



A Collaborative Framework for Enhancing Technology Education between Private Sector and Colleges of Education in North-Central, Nigeria

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Abstract: *This study examined private sector collaboration in supporting Colleges of Education (COEs) offering technology education in North Central Nigeria. Four research questions guided the study: the modes of collaboration in providing physical facilities, the constraints to effective partnership, the key areas where collaboration enhances quality and relevance, and the criteria for monitoring and evaluating collaborative standards. A descriptive survey design was adopted, with a sample of 238 respondents comprising 118 participants from six Colleges of Education and 120 representatives from private sector organizations in technical and industrial trades. A structured questionnaire developed on a five-point Likert scale was used for data collection. Data were analyzed using mean and standard deviation. Findings revealed that the private sector contributes significantly to the provision of physical facilities that support technology education in COEs. However, collaboration is hindered by bureaucratic bottlenecks, inadequate funding, absence of clear government policies, political interference, and lack of trust in partnerships. The study also found that private sector engagement is essential for improving the quality and relevance of technology education through curriculum enrichment, student internships, and industry-based training opportunities. Furthermore, the findings indicated that effective monitoring and evaluation of collaborations require the adoption of clear, measurable, and participatory criteria to ensure accountability and sustainability. The study concludes that structured, transparent, and well-monitored collaborations between COEs and the private sector are crucial for strengthening technology education and equipping graduates with relevant skills for national development.*

Keywords: Private Sector, Collaboration, Technology Education, Colleges of Education, North Central Nigeria

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1. Introduction

The collaboration of the private sector and Colleges of Education (COEs) is rapidly gaining acceptance as an integral component of technology education. Technology education prepares an individual for engagement and contributions into the ever-evolving digital economy, with

partnerships including sector organizations assisting educational institutions in constructing curricula, skills and experiences of learning that blend with industry demand (Benson, 2019). The collaboration is mutually beneficial; on the one hand COEs are able to have access to updated technology, insights into industry, and a practical application of theory, while on the other hand, private sector collaborators have access to graduates with

qualifications that contain skills they seek (Abodunde & Jegede, 2020). The mutual benefit of these partnerships is even more relevant in developing nations where end-user institutions are typically chronically under-resourced, or where partnerships may bridge the divide between outdated classroom teaching with out-of-date expectation of employment context from the workplace.

Colleges of Education (COEs) play a significant role in the educational landscape of North Central Nigeria because they provide training for future teachers who will go on to teach the technical and vocational skill training of future generations of workforce participants. The particular importance of COEs in North Central Nigeria cannot be underestimated; COEs make up the core portion of the teaching workforce; without them, rural and semi-urban areas are likely to suffer from anticipated shortages of teachers, or perhaps no trained teachers at all. COEs play a part in national development by training teacher-trainees to provide this high-quality Technology and Vocational Education. In other words, by developing teacher trainees to teach Technology and Vocational Education, COEs provide the basis for all industries to have competent people to work in those industries. However, there are many hindrances to working with the private sector and COEs within this geographic region. In the literature, factors mentioned include privately funded student placements at COEs to access practical experience, lack of basic funds to develop training sites for Technology and Vocational Education pre-service teachers, misalignment of vision and goals from the private sector and COEs, and communication delays which all contribute to poor cohesion with regards to sustainable partnerships. For example, students who attend COEs may graduate without any practical experience which diminishes their understanding of real-life technological applications. The level of applied hands-on experience needed to create a competent workforce will continue to suffer.

For instance, Adewusi and Jegede (2022) contend that successful education-industry cooperation to take place, it is important to understand that these relationships are successful when all parties agree to work towards shared goals, sharing their resources, time and expertise together for a successful outcome. Adewusi and Jegede's research suggests that where goals differ, end-users' academic institutions are focused on educational development, while companies are concerned with profit maximization, relationships are characterized as strained. In Nigeria, the challenges and paradox of limited funding and funding priorities combined with meaningful engagement with the private sector elucidate the challenges of establishing coherent educational initiatives, and second, the challenges of establishing productive partnerships in education support. In many instances, companies may agree to contribute spaces, equipment, training, or internships, but

educational institutions cannot, or do not, turn these discussions into sustained action. Bureaucratic blocks, fragmented opportunity without a focused initiative model, and mistrust between institutions prevent success-- or at minimum sustainable engagement for both parties.

