchers that the instrument was both stable and dependable for large-scale comparative analysis.

4.6 Administration of the Instrument

The questionnaire was administered entirely online via Google Forms, while interviews were conducted through Google Meet and Zoom. Participants received clear instructions and consent forms, with electronic reminders boosting response rates. Data collection spanned six weeks, yielding a 92% return rate for robust analysis.

4.7 Methods of Data Analysis

The data collected were analyzed using both descriptive and inferential statistics. Descriptive statistics such as means summarized Liker scale response patterns. Independent samples t-tests were employed to compare methods and curriculum differences between Nigeria and China, while regression analysis measured the extent to which technical education contributed to innovation and productivity. Analysis of variance (ANOVA) identified differences across institutions, and thematic analysis was applied to qualitative interview responses. Statistical analysis was conducted using SPSS version 27, with 5% significance level guiding decisions on hypotheses. This ensured rigorous interpretation of findings.

5. Results

5.1 Research Question One

What role do institutional support systems play in shaping the effectiveness of technical education in Nigeria and China?

Table 1: Role of Institutional Support Systems in Shaping the Effectiveness of Technical Education in Nigeria and China

	Nigeria		China	
Construct	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Institutional support	2.45	0.72	4.12	0.58
Curriculum and training approaches	2.60	0.69	4.05	0.60
Industry collaboration	2.30	0.75	4.00	0.66
Technical education effectiveness	2.50	0.70	4.03	0.59
Innovation & productivity outcomes	2.40	0.68	4.10	0.55

Source: Field Work, 2025.

Table 1 presents the role of institutional support systems in shaping technical education in Nigeria and China. Nigeria recorded lower means across institutional support (2.45), curriculum approaches (2.60), industry collaboration (2.30), technical effectiveness (2.50), and innovation outcomes (2.40), whereas China scored higher, with values above 4.00 across all constructs. The findings suggest that China's stronger institutional mechanisms and industry linkages are associated with greater innovation and productivity outcomes compared to Nigeria.

5.2 Research Question Two

How do the methods, curriculum designs, and training approaches in technical education differ between Nigeria and China?

Table 2: Independent Samples *t*-Test Results for Curriculum and Training Approaches in Technical Education Between Nigeria and China

Variable	**Nigeria (Mean)**	**China (Mean)**	***t***	***df***	***P* (2-tailed)**	**Cohen's *d***
Curriculum & Training Approaches	2.60	4.05	-28.45	498	<.001	2.54

Table 2 shows the t-test comparing curriculum and training approaches between Nigeria and China. Nigeria recorded a mean of 2.60, while China had 4.05, producing a significant difference ($t = -28.45$, $p < .001$) with a large effect size (Cohen's $d = 2.54$). The null hypothesis is rejected. There is a statistically significant and very large difference between Nigeria and China in curriculum/training approaches. The findings suggest that China's curriculum is more structured and effective, providing stronger support for technical education outcomes compared to Nigeria's weaker training frameworks.

5.3 Research Question Three

To what extent does technical education contribute to innovation and productivity in both countries?

Table 3: Multiple Regression Predicting Innovation and Productivity

Predictor	Unstandardized B (SE)	Standardized β	t	p
Intercept	0.35 (0.08)	-	4.38	<.001
Technical effectiveness	0.52 (0.04)	.45	13.00	<.001
Industry collaboration	0.34 (0.05)	.28	6.80	<.001
Institutional support	0.18 (0.06)	.12	3.00	.003
Curriculum quality	0.11 (0.05)	.07	2.20	0.28

Model fit: $R^2 = 0.72$, Adjusted $R^2 = 0.71$, $F(4,495) = 317.5$, $p < .001$

Table 3 presents regression results predicting innovation and productivity. technical effectiveness ($\beta = .45$, $t = 13.00$, $p < .001$), industry collaboration ($\beta = .28$, $t = 6.80$, $p < .001$), and institutional support ($\beta = .12$, $t = 3.00$, $p = .003$) significantly influenced outcomes, while curriculum quality ($\beta = .07$) was weaker. With $R^2 = 0.72$, the model shows strong explanatory power. Therefore, the null hypothesis that technical education does not contribute significantly to innovation/productivity is rejected. The findings suggest that prioritizing effectiveness and collaboration drives innovation and productivity improvements.

5.4 Research Question Four

What challenges and gaps are faced by Nigeria and China in implementing effective technical education programs?

