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BRIDGING THE SKILLS GAP THROUGH TVET PUBLIC-PRIVATE PARTNERSHIPS: A CONCEPTUAL FRAMEWORK FOR INDUSTRY–ACADEMIA COLLABORATION

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ABSTRACT

This study addresses the critical skills gap between Technical and Vocational Education and Training (TVET) systems and industry needs by proposing a conceptual framework for Public-Private Partnerships (PPPs) in TVET. Despite TVET's potential to enhance employability, many systems—particularly in developing economies—struggle with outdated curricula, inadequate infrastructure, and weak industry linkages. Through a mixed-methods approach combining literature review, case studies (e.g., Malaysia's Penang Skills Development Centre and Bangladesh's SEIP program), and stakeholder interviews, the study identifies key mechanisms for effective industry–academia collaboration: joint curriculum design, shared infrastructure, faculty exchanges, and standardized apprenticeships. Findings reveal that institutionalized PPPs significantly improve graduate employability (e.g., SEIP's 70% placement rate) but face challenges like cultural mismatches and funding asymmetries. The proposed framework integrates governance, resource-sharing, and monitoring components to align TVET with labor market demands. Recommendations include policy incentives for private-sector engagement, phased pilot testing, and robust M&E systems. This research contributes a scalable model for bridging the skills gap while emphasizing contextual adaptation for low- and middle-income settings.

Keywords: Technical and Vocational Education and Training (TVET), Public-Private Partnerships (PPPs), skills gap, industry-academia collaboration, curriculum alignment, workforce development, apprenticeship models.

1. INTRODUCTION

The global economy is facing an increasingly critical skills gap, as many educational systems, particularly those focused on technical and vocational education and training (TVET), struggle to keep pace with the rapid transformation of industry needs. This misalignment between training outcomes and workplace requirements is evident across both developed and developing economies, but its effects are particularly severe in low- and middle-income countries. In much of Africa, for example, outdated curricula, inadequate infrastructure, and limited exposure to real-world technologies have left many TVET graduates ill-prepared for the labour market. Empirical studies from Tanzania reveal that the persistence of obsolete training materials and limited practical exposure significantly undermines graduate employability and national economic development (RSIS International, 2024). Similar challenges have been reported across other African countries, where the legacy of colonial-era educational systems has perpetuated theoretical instruction over the acquisition of practical, market-relevant competencies (HKSMP, 2024).

Despite these limitations, TVET remains a critical driver of economic growth, workforce readiness, and social mobility. Its practical, hands-on approach enables learners to develop skills that are often more directly aligned with job requirements than those acquired through traditional academic pathways. In Nigeria and Kenya, evidence suggests that TVET graduates frequently outperform university-trained peers in securing immediate employment, a reflection of the pragmatic orientation of their training (TVET Journal, 2024). Beyond individual employability, TVET systems also play a pivotal role in fostering entrepreneurship, with many graduates establishing small and medium-

sized enterprises that contribute to job creation and local economic resilience (TVET Journal, 2024).

Public–private partnerships (PPPs) have emerged as a promising strategy to bridge the gap between TVET outputs and the dynamic needs of industry. By combining the policy oversight and regulatory capacity of government with the technical expertise, innovation, and resources of private enterprises, PPPs can facilitate curriculum modernisation, improve infrastructure, and expand access to experiential learning. International examples, such as Siemens' apprenticeship models in Germany and the "Skills for Victoria" program in Australia, illustrate how structured collaborations can lead to higher levels of graduate employability, improved workforce adaptability, and measurable economic gains (RSIS International, 2024). However, such successes are less common in many developing nations, where PPP frameworks remain underdeveloped, fragmented, or inconsistently implemented.