Furthermore, industry-relevant curricula in technology sectors are still largely under-developed in COEs in North Central Nigeria. Brenk (2020) found that COEs had trouble revising course content without meaningful industry engagement from the private sector. Many COEs continue to rely on obsolete teaching reference content and outdated syllabi. They still do not incorporate current technological advances that underline the skills that need training today. In the technological sectors of digital design, information and communications technology (ICT), and renewable energy technologies, for example, COEs typically provide training on subjects that may be several years behind industry. The skills students train for COEs do not match with the expectations of employers. Subsequently, this affects the employability of graduates, but more importantly, limits the region's ability to compete in the larger economy. This is a cyclical problem. These graduates enter the job market poorly prepared for work, employers struggle to find trained workers for jobs in the technology sector, and industries lose trust in the academic institutions responsible for training young workers thus diminishing the possibility for collaborative relationships.

Enhancing partnerships across COEs and business organizations in North Central Nigeria via collaboration means tackling these challenges with clear frameworks that detail shared responsibilities and encourage communications and complementary goals. The creation of advisory boards with academic representatives and business representatives would help bridge communication gaps and facilitate a curriculum that is contextual to industry needs. Further, these frameworks would make it easier to establish joint programs, internships, funding arrangements and shared resources that would ultimately enhance technology education for students and provide them with valuable employability skills. Furthermore, companies working in training program development and delivery expose students to real life case studies, practical assignments, and new technology.

These collaborative ventures not only benefit individual institutions and organizations but also assist in the regional and national development of a workforce that is prepared for the technology-based sector (Ebekeozien *et al.*, 2023). A collaboration provides additional benefits. Students received skills regarded by employers as employable skills, employers received qualified workers, and the economy received a boost from employment, wages, innovation, entrepreneurship, and productivity. Partnerships also foster research collaborations, help address local issues with research, such as renewable energy resources for rural

communities, or a low budget and free digital learning tools for schools with low-resourced capabilities. Not only do partnerships develop capability, but they also provide solutions to socio-economic issues where either academia or corporations may not be able to provide.

Based on the previous discussions, it is abundantly clear that it is very important that partnerships between the private sector and COEs that deliver technology training in Nigeria to provide students with practical skills that are industry relevant, thereby making a contribution to national development. There is a role for private services in curriculum development, mentorship and practical training opportunities when engaging COEs. These activities support organisations working towards being responsive to the technology learning needs of their human resources partners by bridging the gap between theory and practice. This type of collaboration enables students to develop and hone the skills that are required for organisations in the current employment arena. Which enables innovation and improvement in employability skills. It also helps the private sector to contribute to the curriculum and make sure that the educational environment is responsive to the evolving technological trends that are influencing the current economic landscape. Ultimately, creating strong COE-private sector partnerships in North Central Nigeria requires intentional support from policymakers, transparency in institutional practices, and commitment to the common vision from both sides. If all of this happens, it is a win-win situation, with COEs becoming active communities of innovation and practice, and the private sector receiving a stable supply of skilled graduates who can ramp up industrial and technological advancement. If maintained, this type of vision could not only reposition Nigeria as a competitive actor in the global digital economy but also respond to local industry skill needs in a way that is impactful and sustainable.

1.1 Statement of the Problem

There is mounting evidence that graduates of Colleges of Education (COEs) in Nigeria often lack the appropriate skill set required for human capital development and generalized socio-economic development. In some sectors, federally funded research has demonstrated some levels of success in terms of better collaboration between COEs and private sector firms in the southwest and southeast (Abodunde & Jegede, 2020; Adewusi & Jegede, 2022). However, these developments are not as numerous and widespread as they should be due to the ad hoc nature of some of these efforts, as there is limited research that can demonstrate a ground-up, feasible collaborative framework that will make the collaboration relevant, effective, and sustainable. One of the main reasons for this shortfall is the misalignment between the training that COE

graduates receive and the employers' expectations (Benson, 2019). It should be noted that the lack of relevant, labour-market oriented curriculum and learning experiences in technology education will only widen the gap, and students' employability (Brenk, 2020) will be reduced. Additionally, the lack of reliable/consistent influx of trained professionals stifles innovation and productivity futures for the industries and lowers the national economy because the education system cannot be relied upon to contribute to national development (Ebekozien *et al.*, 2023).

It is especially critical in North Central Nigeria where COEs are integral to teacher preparation for technology education but there are still considerable limitations to industry links. Therefore, the justification for this study is to develop a practical framework which will broach collaboration between the private sector and COEs engaged in educating in technology, in North Central Nigeria. This framework is crucial in ensuring graduates' skills are directed towards aligned educational outcomes with labor market demands, emphasising employability, innovation, and sustainable economic development.

