

Public-Private Partnerships and Industry Collaboration for Advancing TVET: A Review of Politeknik Sultan Mizan Zainal Abidin

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Abstract

This paper investigates how public-private partnerships (PPPs) and industry collaboration can strengthen Technical and Vocational Education and Training (TVET) in Malaysia, using Politeknik Sultan Mizan Zainal Abidin (PSMZA) as a case study. Guided by the Hala Tuju, Transformasi Politeknik 2023–2030 framework, the study emphasizes the importance of structured industry engagement in enhancing curriculum relevance, promoting work-based learning, supporting applied research, and fostering entrepreneurship. PSMZA exemplifies effective collaboration through curriculum co-development with industry, student industrial placements, joint research initiatives, and the creation of Centres of Excellence. These efforts demonstrate strong alignment with industry needs and highlight how institutional partnerships can bridge the gap between education and employment. Despite these strengths, the paper also identifies key challenges, including limited resources, misaligned expectations between stakeholders, and the need to keep pace with technological changes. To overcome these obstacles, the study recommends increasing government support, strengthening industry-education engagement, upskilling educators, and improving assessment practices. This case study reinforces the critical role of innovative PPPs and sustained industry collaboration in transforming Malaysia's TVET ecosystem. By adopting such strategies, institutions like PSMZA can better prepare graduates with relevant, future-ready skills to thrive in a rapidly evolving job market.

Key Words: *Public-Private Partnerships, Industry Collaboration, TVET, Politeknik Sultan Mizan Zainal Abidin*

1.0 Introduction

Technical and Vocational Education and Training (TVET) equips youth with industry-relevant skills, thereby enhancing national productivity and fostering innovation. In line with this objective, Malaysia's *Hala Tuju Transformasi Politeknik 2023–2030* aims to elevate TVET quality, strengthen institutional branding, and improve graduate employability (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2023). To achieve this, polytechnics such as PSMZA must deliver comprehensive, industry-aligned education while cultivating adaptable, entrepreneurial graduates capable of thriving in Industry 4.0 and the future economy (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2023). Central to the *Hala Tuju Transformasi Politeknik* initiative is the establishment of robust public-private partnerships (PPP) and structured industry collaboration, which are critical in addressing the growing demand for digitally proficient and skilled workers (George et al., 2024; Ngatiman et al., 2023).

Key priorities in strengthening Technical and Vocational Education and Training (TVET) include not only bridging the persistent skills gaps between graduates and industry demands but also ensuring that the curriculum remains relevant and responsive to evolving technological and economic landscapes (Fauwaz Abdul Aziz, 2023; Kementerian Ekonomi, 2023). Moreover, it is essential to integrate structured work-based learning experiences, such as industrial attachments and apprenticeships, so that students can develop hands-on, practical competencies in real-world settings. In addition, aligning educational content with industry standards and future workforce needs requires continuous engagement with employers and stakeholders, thereby fostering mutual understanding and curriculum co-development (Azahar, 2022). Consequently, such integration not only enhances the employability of graduates but also contributes to a more agile and innovative-driven workforce. Ultimately, by prioritizing these interconnected strategies—bridging skills mismatches, maintaining curricular relevance,

and embedding experiential learning—TVET institutions can better fulfill their mission of producing future-ready graduates equipped with both technical expertise and adaptive soft skills (Da, 2025).



Figure 1: Malaysia's policies

Furthermore, polytechnics are positioned as innovation and entrepreneurial hubs, where industries actively engage in talent development and applied research. This strategic direction aligns with broader national frameworks, including *Malaysia Madani* (Institut Tadbiran Awam Negara, 2024), *Ekonomi MADANI: Memperkasa Rakyat*, and the Twelfth Malaysia Plan, all of which emphasize human capital development. To institutionalize these efforts, PSMZA fosters collaboration through curriculum development, industrial training programs, applied research initiatives, and entrepreneurship support. By doing so, these partnerships ensure that TVET remains dynamic, technologically advanced, and responsive to evolving industry demands (Hazrat et al., 2023). Consequently, this approach prepares a resilient, future-ready workforce capable of adapting to shifting economic and technological landscapes.