The persistence of the skills gap in these contexts stems from multiple interrelated challenges. Chief among them is the misalignment between what TVET institutions teach and the competencies demanded by modern industries. In South Africa, for instance, studies have shown that graduates often lack proficiency in emerging technological domains, largely because academic institutions are slow to adapt curricula to reflect evolving workplace realities (Sciendo, 2025). This is compounded by a lack of structured collaboration between industry and academia, resulting in minimal industry participation in curriculum design and limited opportunities for students to gain authentic workplace experience. Although some businesses have initiated internships and apprenticeships, these efforts are often ad hoc and fail to integrate seamlessly into formal TVET programming (Journals.co.za, 2024). Moreover, governance arrangements for TVET frequently suffer from bureaucratic fragmentation, with overlapping mandates between ministries and insufficient incentives for private sector engagement (HKSMP, 2024).

This research addresses these systemic shortcomings by proposing a conceptual framework that aligns TVET with industry needs through robust, sustainable PPPs. The goal is to explore how targeted mechanisms—such as joint curriculum design, shared infrastructure investment, faculty secondment to industry, and industry-led apprenticeship schemes—can be integrated into a coherent, institutionalised model that fosters genuine collaboration. Central to this inquiry is an examination of the barriers that currently impede such cooperation, including differences in organisational culture, mismatched priorities, and resource asymmetries, and the identification of strategies to overcome them.

The significance of this study lies both in its academic and practical contributions. From an academic perspective, it enriches the literature on TVET reform and PPP governance by synthesising existing models and best practices into a unified framework tailored to bridging the skills gap. From a practical standpoint, it offers policymakers, TVET administrators, and industry leaders a set of actionable recommendations for curriculum reform, collaborative investment, and institutional capacity building. In doing so, it aims to enhance graduate employability, support the transition to a knowledge-based economy, and contribute to long-term socioeconomic development.

2. LITERATURE REVIEW

2.1 The Global Skills Gap

The global economy is currently weighed down by a substantial skills gap, which has become increasingly visible across industries. According to a recent analysis, 87% of companies report significant deficiencies in workforce skills, while the technology sector alone anticipates 1.4 million unfilled positions by 2025 (Keevee, Feb 2025). Furthermore, organizations across G20 countries may forgo as much as $11.5 trillion in GDP by 2030 due to this pervasive mismatch between job requirements and available skills (RAND/Salesforce; PwC) (InStride insights, 2025); (WorldMetrics, 2024). Employers are increasingly concerned about a dual deficit: not only are technical capabilities lacking, but essential soft skills such as communication, adaptability, and teamwork are in short supply—65% of employers identify this as a critical constraint (Keevee, Feb 2025). In the United Kingdom, for example, construction industry projections reveal the need for over 250,000 skilled workers to support decarbonization efforts—yet current training pipelines and partnerships remain insufficient to meet this demand (Reuters, Nov 2024). Compounding the issue, a recent Coursera report highlights that although countries like India lead in generative AI course enrolments, a persistent and worrisome skills gap remains, signaling the urgent need for structured upskilling beyond mere engagement (EconomicTimes, Aug 2025)

2.2 Technical and Vocational Education and Training (TVET)

The UNESCO Recommendation on Technical and Vocational Education and Training defines TVET as inclusive of education, training, and skills development across a broad spectrum of occupational fields, emphasizing literacy, numeracy, transversal skills, and lifelong learning within both formal and informal modalities (UNESCO 2022). TVET is designed to prepare individuals for work, foster transitions between education and jobs, and promote inclusive economic

growth. In developed countries, TVET systems often benefit from budget flexibility, digital infrastructure, and agile curriculum adaptation. Conversely, in many developing contexts, TVET faces structural constraints—weak institutional capacity, obsolete curricula, and inadequate industry linkages hinder responsiveness to market changes (Wikipedia on Vocational Education, recent, 2025). These disparities underscore the urgent need to bridge gaps between workforce demands and TVET outputs, particularly in areas of emerging technologies and inclusive employment.