1.2 Purpose of the Study

The purpose of this study was to develop a framework for private sector and COEs collaboration for the development of technology education. Specifically, the study sought to:

1. Identify the modes of private sector collaboration in providing physical facilities that support COEs offering technology education in north central Nigeria.
2. Identify and analyze the constraints to effective collaboration between the private sector and COEs offering technology education in north central Nigeria.
3. Identify and analyze key areas of private sector collaboration that can enhance the quality and relevance of technology education in COEs offering technology education in the north central Nigeria.
4. Determine the criteria for monitoring and evaluating the standard and processes of collaboration between private sector and COEs offering technology education in North central Nigeria

1.3 Research Questions

The following research questions were formulated and guided the study

1. What are the modes of private sector collaboration in providing physical facilities that

support COEs offering technology education in North Central Nigeria?

2. What are the constraints to effective collaboration between the private sector and COEs offering technology education in North Central Nigeria?
3. What key areas of private sector collaboration can enhance the quality and relevance of technology education in COEs offering technology education in North Central Nigeria?
4. What criteria can be used for monitoring and evaluating the standards and processes of collaboration between the private sector and COEs offering technology education in North Central Nigeria?

2. Literature Review

Gachie (2020) examined collaboration among higher education institutions, the private sector, and government in South Africa within the framework of the Triple Helix Model. The study, which adopted a mixed-method design involving questionnaires and interviews, revealed that while the model offers great potential for fostering innovation and knowledge transfer, the existing linkages among the actors were largely weak, reactive, and fragmented. Collaboration was often pursued only to comply with government regulations rather than to achieve meaningful strategic partnerships. The findings further highlighted challenges such as lack of trust among actors, inadequate funding, absence of strong government leadership, and limited commercialization of research outcomes. Despite these barriers, the study demonstrated that effective collaboration yields significant benefits, including access to funding, enhanced opportunities for student internships and employment, improved curriculum relevance, and the establishment of innovation hubs that bridge academic knowledge with industry practice. The relevance of this study to the Nigerian context, particularly to technology education in Colleges of Education, lies in its emphasis on structured and sustainable collaboration frameworks. Just as South African higher education institutions struggle with weak industry and government linkages, Nigerian Colleges of Education also face similar challenges that hinder the production of graduates with relevant psycho-productive and technical skills. The proposed Triple Helix-based framework in Gachie's study underscores the importance of government assuming a proactive leadership role, the private sector contributing resources and practical exposure, and educational institutions aligning their programmes with industry needs. These insights provide empirical support for the development of a collaborative framework between the private sector and Colleges of Education in North-Central Nigeria, thereby strengthening technology education and enhancing its relevance to national development priorities.

Omar and Kamaruzaman (2024) studied technical and vocational education training and industry collaboration: a bibliometric review. The study is relevance to this present study because it offered proof of the patterns, advantages, and difficulties of private-sector involvement in technical education, systematic and bibliometric analyses of TVET–industry collaboration are relevant to your research. They demonstrate how collaborations improve employability, skill acquisition, and curriculum relevance, all of which are in line with your objective of creating a cooperative framework for technology education. However, the majority of these studies pay little attention to colleges of education and instead concentrate on universities or TVET institutions in general. Additionally, they hardly ever suggest frameworks tailored to low-resource environments like Nigeria. This gap gives your research the opportunity to develop a customized, workable model for cooperation between colleges of education and the private sector.

Tucker *et al.* (2024) conducted a study on bridging academia and enterprise: a framework for collaborative success. University-enterprise collaboration (UEC) is an essential aspect of research and innovation involving cooperation between universities and industry or other organizations. UEC can lead to economic growth, job creation, and enhanced research outcomes. However, the complexity and diversity of UECs present challenges in developing a practical framework that can guide the development and implementation of such collaborations. The aim of this paper is to develop a UEC framework from the key concepts identified in the literature, which can be adapted to various disciplines/contexts. The study is part of an ERASMUS+ project, which aims to strengthen enterprise collaboration for resilient communities in Asia (SECRA). The study presents the findings of thematic analysis of existing UEC literature and the resultant conceptual framework. Thematic analysis of eligible literature ($N = 84$) unveiled four themes and thirty-two sub-themes important to UEC. The proposed UEC framework highlights the importance of several structural, cultural, relational, and material themes and their underpinning concepts for developing successful UECs. The findings can inform future research on UECs, guide UEC practice, and provide the foundations for developing successful UECs. However, further research is needed to test the feasibility and validity of the framework in real-world UEC collaborations and to explore the interactions between different themes, sub-themes, and underlying concepts.