2.0 Concept of Public-Private Partnerships (PPP) in TVET

Public-private partnerships (PPPs) in Technical and Vocational Education and Training (TVET) facilitate the exchange of resources, expertise, and responsibilities, thereby enhancing the quality of education. Such collaborations ensure curriculum alignment with industry needs, provide internship opportunities, integrate contemporary technologies, and improve graduate employability. As outlined in *Hala Tuju Transformasi Politeknik 2023–2030* (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2023), PPPs are instrumental in bridging the gap between educational institutions and industrial demands, a priority underscored by Malaysia's national policies, including *Ekonomi MADANI* and the Twelfth Malaysia Plan. A key initiative under this framework is the Talent Enhancement Programme (TEP), where industries actively participate in upskilling and reskilling TVET students, fostering sustainable, high-impact partnerships. Additionally, the Structured Industry Placement for Lecturers (SIP) enables educators to acquire current industry competencies, ensuring pedagogical relevance. Concurrently, Work-Based Learning (WBL) models embed real-world experiences into academic curricula, reinforcing practical skill development.

To further strengthen the TVET ecosystem, TVET Collaboration Hubs (TCH) serve as platforms for institutional-industry cooperation in research, technological advancement, and program innovation. At the national level, the Government-Industry TVET Council (GITC) provides a structured forum for industry stakeholders to contribute to policy

formulation and curriculum development (The Government-Industry TVET Coordination Body (GITC), 2024). Through this reinforced PPP model, TVET institutions such as PSMZA are better positioned to produce adaptable, industry-ready graduates, thereby supporting Malaysia's dynamic economic and industrial evolution in line with its broader developmental aspirations (Sekretariat Majlis TVET Negara, 2024).

3.0 Industry Collaboration in TVET

To enhance the employability of Technical and Vocational Education and Training (TVET) graduates, strategic industry partnerships are integral, encompassing curriculum co-development, expert-led guest lectures, collaborative research, structured internships, apprenticeships, and direct employment pathways. This approach is institutionalized under *Hala Tuju Transformasi Politeknik 2023–2030*, which positions industry engagement as a pivotal strategy for ensuring polytechnics remain aligned with labor market demands and future-oriented skills (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2023). Aligned with Malaysia's national economic policies—including *Ekonomi MADANI*, the Twelfth Malaysia Plan (12MP), and the National TVET Policy—initiatives such as the Industry Advisory Council (IAC), CEO@PolyCC, and Talent Enhancement Programmes (TEP) facilitate direct industry involvement in curriculum design. These collaborations integrate real-world competencies, emerging technologies, global industry trends, and micro-credentials into TVET programs. Specifically, CEO@PolyCC engages corporate leaders to deliver instruction in business, technology, and leadership, fostering industry-relevant mentorship (García-Sánchez et al., 2024; Rodzalan et al., 2022).

Furthermore, TVET Collaboration Hubs (TCH) drive applied research, creating synergies among academia, government, and industry to address sector-specific challenges. Industry-academic oversight mechanisms, such as *Sangkutan Industri Pensyarah* (SIP) and Work-Based Learning (WBL), ensure rigorous supervision and practical skill application. Notably, approximately 18,000 corporate partners have contributed over RM2.2 million in funding, enabling polytechnics to evolve into centres of research, innovation, and agile talent development. This dynamic collaborative ecosystem ensures that TVET institutions remain responsive to national economic priorities, technological advancements, and global workforce trends. By embedding industry expertise into education, Malaysia's TVET system supports the nation's strategic goals of fostering a skilled, competitive, and future-ready workforce, thereby driving sustainable economic growth under its broader developmental frameworks.

4.0 Public-Private Research Networks and TVET

Public-private research networks play a pivotal role in enabling Technical and Vocational Education and Training (TVET) institutions to integrate cutting-edge information technologies and industry best practices. These strategic collaborations serve as catalysts for technological advancement, innovation diffusion, and entrepreneurial capacity-building among students and faculty. Under the *Hala Tuju Transformasi Politeknik 2023–2030* framework, polytechnics are strategically positioned as solution providers for industry challenges, leveraging public-private research to enhance both industrial productivity and societal well-being - a key alignment with Malaysia's *Ekonomi MADANI* vision and the Twelfth Malaysia Plan's emphasis on human capital development (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2023). The Polytechnic Private Research Network (PPRN) exemplifies this approach, having allocated RM4.19 million to fund more than 115 industry-academia collaborative projects. Through PPRN initiatives, polytechnic educators and students engage directly with industry partners to co-develop market-oriented solutions, optimize industrial processes, and create commercially viable products. A notable illustration is the Innovation and Commercialisation Centre at Politeknik Sultan Salahuddin Abdul Aziz Shah, which has emerged as a hub for technology

transfer, product commercialization, and sustained industry partnerships (Nurul Ain Albaihaki Awang, 2024).