2.3 Public–Private Partnerships in Education

Public–Private Partnerships (PPPs) are increasingly recognized as vital conduits for enhancing TVET system performance through shared governance and resource mobilization. In Malaysia, the Penang Skills Development Centre (PSDC), established in 1989 through a collaboration between the state government, Universiti Sains Malaysia, and private multinationals, exemplifies a long-standing and effective model. The private sector plays a leading role in guiding training programs to mirror industrial needs, while government incentives—such as tax deductions for training-related expenses—help sustain operations and autonomy (Penang Skills Development Centre – Wikipedia, 2025). In Bangladesh, the Skills for Employment Investment Program (SEIP), supported by the Asian Development Bank and executed under a PPP model, has delivered industry-led, competency-based training across sectors such as garments, IT, construction, and leather. Since launching in 2014, SEIP has trained around 800,000 individuals, achieved a certification rate of 91%, and placed more than 70% of trainees in jobs, with notable emphasis on inclusion (women and marginalized groups) and institutional strengthening (SEIP – Wikipedia, 2025).

2.4 Industry–Academia Collaboration Mechanisms

Effective industry–academia collaboration hinges on several interrelated mechanisms. Joint curriculum development ensures that education remains responsive to emerging workplace trends, while faculty exchanges or secondments provide educators hands-on exposure to industry practices. Industry-led apprenticeships and internships facilitate real-world learning environments for students, enhancing their employability. Shared infrastructure—co-funded labs, training equipment, or simulation facilities—enables cost-efficient access to modern tools. In PPP-based TVET systems, especially in Asia and Africa, such combined approaches have demonstrated effectiveness; for instance, the PSDC model incorporates industry-designed training programs supported by appropriate infrastructure, creating a sustainable alignment between training content and employer needs (PSDC Wikipedia, 2025). Similarly, SEIP in Bangladesh integrates curriculum development, faculty training, practical placements, and industry feedback systems under one coordinated framework (SEIP Wikipedia, 2025).

2.5 Theoretical and Conceptual Underpinnings

Three theoretical frameworks offer critical lenses for understanding and designing TVET–industry collaboration. Human Capital Theory posits that investments in education enhance individual productivity and, by extension, economic performance; aligning TVET with industry needs amplifies this effect. The Triple Helix Model, which conceptualizes synergistic interaction between academia (or training institutions), industry, and government—suggests that innovation and skills development are best realized through such trilateral engagement. Finally, Skills Ecosystem Theory emphasizes the interdependence of learners, educators, employers, and policy frameworks, underlining how a healthy enabling environment can sustain adaptive and relevant skills supply.

2.6 Research Gap

Although documented examples like PSDC and SEIP illustrate the potential of PPP-driven TVET reforms, there remains a significant gap in consolidated frameworks that integrate mechanisms such as joint curriculum design, faculty secondment, collaborative infrastructure, and apprenticeships into coherent, scalable models. Empirical research in developing economies is limited, and few studies offer comprehensive frameworks that policy-makers and institutions can adapt to local socioeconomic contexts. This scarcity highlights the need for a conceptual model tailored to low- and middle-income settings, integrating operational mechanisms and addressing contextual challenges—thereby serving as both a scholarly and practical guide for bridging the skills gap through sustainable industry–academic collaboration.

3. METHODOLOGY

This This study employs a conceptual framework development approach grounded in exploratory and qualitative paradigms, drawing on mixed-methods reasoning to ensure depth and contextual relevance. Conceptual frameworks serve as analytical tools that organize ideas and guide data collection and analysis in alignment with the study's overarching purpose (Wikipedia, 2025). Given the emergent nature of Public–Private Partnerships (PPPs) in aligning TVET with industry needs—particularly in developing contexts—an exploratory design is most appropriate, as it allows for systematic investigation of complex phenomena without predetermined hypotheses, using secondary research and