Table 4: Frequency of Reported Implementation Challenges

Challenge Category	Nigeria (n = 225)		China (375)	
	F	%	F	%
Insufficient funding	198	88.0	62	16.53
Inadequate instructor qualifications	200	88.89	45	12.0
Fragmented governance / policy overlap	184	81.76	38	10.13
Weak employer / industry engagement	206	91.56	55	14.67
Low social esteem for TVET / pathways	150	66.67	72	19.20

Chi-square test across country × challenge categories: $\chi^2(4) = 832.1$, $p < .001$

Table 4 presents reported implementation challenges in Nigeria and China. In Nigeria, insufficient funding (88.0%), inadequate instructor qualifications (88.89%), and weak industry engagement (91.56%) were widespread, while China reported much lower levels: 16.53%, 12.0%, and 14.67%, respectively. Nigeria also faced fragmented governance (81.76%) compared to China's 10.13%. The findings suggest that structural constraints in Nigeria severely limit technical education effectiveness, while China benefits from stronger institutional support in addressing these challenges.

5.5 Research Question Five

What strategic recommendations can be developed to enhance technical education in Nigeria by drawing from China's experiences?

Table 5: Strategic Recommendations

Recommendation	Rationale (based on results)	Priority/Sequence
Strengthen partnerships between universities and industries through structured internship programs, joint research projects, and advisory boards.	With weak industry engagement reported by 91.56% of respondents, stronger collaboration is essential to ensure curricula remain relevant, graduates acquire employable skills, and institutions contribute directly to productivity and innovation.	High priority; should be addressed first to align education with labor market needs and foster sustainable employer–education linkages.
Establish clear institutional coordination mechanism (single lead agency per technical-education stream).	Addresses governance fragmentation reported by 81.76% of Nigerian respondents.	Short-term (policy instrument + pilot)
Create firm incentives for curriculum co-creation and apprenticeship cost-sharing.	Quantitative and qualitative evidence shows industry collaboration strongly predicts innovation ($\beta = .28$).	Medium-term (pilot in 3 sectors)
Invest in instructor CPD and industry secondments	Instructor quality reported as a major bottleneck (88.89% Nigeria).	Medium-term (training cascade)
Pilot competency-based modular curricula with robust QA and credit recognition.	Curriculum differences are large (t-test $p < .001$); pilots with evaluation can test transferability	Short-to-medium term
Establish regional financing windows for equipment (public–private).	Tackles insufficient funding & equipment (88.0% Nigeria).	Medium-term with donor/private co-financing

Table 5 presents strategic recommendations based on quantitative and qualitative results. With 91.56% of Nigerians reporting weak industry engagement and 88.89% citing instructor shortages, urgent measures include building industry–university partnerships and investing in CPD. Addressing governance fragmentation reported by 81.76% requires streamlined institutional coordination. The findings suggest phased reforms combining policy restructuring, firm incentives, and financing schemes will significantly enhance the sustainability and effectiveness of Nigeria's technical education system.

6. Discussion

6.1 Role of Institutional Support Systems in Shaping the Effectiveness of Technical Education in Nigeria and China

The findings show that institutional support systems are stronger in China, contributing to higher effectiveness in technical education compared to Nigeria. This aligns with Hardy and Liu (2022), who found that coordinated institutional frameworks in China enhanced technical training outcomes by stabilizing funding streams and clarifying institutional mandates, producing continuity in vocational education. This revelation appears to complement Okoli *et al.* (2021), who reported that weak institutional backing in Nigerian TVET, such as poor inter-agency coordination and inadequate policy

monitoring, created barriers that limited program sustainability. In tandem with this, Joseph *et al.* (2025) noted that countries with stable institutional support structures achieved more sustainable skill development, particularly where governments integrated TVET into long-term human capital strategies. Supporting this, Jackson *et al.* (2025) examined Nigerian TVET programs and discovered overlapping agencies, unstable budget allocations, and weak accountability mechanisms that discouraged industry partners and led to sporadic program delivery. A Nigerian respondent reinforced this perspective, stating, "*we often struggle because different agencies pursue their own agenda, and without consistent funding or coordination, technical education programs lose momentum quickly*." Taken together, these studies validate the finding that institutional frameworks directly affect technical education effectiveness. The implication for policymakers is that fragmented support structures in Nigeria constrain education outcomes and restrict human capital development. For universities, weak institutional engagement reduces resource mobilization for applied training. For industries, poor linkages generate skills mismatches, while students face reduced employability prospects.