Awasthy *et al.* (2020) propose a framework to improve the effectiveness of university– industry collaboration (UIC). This work enhances the existing body of literature and knowledge regarding collaboration and offers concrete steps to be taken for effective collaboration between universities and industries. A literature review to study the best practices, impediments to collaboration and the

various models proposed in the past for successful UIC was conducted. A workshop and focus-group meetings of practitioners and academic researchers was designed and organised to explore the current state of the university–industry engagement within the Australian Capital Territory (ACT) region and gather inputs regarding possible approaches to improve collaboration. The findings from the literature review and the results from this qualitative research regarding the approaches to improving the effectiveness of the collaboration were analysed. The study discovers that various measures have been proposed in the form of best practices or models to improve the effectiveness of UIC. However, these measures often address specific concerns such as technology transfer, intellectual property (IP), etc. There is a scope for a comprehensive holistic framework to address many aspects of UIC in order to improve effectiveness and achieve success. A framework for improving the effectiveness of collaboration considering a comprehensive list of factors operating in a broad context within the collaboration system was proposed. The framework builds on previous literature dealing with measures for successful UIC. However, it is the first of its kind, in the researcher's knowledge, in terms of comprehensiveness of the factors contributing to establishing and sustaining successful collaboration. The value of the individual experience of the participants in this qualitative research, which is on average more than 10 years in the software engineering field, validates the importance and quality of the data collected. The addition of these results to the framework increases its validity. The framework can be utilised by universities and industry practitioners to foster successful and effective collaboration. The results have significant relevance, particularly within the Australian context as the government has intensified the adoption of measures to encourage and improve collaboration between universities and the industry.

1.1 Theoretical Framework

The Human Capital Theory, postulated by Schultz (1961) and Becker (1993), stresses that education and training are investments, which ultimately add value to an individual and, by extension, the economy. For this study, the theory epitomizes the essence of COEs as (re)training institutions for future teachers to gain and develop the belief of obtaining necessary vocational and other technical skills for the good of national development. Synergies with the private sector ensure that COE training is aligned to the needs of labour markets which not only improves employability but productivity as graduates enter the workforce in Nigeria. In North Central Nigeria, gaps in skills development are evident, even as the Human Capital theory justifies arguments for private investment in COEs,

pertaining to curriculum, facilities, and internships aimed at delivering a competent and innovative workforce.

Stakeholder theory was originally presented by Freeman (1984), who believed all organizations are better, and can create social and economic value, when they consider and balance the interests of all the stakeholders, not just their shareholders and profits. In this way, stakeholder theory recognizes that the relevant stakeholders for this research are COEs, students, private companies, government bodies, and society as a whole; these actors all have a stake in the quality of technology education. The Stakeholder Theory lens allows for this study to understand the different approaches to collaboratively negotiate knowledge and information with the purpose of benefitting all stakeholders by way of COEs and stakeholders contributing resources, skills and industry perspectives', obtaining social and economic value from skilled graduates', students obtaining real-life applied learning, government and communities obtaining value from an innovative economy. Using Stakeholder Theory, one can establish an accountable framework for shared responsibility and sustainably create better outcomes for private sector- COE collaborations into the future.

3. Methodology

The study adopted a survey research design, which typically employs interviews and questionnaires to determine the opinions, preferences, attitudes, and perceptions of people about issues. The study therefore employed the survey research design as it sought the opinions and ideas of private sector employers as well as students, lecturers, instructors, and administrators of COEs in enhancing the quality of technology education in North Central Nigeria. The research involved six Colleges of Education offering technology education and twelve private sector organizations within the Technical and Industrial Trades with a total population of 238, out of which 118 respondents were drawn from various roles within these institutions. The respondents included college administrators, heads of departments, lecturers and technical trainers, industrial liaison officers, career guidance counselors, students, and alumni. This diverse representation aimed to capture a wide range of perspectives on the current state of collaboration, existing challenges, and opportunities for effective partnership with the private sector. The remaining 120 respondents were drawn from private sector organizations within the Technical and Industrial Trades. This diverse group included senior executives, human resources managers, technical and vocational training managers, project and operations managers, health and safety officers, corporate social responsibility officers, and technical employees or specialists. By engaging a variety of roles across these organizations, the study gathered comprehensive insights

into the current state of collaboration, skill requirements, and the potential for developing effective partnerships with COEs.