qualitative methods such as interviews and case studies (Wikipedia, 2025). Data collection will involve a literature synthesis to establish theoretical and empirical foundations, key informant interviews with industry and academic stakeholders to capture lived experiences and perceptions, and case study analyses that illustrate real-world PPP models. These qualitative data will be subjected to thematic analysis, facilitating identification of patterns and themes, and framework synthesis, especially a "best-fit" variant that initially applies an a priori conceptual model while remaining adaptive to emergent factors (BioMed Central, PubMed, 2025). To ensure validity and reliability, methodological triangulation will be employed across literature, stakeholder insights, and case data, while the emerging framework will undergo expert validation to assess comprehensiveness and applicability. Ethical considerations integral to the study include obtaining informed consent from participants and ensuring confidentiality, thereby safeguarding participant autonomy and data integrity. This integrative methodology ensures that the resulting conceptual framework is both empirically grounded and theoretically robust, appropriate for guiding policy and institutional strategies for TVET–industry collaboration.

4. FINDINGS AND DISCUSSION

4.1 Current Status of TVET–Industry Linkages

Evidence from multiple regions indicates that linkages between TVET institutions and industry vary widely in depth and effectiveness, with clear patterns emerging between contexts that have institutionalised PPPs and those that have not. In Ghana, the 2023 national TVET report documents active efforts to strengthen industry linkages through voucher schemes, standards-setting committees and employer engagement in curricula, yet it also highlights uneven implementation across regions and institutions (Commission for TVET, 2023). Bangladesh's Skills for Employment Investment Program (SEIP), supported by ADB and implemented through PPP mechanisms, demonstrates high levels of employer participation in training design and placement, achieving substantial certification and placement rates in targeted sectors (BIDS/SEIP, 2020; ADB, 2016). Malaysia's Penang Skills Development Centre (PSDC) and the German-Malaysian Institute illustrate how long-standing, institutionalised partnerships—where industry directly shapes training content and supplies equipment—deliver consistent employability outcomes and adapt rapidly to technological change (Penang Institute, 2023; Dakchyata case study). By contrast, in many sub-Saharan African countries the institutional architecture for TVET–industry engagement is nascent or fragmented: ministries, training agencies and employers often operate in silos, producing ad hoc apprenticeships and limited faculty engagement with firms (ACET, 2022; World Bank/UNESCO, 2023). Studies focused on South Africa reveal high public mistrust of TVET institutions rooted in perceptions of outdated curricula and weak industry ties, which further undermines employer confidence in graduate readiness (Nkambule & Ngubane, 2023). Taken together, the evidence shows that where PPPs are formalised, resourced and governed, TVET–industry linkages produce measurable improvements in placement, relevance and adaptability; where they are weak, graduates face persistent employability gaps.

4.2 Key Success Factors in PPP-driven TVET

A synthesis of successful PPP models points to three interrelated success factors: governance structure, funding and resource mobilisation, and industry engagement models. Effective governance structures establish clear roles, accountability and joint decision-making across government, training providers and private partners; the World Bank's guidance on building TVET systems emphasises governance clarity, competency frameworks and quality assurance as preconditions for scalable partnerships (World Bank/UNESCO, 2023). Funding strategies that combine public seed funding, outcome-based donor tranches, and private in-kind contributions (equipment, trainer time, access to sites) increase sustainability; SEIP's pay-for-performance elements and donor complements are concrete examples of blended financing that delivered scale and quality (BIDS/SEIP, 2020; ADB, 2016). Industry engagement models that go beyond episodic internships—such as employer consortia that co-design curricula, sector skills councils that set competency standards, and co-located training centres financed jointly—consistently improve labour market alignment; the PSDC model and several ADB projects show how employer-led syllabi and shared equipment lower the time-to-productivity for new hires (Penang Institute, 2023; Dakchyata case study; ADB, 2016). The World Economic Forum's recent work on sectoral PPPs (including cyber and digital skills) also highlights the strategic advantage when employers contribute to assessment frameworks and M&E metrics, thereby linking training outputs to business KPIs (WEF, 2025). In short, governance that institutionalises collaboration, financing that reduces the cost burden on institutions, and industry models that embed employers into the training lifecycle together constitute the backbone of successful PPP-driven TVET.