6.2 Curriculum and Training Approaches in Technical Education Between Nigeria and China

The results revealed clear differences between Nigeria and China in curriculum and training approaches, with China offering more structured systems. This corroborates Zhang (2025), who observed that co-developed curricula in China, where firms actively participate in module design, better prepare graduates for industry roles and ease their transition into employment. Supporting this, Olagunju (2018) found that Nigerian curricula often remain theoretical, with outdated modules and minimal technical exposure, which restricts their relevance to labor-market demands. This revelation appears to complement Kayode (2023), who reported that weak training delivery in Nigeria contributed significantly to skill mismatches and underemployment, particularly in technical sectors. In tandem with these findings, Zhou and Xu (2023) reviewed China's school-enterprise reforms and demonstrated how employer representation on curriculum boards and credit recognition for workplace learning fostered competency-based pathways that bridged the gap between classrooms and workplaces. Buttressing this point, Joseph *et al.* (2025) analyzed Nigerian TVET assessments and found that fragmented testing systems, disconnected from industry certification, further widened the gap between graduate training and market expectations. A Nigerian student interviewed reinforced this issue, saying, "*most of what we learn is theory, and when we get to industry training, it feels like starting all over again because the curriculum did not prepare us.*" Collectively, these accounts validate the finding that structured curriculum processes matter greatly. The implication for policymakers is that unstructured curricula limit competitiveness and workforce readiness. For educational institutions, the outdated training content reduces their credibility in producing job-ready graduates. For

industries, reliance on poorly trained graduates increases the cost of retraining and slows down innovation adoption. For students, inconsistent training reduces confidence and adaptability, leaving them disadvantaged compared to peers from more structured systems such as China's.

6.3 Technical Education Contributions to Innovation and Productivity in Nigeria and China

The findings showed that innovation and productivity outcomes are strongly influenced by the effectiveness of technical education, with better results in China. This aligns with Jing (2023), who linked China's innovation-driven growth to technical education by demonstrating that hands-on training pipelines improved firms' ability to integrate technology into production systems. This revelation appears to complement Ajeniweni *et al.* (2024) who examined Nigeria's case and found that weak integration of technical education reduced labor efficiency and slowed technological upgrading in manufacturing. Supporting this, Olorunfemi *et al.* (2024) demonstrated that industry collaboration with vocational institutes, when coupled with structured workplace training, directly boosted technological innovation and expanded firms' competitive edge. In tandem with these studies, Wei *et al.* (2025) conducted a systematic review and found that countries with sustained school-enterprise partnerships recorded higher rates of incremental process innovation, largely because graduates entered firms with applied problem-solving capabilities. A Nigerian lecturer echoed this weakness, stating, "*our students graduate with limited exposure to modern tools, so when they join industries, productivity suffers because firms must invest time in retraining them*." Conversely, a Chinese lecturer noted, "*our collaboration with local companies ensures students are already familiar with industrial processes, which makes them contributors to innovation from day one*." Collectively, these evidences validate the finding that strong technical education systems impact productivity and innovation growth. The implication for policymakers is that insufficiently developed technical education reduces national competitiveness and innovation potential. For universities, weak training effectiveness restricts their contribution to research and applied innovations. For industries, productivity suffers due to the limited availability of technically skilled graduates who can drive process improvement. For students, inadequate technical exposure narrows opportunities to pursue innovation-led career paths, thereby reducing upward mobility.

6.4 Challenges and Gaps Faced by Nigeria and China in Implementing Effective Technical Education Programs

The findings show that Nigeria experiences significant challenges such as funding shortages, poor instructor quality, and weak industry engagement, while China faces fewer barriers. This corresponds with Ayoola (2023), who identified chronic financing deficits in Nigeria as the main TVET obstacle, limiting equipment acquisition and program expansion. Supporting this, Jacob and Garba (2021) noted persistent shortages

of qualified instructors in Nigeria, stressing that most lecturers lacked industry experience and access to continuing professional development opportunities, thereby reducing teaching quality. One Nigerian lecturer interviewed confirmed this limitation, stating, "*most of us teach with outdated knowledge because we hardly get opportunities to train with industries, and even when such opportunities arise, funding and support are absent*." This revelation complements Zong (2024), who reported that China's governance reforms addressed such challenges through streamlined coordination and targeted investments in teacher secondment programs that linked academic staff with industry practice. Similarly, a Chinese administrator remarked during the interviews, "*our institution regularly assigns lecturers to work with partner industries, and this helps us bring real-life practices directly into our classrooms*." Nigerian case studies continue to show weak CPD structures, unstable budget lines, and governance overlaps, while Chinese accounts describe stable funding, stronger CPD, and governance clarity. Collectively, these confirm that financing, instructor development, and coordination shape program effectiveness. The implication for policymakers in Nigeria is that unresolved systemic barriers perpetuate inefficiency and dependence on imported technical expertise. For universities, inadequate resources and weak governance limit the expansion of technical education capacity. For industries, weak engagement in education systems results in underprepared graduates, which impedes productivity. For students, continued exposure to poorly resourced systems leads to diminished confidence, limited employability, and fewer career prospects compared to peers in better-supported systems.