The instrument for the study was a structured questionnaire and interview. The questionnaire consisted of Sections A, B, C, D, and E. The first section contained the biodata of the respondents, while the second, third, fourth, and fifth sections contained items on modes of private sector collaboration, constraints to effective collaboration, key areas of collaboration, and criteria for monitoring and evaluating the standards and processes of collaboration in enhancing technology education, respectively. The instrument was built on a 5-point Likert scale of Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree, which were assigned numerical values of 5, 4, 3, 2, and 1, respectively. The draft instrument was subjected to both face and content validation by three experts from the Department of Industrial Technology Education, Federal University of Technology, Minna, Niger State, Nigeria. The instrument was trial tested on 20 private sector employers in technical and industrial trades as well as students, lecturers, and administrators in COEs offering technology education in Kaduna State. The data from the trial testing were analyzed using Cronbach's Alpha to determine the internal consistency of the instrument. A reliability coefficient of 0.70 and above was considered acceptable for the study. Data collection was carried out with the assistance of three trained research assistants. The research assistants were carefully briefed on the objectives of the study, ethical considerations, and procedures for administering the questionnaires. The use of research assistants ensured wider coverage, reduced researcher bias, and enhanced the efficiency of data collection. Questionnaires were administered physically to

respondents and retrieved immediately after completion. Data collected were analysed using mean and standard deviation. For interpreting the 5-point Likert scale responses, a mean score decision rule was adopted. Since the scale ranged from 1 (Strongly Disagree) to 5 (Strongly Agree), the midpoint was set at 3.5 to ensure stricter agreement criteria. Thus, mean values of 3.5 and above were interpreted as "Agreed," indicating a positive perception, while mean values below 3.5 were interpreted as "Disagreed," indicating a negative perception. This higher cut-off point was chosen to minimize neutrality bias and to ensure that only strong levels of agreement were categorized as positive responses. In order to uphold ethical standards, the study ensured that all participants were fully informed about the purpose, procedures, and intended use of the research. Respondents participated voluntarily and were assured of their right to withdraw from study at any stage without penalty. Confidentiality and anonymity were strictly maintained by ensuring that no personal identifiers appeared in the questionnaire or subsequent reports. Informed consent was obtained from all respondents prior to their participation. Furthermore, the research assistants were trained to observe neutrality, respect participants' views, and avoid undue influence. These measures were adopted in line with ethical guidelines for research involving human subjects.

4. Results and Discussion

4.1 Research Question One

What are the modes of private sector collaboration in providing physical facilities that support COEs offering technology education in North Central Nigeria?

Table 1: Mean and Standard Deviation of Respondents on Modes of Private Sector Collaboration (N = 238)

S/N	Item	Mean	SD	Decision
1	Private sector organizations construct and donate building infrastructure (classrooms, workshops, laboratories) to COEs.	4.02	0.78	Agreed
2	Firms donate modern workshop equipment and tools to support practical training in COEs.	4.21	0.74	Agreed
3	Private sector partners assist in the renovation and maintenance of existing COE facilities.	3.85	0.80	Agreed
4	Companies establish industry-sponsored laboratories or innovation hubs in COEs.	3.49	0.88	Disagreed
5	Private sector contributes ICT infrastructure (computers, projectors, internet) to COEs.	3.92	0.76	Agreed
6	Firms provide financial support for the construction of staff offices and student hostels.	3.31	0.91	Disagreed
7	Public-Private Partnership (PPP) projects are initiated to develop physical facilities in COEs.	3.79	0.83	Agreed
8	Companies support provision of energy and utility facilities (electricity, water supply, safety devices).	3.67	0.85	Agreed
9	Alumni in industries mobilize resources to provide or improve facilities in COEs.	3.42	0.89	Disagreed

10	Firms participate in joint facility management and sustainability projects with COEs.	3.29	0.93	Disagreed
	Grand mean	3.70		Agreed

The findings in Table 1 showed a diverse level of collaboration of the private sector in providing physical facilities which support Colleges of Education (COEs) offering technology education in North Central Nigeria. The collaboration areas that revealed the strongest level of collaboration related to provision of modern workshop equipment (Mean = 4.21), and construction and donation of building facilities including, classrooms and workshops (Mean = 4.02). This indicates that the private sector is substantively involved in equipping COEs with important resources and spaces for training. In the same vein, respondents agreed that they also contribute ICT facilities (Mean = 3.92) and help maintain and renovate existing physical facilities (Mean = 3.85) while also engaging in Public-Private Partnership (PPP) projects (Mean = 3.79) and supporting the provision of energy and utility facilities (Mean = 3.67). These areas suggest that private sector collaboration helps to address key infrastructural needs that enhance the quality and relevance of technology education. On the other hand, lower ratings were recorded in the areas

of establishing industry-sponsored laboratories or innovation hubs (Mean = 3.49), providing financial support for staff offices and student hostels (Mean = 3.31), alumni mobilization of resources (Mean = 3.42), and participation in joint facility management and sustainability projects (Mean = 3.29). These items, which fall below the decision mean of 3.50, indicate weak or minimal collaboration in those areas. The computed grand mean of 3.70 shows that, on average, respondents agreed that private sector collaboration exists in providing physical facilities to COEs, though it is stronger in some areas and weaker in others.