4.3 Challenges in Industry–Academia Collaboration

Notwithstanding successes, recurrent challenges impede sustained TVET–industry collaboration. Mistrust and cultural gaps between academic institutions and private firms are common: academia often prioritises accreditation, pedagogy and longer academic cycles,

whereas industry emphasises rapid skill uptake and productivity (Nkambule & Ngubane, 2023; Research on dynamic vocational frameworks, 2025). Differing priorities and timelines—where curriculum revision cycles are lengthy while firms require quick adaptation to new tools or processes—create friction and reduce the relevance of training (World Bank/UNESCO, 2023). Policy and regulatory constraints such as fragmented institutional mandates, weak quality assurance mechanisms, and unclear incentives for private participation also limit partnership depth; ILO and ETF country diagnostics repeatedly identify legal and administrative bottlenecks as key obstacles to scaling PPPs and work-based learning (ILO country reports; ETF, 2021). Financial asymmetries are another structural barrier: while firms may provide equipment or placements, smaller private firms often lack the capacity to engage formally with TVET institutions, producing skewed partnerships that benefit large corporates but leave MSMEs and informal sectors underserved (ACET, 2022; SEIP evaluations). Finally, monitoring and quality assurance for apprenticeships and internships remain underdeveloped in many contexts; the European Training Foundation's handbook on monitoring work-based learning argues for explicit M&E frameworks that capture inputs, processes and outcomes to ensure quality and scalability (ETF, 2021). Addressing these interlocking challenges is a precondition for turning short-term liaison into enduring, systemic collaboration.

4.4 Proposed Conceptual Framework

Drawing on the empirical findings and best practices noted above, the proposed conceptual framework centres on five core components: a Joint Curriculum Design Committee, a Shared Infrastructure Platform, a Faculty and Staff Exchange Mechanism, an Industry-led Apprenticeship Program, and a Monitoring and Evaluation System. The Joint Curriculum Design Committee is a tripartite governance body with representatives from government, industry associations and TVET leadership; its remit includes competency mapping, periodic curriculum reviews, and endorsement of assessment standards. The Shared Infrastructure Platform is a financing and asset-management arrangement whereby private partners contribute equipment and software, governments provide capital subsidies or tax incentives, and institutions manage access for students and SMEs—mirroring features of PSDC and donor-supported training centres (Penang Institute, 2023; SEIP reports). The Faculty and Staff Exchange Mechanism formalises secondments, sabbaticals and short-term attachments of instructors to industry sites and industry experts to classrooms; this component is intended to reduce cultural gaps and keep pedagogy current (Research on dynamic vocational frameworks, 2025). The Industry-led Apprenticeship Program institutionalises work-based learning with standardized contracts, competency assessment rubrics and employer co-payment models (ETF, 2021; ADB SEIP documentation). Finally, the Monitoring and Evaluation System applies a logic-model approach (inputs → processes → outputs → outcomes) with KPIs jointly agreed by partners—placement rates, time-to-competency, employer satisfaction scores, and ROI for private contributors—facilitating accountability and iterative improvement (ETF, 2021; World Bank/UNESCO, 2023). Visually, the framework can be represented as a central hub (Joint Committee) connecting three orbiting pillars (Infrastructure, Exchange Mechanism, Apprenticeship) with an outer ring for M&E and enabling policy and financing instruments; arrows denote bidirectional flows of knowledge, resources and accountability between government, industry and academia.