Complementing these efforts, the Community-Technology Collaboration Hub (C-TeCH) fosters multi-stakeholder engagement among academics, industries, institutions, and local communities to develop socially impactful technologies. Furthermore, nationwide student innovation competitions stimulate creative problem-solving and commercialization readiness among TVET learners. These interconnected strategies collectively enhance the capacity of polytechnics like PSMZA to produce work-ready graduates while simultaneously driving Malaysia's innovation ecosystem forward - directly supporting the nation's strategic objectives of technological sovereignty, economic resilience, and inclusive development as outlined in recent policy frameworks. This comprehensive approach demonstrates how Malaysia's TVET transformation aligns with broader national priorities, creating synergistic relationships between education, industry, and community development to foster sustainable economic growth in the Fourth Industrial Revolution era (Kementerian Ekonomi, 2023).

5.0 TVET Landscape in Malaysia

Malaysia's Technical and Vocational Education and Training (TVET) ecosystem operates under a multi-ministerial governance framework, necessitating coordinated inter-agency collaboration to effectively bridge skills gaps and propel national economic growth. This institutional architecture aligns with the country's strategic development frameworks, including the Twelfth Malaysia Plan (2021-2025) and Ekonomi MADANI, which prioritize human capital development through industry-aligned education. The establishment of the TVET Empowerment Cabinet Committee exemplifies the government's commitment to policy coherence, while the Malaysian Education Blueprint (2013-2025) institutionalizes industry-centric TVET reforms as a cornerstone of Malaysia's human resource development strategy (Ministry of Education Malaysia, 2013). Such policy instruments collectively reinforce the paradigm shift from supply-driven to demand-driven vocational training, ensuring workforce competencies remain responsive to the evolving needs of key economic sectors under Malaysia's industrialization agenda. This governance approach facilitates synergistic partnerships between public institutions and private enterprises, thereby enhancing the TVET system's capacity to produce job-ready graduates while supporting the nation's aspirations for technological advancement and high-income status (Da, 2025; George et al., 2024; Kementerian Ekonomi, 2023; Sekretariat Majlis TVET Negara, 2024).

6.0 Case Study: Politeknik Sultan Mizan Zainal Abidin (PSMZA)

6.1 Background

Politeknik Sultan Mizan Zainal Abidin (PSMZA), strategically located in Dungun, Terengganu, represents a key institutional component of Malaysia's Technical and Vocational Education and Training (TVET) ecosystem. Established in 2001 on a 100-hectare campus at Bukit Bauk with a capacity for 5,000 students, PSMZA's comprehensive infrastructure encompasses academic blocks, specialized laboratories, technical workshops, lecture halls, a resource center, Islamic facilities, sports amenities, and residential accommodations as shown in Figure 2. This physical capacity directly supports Malaysia's national objectives under Ekonomi MADANI and the Twelfth Malaysia Plan to expand quality technical education infrastructure. The institution's pedagogical approach combines rigorous academic instruction with intensive practical training, producing graduates with immediate industry relevance. PSMZA offers three-year diploma programs across critical technical domains including civil engineering, mechanical engineering, electrical systems, and information technology - all aligned with Malaysia's priority economic sectors. The

curriculum's strong emphasis on hands-on competencies reflects the Malaysian Education Blueprint's (2013-2025) directive for work-ready skill development.



Figure 2: Aerial view of Politeknik Sultan Mizan Zainal Abidin

A prime example of PSMZA's industry alignment is its Automotive Technologies Centre (ATeC), which provides cutting-edge training in conventional and advanced vehicle systems, including hybrid and electric vehicle technologies. Through strategic partnerships with automotive industry leaders, ATeC ensures program content remains responsive to technological advancements and labor market demands. This collaborative model, endorsed by Hala Tuju Transformasi Politeknik 2023-2030, enhances graduate employability both domestically and internationally while supporting Malaysia's aspirations for technological sovereignty and high-value industrial development. The institution's success in producing work-ready technicians directly contributes to overcoming skills shortages identified in national policy frameworks, making PSMZA a crucial enabler of Malaysia's human capital development agenda.