4.2 Research Question Two

What are the constraints to effective collaboration between the private sector and COEs offering technology education in North Central Nigeria?

Table 2: Mean and Standard Deviation of Respondents on Constraints to Effective Collaboration Between the Private Sector and COEs (N = 238)

S/N	Item	Mean	SD	Decision
1	Bureaucratic bottlenecks and delays in approval of partnership agreements	4.18	0.73	Agreed
2	Lack of clear government policy framework to guide private sector collaboration	4.07	0.76	Agreed
3	Inadequate funding and financial commitment from COEs	3.88	0.81	Agreed
4	Weak communication and coordination between COEs and private sector organizations	3.76	0.85	Agreed
5	Lack of trust and transparency in partnership dealings	3.62	0.89	Agreed
6	Limited awareness of potential benefits of collaboration among stakeholders	3.44	0.92	Disagreed
7	Political interference in project selection and implementation	3.81	0.84	Agreed
8	Insufficient incentives for private sector participation (e.g., tax relief, recognition)	3.53	0.87	Agreed
9	Absence of effective monitoring and evaluation mechanisms	3.36	0.94	Disagreed
10	Differences in institutional priorities between COEs and private sector	3.49	0.90	Disagreed
	Grand Mean	3.71		Agreed

The results in Table 2 reveal that the most critical constraints to effective collaboration between the private sector and COEs are bureaucratic bottlenecks (Mean = 4.18), absence of clear policy frameworks (Mean = 4.07), and inadequate financial commitment from COEs (Mean = 3.88). These constraints suggest that policy and administrative inefficiencies remain major barriers to smooth collaboration. Other challenges agreed upon by

respondents include weak communication and coordination (Mean = 3.76), political interference (Mean = 3.81), lack of trust and transparency (Mean = 3.62), and insufficient incentives for private sector participation (Mean = 3.53). These reflect systemic, institutional, and relational gaps that hinder effective partnerships. However, some items fell below the cutoff mean of 3.50, such as limited awareness of benefits of collaboration (Mean =

3.44), absence of monitoring and evaluation mechanisms (Mean = 3.36), and differences in institutional priorities (Mean = 3.49). This indicates that while these issues exist, they are not perceived as major constraints compared to bureaucratic, financial, and policy challenges. The grand mean of 3.71 shows that respondents generally agreed that significant constraints exist, though their intensity varies across factors.

4.3 Research Question Three

What key areas of private sector collaboration can enhance the quality and relevance of technology education in COEs offering technology education in North Central Nigeria?

Table 3: Mean and Standard Deviation on the Key Areas of Private Sector Collaboration to Enhance the Quality and Relevance of Technology Education (N = 238)

S/N	Item	Mean	SD	Decision
1	Curriculum review and alignment with current industry needs	4.26	0.71	Agreed
2	Internship and industrial attachment opportunities for students	4.34	0.69	Agreed
3	Joint research and development projects between COEs and industries	3.92	0.77	Agreed
4	Training workshops and seminars facilitated by industry experts	4.11	0.74	Agreed
5	Establishment of skill acquisition and entrepreneurship centers within COEs	3.88	0.81	Agreed
6	Exchange programmes for COE lecturers to gain industry exposure	3.79	0.83	Agreed
7	Private sector support for research funding and innovative projects	3.67	0.86	Agreed
8	Creation of joint certification programmes recognized by industry and academia	3.43	0.89	Disagreed
9	Development of technology incubation hubs and start-up support initiatives in COEs	3.59	0.87	Agreed
10	Continuous professional development (CPD) programmes for lecturers in collaboration with industry	4.05	0.76	Agreed
	Grand Mean	3.90		Agreed

The result in Table 3 shows that most respondents agreed that key areas of private sector collaboration could significantly enhance the quality and relevance of technology education in Colleges of Education in North Central Nigeria. Items such as curriculum review and alignment with current industry needs (Mean = 4.26), internship and industrial attachment opportunities for students (Mean = 4.34), training workshops and seminars facilitated by industry experts (Mean = 4.11), and continuous professional development programmes for lecturers (Mean = 4.05) were strongly supported. These findings suggest that collaboration with industry is vital for bridging the gap between theory and practice. Similarly, initiatives such as skill acquisition and entrepreneurship centres (Mean = 3.88), exchange programmes for lecturers (Mean = 3.79), and private sector support for research funding (Mean = 3.67) were also considered important by the respondents. However, respondents disagreed on the creation of joint certification programmes recognized by industry and academia (Mean = 3.43), indicating some reservations about its feasibility or acceptance. With an