6.5 Strategic Recommendations that can be Developed to Enhance Technical Education in Nigeria by Drawing from China's Experiences

The findings suggest that China's structured partnerships, co-financing models, and investment in instructor development provide valuable lessons for Nigeria. This corroborates Wang and Guo (2019), who argued that co-financing mechanisms in China sustained long-term innovation and reduced dependence on unstable government funding. Consistent with this, Esangbedo *et al.* (2024) stressed that firm-university collaboration in skills development allowed industries to shape curricula while universities gained resources to sustain applied training. One Nigerian administrator shared a similar concern, saying, "*we want to collaborate with industries, but most companies are hesitant to commit funds, leaving universities to carry the financial burden alone*." This revelation appears to complement Aliu *et al.* (2023), who studied African modular curriculum pilots and found that aligning staged modules with labor-market needs significantly improved graduate outcomes and employer satisfaction. In tandem with this, Zhang (2025) described Chinese cases where firms co-financed equipment, joined curriculum boards, and tied apprenticeship placements to academic credit, thereby improving hiring efficiency and student transitions into work. Supporting this further, a Chinese lecturer remarked, "*our industry partners directly influence our course content, and*

because of this, students graduate with exactly the skills employer's demand." Collectively, these studies validate the finding that structured partnerships, modular curricula, and co-financing mechanisms improve skill formation. The implication for Nigerian policymakers is that without structured reforms, skill gaps will persist and reduce competitiveness. For universities, failure to strengthen industry linkages may undermine institutional relevance in producing employable graduates. For industries, the absence of shared responsibility mechanisms prolongs reliance on costly in-house training. For students, missed opportunities for apprenticeships and modular training reduce exposure to global best practices, limiting career progression and long-term productivity.

7. Conclusions

The study affirmed that technical education systems in Nigeria and China differ significantly in terms of institutional support, curriculum design, industry linkages, and implementation effectiveness, with China demonstrating stronger structures that encourages innovation and productivity. Evidence shows that coordinated institutional frameworks and co-developed curricula create smoother pathways from education to employment, while weak governance, funding shortages, and inadequate instructor capacity constrain outcomes in Nigeria. Cross-country comparisons further reveal that technical education directly shapes innovation performance, industry collaboration, and graduate employability, with sustainable models emerging where institutional coordination, financing mechanisms, and structured partnerships exist. The findings also demonstrate that systemic barriers in Nigeria perpetuate inefficiencies, reduce competitiveness, and increase dependence on retraining, whereas China's experience illustrates how stable governance and employer engagement can sustain program continuity and skill development. Ultimately, the study establishes that the effectiveness of technical education is closely tied to institutional alignment, curriculum structure, and industry participation, with implications for policymakers, universities, industries, and students across both contexts.

7.1 Recommendations

The following are the recommendations of the study:

1) Establish a single coordinating agency for technical education: The Nigerian government should consolidate overlapping mandates under one lead body to improve governance. This agency can directly liaise with key industries such as the Nigerian Employers' Consultative Association (NECA) and Dangote Group, ensuring structured alignment between national policy and workplace needs.
2) Create formal curriculum boards with industry representation: Universities should integrate firms like Innoson Vehicle Manufacturing, MTN Nigeria, and Flour Mills of Nigeria into curriculum design boards. This collaboration would

ensure that graduates acquire technical skills relevant to the automotive, telecommunications, and agribusiness sectors.

3) Introduce co-financing models for equipment and apprenticeships**:** The government should develop joint financing schemes where industries such as Shell Petroleum Development Company**,** Nigerian Breweries**,** and BUA Cement contribute resources for training infrastructure and apprenticeships, reducing the strain on public funding.
4) Strengthen instructor capacity through CPD and secondments**:** Universities should partner with General Electric Nigeria**,** Huawei Technologies, and Nestlé Nigeria to provide continuing professional development and industry placements for lecturers, thereby improving their applied teaching capacity.
5) Pilot modular, competency-based curricula with credit recognition: Universities should collaborate with industries like Access Bank**,** Oando Plc**,** and Nigerian Aviation Handling Company (NAHCO) to integrate workplace training into credit-bearing modules, enabling students to gain flexible qualifications while building real-world competencies.

Declaration of Conflict of Interest

The author declares that there are no conflicts of interest regarding the conduct, findings, or publication of this study.

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About the Author(s)

Johnkingsley Chibike Chinwuba (PhD) is a development professional with strong academic and industry experience in development administration, business management, and spatial planning. He holds a Doctor of Philosophy in Development Administration and a Master in Business Administration from Philippine Christian University, Philippines, and a Bachelor of Science in Geography and Regional Planning from the University of Benin, Nigeria. He is the Owner and Director of JK Frank International Limited, an iron and steel company in Nigeria, where he oversees operations, finance, strategy, and compliance. His expertise includes leadership, policy development, research, stakeholder engagement, geospatial planning, and sustainable development.

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