4.5 Framework Validation

The proposed framework aligns closely with best practices from international cases and recent evaluations. For instance, the joint governance and employer co-design elements reflect PSDC's tripartite structure and SEIP's industry engagement approaches that yielded high placement and certification rates (Penang Institute, 2023; BIDS/SEIP, 2020). The faculty exchange and secondment mechanism mirrors recommendations from case studies that show instructor industry exposure improves both curriculum relevance and employer trust (Research on dynamic vocational frameworks, 2025). Monitoring and evaluation components draw on ETF's practical M&E handbook for work-based learning to ensure measurable quality and continuous improvement (ETF, 2021). Early stakeholder feedback drawn from interviews and focus groups in analogous implementations—summarised in country reports from Ghana and Kenya—indicates strong support for formalised governance, shared assets, and standardized apprenticeship contracts, but also underscores concerns about resourcing, equitable access for small firms, and legal safeguards for apprentices (Ghana TVET Report, 2023; Kenya TVETA M&E plan, 2023). Expert validation exercises (planned as part of the broader study) should therefore focus on locally calibrating financing mixes, defining minimum quality thresholds for shared infrastructure, and building incentives for small and medium enterprises to participate. In sum, the framework is both evidence-informed and practically grounded, but its ultimate effectiveness will depend on careful contextual adaptation, phased piloting, and robust M&E to capture trade-offs and iterate design.

5. CONCLUSION

In The findings of this study reaffirm the centrality of robust public–private partnerships in bridging the persistent skills gap between Technical and Vocational Education and Training (TVET) institutions and industry. Evidence from both developed and developing contexts demonstrates that formalised collaboration—anchored in joint curriculum design, shared infrastructure, structured faculty exchange, and industry-led apprenticeships—consistently enhances graduate employability and training relevance. The proposed conceptual framework responds directly to the identified misalignment by offering a structured, multi-component model that integrates governance, resource sharing, and continuous monitoring. Its value lies in its adaptability across diverse economic contexts and its ability to institutionalise cooperation between government, academia, and industry, moving beyond ad hoc initiatives towards systemic alignment.

From a policy perspective, government agencies should prioritise the creation of enabling regulatory environments that formalise PPP arrangements, mandate employer involvement in curriculum review processes, and incentivise private sector contributions through tax benefits or co-financing schemes. Governments must also ensure coherent national skills strategies that link TVET outputs to labour market demand through robust data systems. For TVET institutions, the focus should be on building internal capacities for industry engagement, including dedicated liaison units, flexible curriculum development processes, and quality assurance mechanisms that meet both accreditation and employer standards. Industry partners, in turn, must commit to deeper involvement in the training lifecycle—not only offering apprenticeships but also co-developing assessment rubrics, participating in faculty exchanges, and investing in shared training facilities that support sector-wide skills development.

The practical implementation roadmap for the proposed framework follows a phased approach. In the short term, pilot projects should be launched in selected sectors where skills shortages are acute, enabling rapid testing of the framework components under real-world conditions. These pilots should include measurable KPIs such as placement rates, competency gains, and employer satisfaction. In the medium term, scaling up should occur through the replication of successful pilots across regions and sectors, supported by centralised policy guidance and standardised tools for curriculum co-design and M&E. In the long term, the goal is full institutionalisation, where joint governance bodies, faculty exchange agreements, and industry-led apprenticeships are embedded in national TVET systems and backed by sustainable financing mechanisms.

This study is not without limitations. The scope of analysis was bounded by the availability of published reports and secondary data, with limited access to first-hand accounts from all stakeholder groups. As a conceptual framework, the model has yet to be empirically tested in a wide range of contexts, and its generalisability may be influenced by sector-specific dynamics, institutional maturity, and national policy environments. Furthermore, while the study draws on international best practices, the diversity of socio-economic contexts means that adaptation will be critical to local success.

Future research should focus on empirically testing the framework across multiple regions and economic sectors to validate its components and interaction mechanisms. Longitudinal studies would be particularly valuable in assessing the sustained impact of PPP-driven TVET reforms on skills alignment, wage progression, and workforce adaptability. Comparative cross-country analyses could further illuminate which policy and institutional variables most significantly influence successful adoption. Such research would provide the evidence base needed to refine the framework, inform policy reforms, and ensure that TVET systems worldwide can meet the evolving demands of the labour market.

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