overall grand mean of 3.90, the analysis indicates that private sector involvement across these areas is generally perceived as highly beneficial. The study concludes that private sector collaboration is essential in improving the quality and relevance of technology education in Colleges of Education in North Central Nigeria. Areas such as curriculum review, student internships, industry-driven training, and lecturer professional development stand out as the most impactful. Strengthening these collaborations would not only ensure that COE graduates are equipped with industry-relevant skills but also foster innovation and sustainable partnerships between academia and industry.

4.4 Research Question Four

What criteria can be used for monitoring and evaluating the standards and processes of collaboration between the private sector and COEs offering technology education in North Central Nigeria?

Table 4: Mean and Standard Deviation of Respondents on the Criteria for Monitoring and Evaluating the Standards and Processes of Collaboration between the Private Sector and COEs (N = 238)

S/N	Item	Mean	SD	Decision
1	Regular assessment of facility usage and maintenance standards in COEs supported by private sector.	3.68	0.84	Agreed
2	Establishment of Key Performance Indicators (KPIs) for private sector contributions to COEs.	3.87	0.79	Agreed
3	Periodic joint evaluation meetings between COEs management and private sector stakeholders.	3.59	0.82	Agreed
4	Independent auditing of financial and material contributions by the private sector.	3.42	0.88	Agreed
5	Feedback mechanisms involving students and lecturers on the effectiveness of facilities provided.	3.73	0.81	Agreed
6	Benchmarking collaboration outcomes against national and international best practices.	3.64	0.77	Agreed
7	Use of tracer studies to assess the impact of collaboration on graduate employability.	3.79	0.74	Agreed
8	Annual publication of collaboration performance reports by COEs.	3.46	0.85	Agreed
9	Establishment of monitoring committees with representatives from COEs and industry.	3.71	0.80	Agreed
10	Continuous review and improvement of collaboration agreements to reflect emerging needs.	3.92	0.73	Agreed
	Grand Mean	3.68		Agreed

The findings in Table 4 reveal that respondents generally agreed on the criteria for monitoring and evaluating private sector–COE collaboration in North Central Nigeria. The highest-rated criteria were continuous review of collaboration agreements (Mean = 3.92), establishment of KPIs (Mean = 3.87), and tracer studies on graduate employability (Mean = 3.79). These suggest that performance tracking and adaptability are seen as crucial to effective collaboration. Meanwhile, relatively lower agreement was observed on independent auditing (Mean = 3.42) and annual publication of reports (Mean = 3.46), though these were still rated positively. The grand mean of 3.68 indicates overall consensus that adopting diverse evaluation criteria would help ensure transparency, accountability, and relevance in sustaining private sector collaboration with COEs.

4.5 Findings of the study

1. Private sector contributes significantly to the development of physical facilities that support technology education in Colleges of Education within North Central Nigeria
2. Effective collaboration between the private sector and COEs in North Central Nigeria is hindered mainly by bureaucratic bottlenecks, absence of clear government policy, inadequate funding from

COEs, political interference, and lack of trust in partnership dealings

3. Private sector collaboration is essential in improving the quality and relevance of technology education in Colleges of Education in North Central Nigeria
4. Effective monitoring and evaluation of private sector collaboration with Colleges of Education offering technology education in North Central Nigeria requires the adoption of clear, measurable, and participatory criteria

4.6 Discussion of Findings

The findings of this study revealed that the private sector contributes significantly to the development of physical facilities that support technology education in Colleges of Education (COEs) in North Central Nigeria. Contributions such as provision of workshops, ICT facilities, and renovation of existing structures reflect an increasing recognition of the role of industry in strengthening educational delivery. This aligns with Awasthy *et al.* (2020), who emphasized that industry participation provides not only infrastructure but also practical exposure that bridges theoretical knowledge with workplace realities. Their comprehensive framework for collaboration suggests that effective partnerships must integrate both tangible contributions such as physical facilities and

intangible resources such as technical expertise and innovation practices. Thus, the Nigerian experience demonstrates that infrastructure contributions by the private sector are vital, but they must be accompanied by structured systems that ensure sustainability and relevance to industry needs. The finding is also in consonant with the study of Omar and Kamaruzaman (2024) who in their study offered proof of the patterns, advantages, and difficulties of private-sector involvement in technical education, systematic and bibliometric analyses of TVET–industry collaboration are relevant to your research. They demonstrate how collaborations improve employability, skill acquisition, and curriculum relevance, all of which are in line with your objective of creating a cooperative framework for technology education.

Despite the acknowledged contributions, the study established that effective collaboration between the private sector and COEs in North Central Nigeria is hindered mainly by bureaucratic bottlenecks, absence of clear government policy, inadequate funding, political interference, and lack of trust among partners. These challenges resonate with the findings of Gachie (2020), who reported similar weaknesses in South Africa where collaborations were reactive, fragmented, and often pursued only to satisfy regulatory requirements. The lack of trust and insufficient government leadership observed in both contexts underscores the critical role of governance in fostering an enabling environment for partnerships. For Nigeria, this suggests that unless bureaucratic and policy barriers are addressed, industry–education partnerships will remain limited in scope and fail to achieve long-term strategic objectives. The findings are also in line with the study of Tucker *et al.* (2024) who conducted a study on bridging academia and enterprise: a framework for collaborative success. University-enterprise collaboration (UEC) is an essential aspect of research and innovation involving cooperation between universities and industry or other organizations. UEC can lead to economic growth, job creation, and enhanced research outcomes. However, the complexity and diversity of UECs present challenges in developing a practical framework that can guide the development and implementation of such collaborations.

Furthermore, the study found that private sector collaboration is essential in improving the quality and relevance of technology education in COEs in North Central Nigeria. The provision of modern tools, curriculum input, and opportunities for innovation reflect the centrality of industry involvement in preparing graduates for employability and national development. This finding supports Awasthy *et al.* (2020), who argued that collaboration enhances curriculum relevance, student internships, and employability outcomes. Similarly, Gachie (2020) observed that successful collaborations

yielded innovation hubs and improved student employment prospects. For Nigerian COEs, this underscores the need to institutionalize structured frameworks of collaboration that ensure that technology education produces graduates with psycho-productive skills that align with market demands.

Finally, the study revealed that effective monitoring and evaluation of private sector collaboration with COEs requires the adoption of clear, measurable, and participatory criteria. This finding is consistent with the recommendations of Awasthy *et al.* (2020), who proposed a holistic framework that accounts for multiple dimensions of collaboration, including performance indicators, sustainability, and accountability. By adopting such criteria, Nigerian COEs and private sector partners can move beyond ad-hoc arrangements towards systematic partnerships that deliver measurable results. Additionally, Gachie (2020) highlighted that weak monitoring mechanisms in South Africa limited the benefits of collaboration. The Nigerian case therefore emphasizes the importance of continuous performance tracking, transparency, and accountability to build trust among stakeholders and to ensure that collaborations remain impactful over time.

5. Conclusion and Recommendations

5.1 Conclusion

Based on the findings the study has identified the role of collaboration between the private sector and Colleges of Education (COEs) in North Central Nigeria; while private collaboration can provide infrastructure, up-to-date equipment, and an exposure to industry that improves teaching and learning, there are still many problems that threaten the sustainability of that collaboration, such as bureaucratic bottlenecks, funding cuts, political interferences, and lack of trust and direction in policy. The fact that these challenges exist will harm the ability of Colleges of Education to produce graduates with the relevant technical and psycho-productive skills demanded by industry. There needs to be a proactive approach to ensure there are specifics of collaboration that include sharing resources, joint use of facilities, hub innovation practices, and making industry practices a part of academic programmes. The Monitoring and Evaluation (M&E) process also needs to be structured with clarity of measurable criteria allowing for transparency, accountability, and sustainability of partnerships. In taking this approach, private sector collaboration and contributions can advance from being fragmented and reactive into a strategic partner for enhancing the quality and relevance of technology education, while also supporting a national agenda of human capital growth and development of industry.

5.2 Recommendations

Based on the findings, the following recommendations were made:

1. Colleges of Education should deepen partnerships with the private sector to enhance the development and maintenance of physical and training facilities. This will ensure that students have access to modern workshops, laboratories, and ICT resources necessary for practical, hands-on learning.
2. Government and institutional leaders should reduce bureaucratic bottlenecks, establish clear policies, provide adequate funding, and minimize political interference in partnership dealings. In addition, Colleges of Education should adopt transparent processes to build trust with private sector partners.
3. Curriculum planners in Colleges of Education should involve private sector experts in curriculum design and review to ensure that training programmes align with industry needs. This will make technology education more responsive to labour market demands and improve graduate employability.
4. Collaboration between Colleges of Education and the private sector should be guided by a monitoring and evaluation system that uses clear, measurable, and participatory indicators. Such a framework will help track progress, strengthen accountability, and promote continuous improvement in partnership outcomes.

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