6.2 Industry Collaboration Initiatives

6.2.1 Curriculum Development

Keeping its curriculum current with industry changes is a PSMZA partnership strength. The polytechnic co-develops and reviews programs with industry experts to ensure graduates have market-relevant skills. PSMZA was named a Premier Digital Tech Institution (PDTI) by MDEC for 2023–2025, demonstrating the industry applicability of its Diploma in Digital Technology curriculum. PSMZA collaborates with industry partners to produce specialized programs, such as the 2023 Professional Diploma Program in Electro-Mechanical Rotating Machine with Elektro Serve (M) Sdn. Bhd. Students and industry workers received customized skills training in this six-month course. Through cooperation, PSMZA updates its curriculum to meet industry standards and certifications. Faculty learn best practices while students graduate, ready to work. This strategy improves employability and tackles TVET's skills gap.

6.2.2 Industrial Training

PSMZA partnered with 99 industry organizations to promote work-based learning. Formal company partnerships provide industrial placements for all diploma students. Industrial Empowerment Day 2023 has increased internship and on-the-job training possibilities, giving students local and international exposure. In July 2024, 24 PSMZA students were flown to Wuhan to attend the training in EV technologies, as illustrated in Figure 3, while in December 2024, six PSMZA students participated in the EV

Automotive Hangzhou Silk Road Youth Exchange Program in China, learning electric car technologies and industry methods. This curriculum opened doors to top automotive businesses' job opportunities. Many PSMZA interns work on genuine industry projects domestically, resulting in job offers after graduation. PSMZA graduates have industry skills and workplace readiness thanks to strong local and international cooperation, improving their employability and career prospects.



Figure 3: Student's mobility to China

6.2.3 Guest Lectures and Seminars

PSMZA has strategically integrated industry expert engagements into its pedagogical framework through regular guest lectures and specialized seminars, aligning with Malaysia's National TVET Policy and Ekonomi MADANI objectives for industry-driven education. These knowledge-sharing platforms serve as critical conduits for exposing students to contemporary industry practices, emerging technological trends, and real-world operational methodologies. The institution systematically invites subject matter experts across key economic sectors prioritized in the Twelfth Malaysia Plan, including automotive engineering, digital transformation, smart logistics, and advanced manufacturing. Complementing these engagements, flagship initiatives such as the CEO@PolyCC program and Industrial Empowerment Day facilitate direct student interaction with C-suite executives, successful entrepreneurs, and leading technologists. These high-value exchanges not only enhance technical competencies but also cultivate essential soft skills, leadership acumen, and industry awareness - all critical elements emphasized in the Malaysian Education Blueprint (Higher Education) 2015-2025.

Through such industry-academia interfaces, PSMZA operationalizes the *Hala Tuju Transformasi Politeknik 2023-2030* mandate for producing holistic graduates who possess both technical mastery and professional maturity, thereby bridging the skills gap identified in Malaysia's labor market while supporting the nation's transition toward knowledge-intensive industries. This multifaceted approach to industry engagement ensures PSMZA students develop a comprehensive understanding of workplace expectations and career pathways, ultimately contributing to Malaysia's human capital development goals and the creation of a future-ready workforce as envisioned in national economic planning documents. The institution's emphasis on leadership mindset development further resonates with *Malaysia MADANI's* call for ethical, competent professionals capable of driving sustainable economic growth.

6.2.4 Research Collaboration

To accelerate applied innovation and solve industrial problems, PSMZA collaborates with industry partners on research. Practical engineering, technological, and renewable energy concerns are addressed in joint research projects. PSMZA faculty and students collaborate with enterprises on market-ready solutions, process improvements, and product design through venues like the PPRN. TVET Collaboration Hub (TCH) collaborations improve these initiatives. PSMZA's research is influential, industry-relevant, and contributes to national economic development because it is often directly commercialized or applied in industry.

6.2.5 Advisory Panels

At PSMZA, industry executives join advisory groups to guide strategic direction and keep academic programs relevant. These committees, like the Industry Advisory Council (IAC), include automotive, digital technology, manufacturing, and logistics experts. They examine curriculum, advise on industry needs, and offer ways to match training to worker needs. Advisors provide vital insights on technical trends, skills needed, and market expectations through regular meetings and consultations. This tight industry connection enables PSMZA to maintain creative, future-ready programs and boosts graduate employability and competitiveness.

6.3 Public-Private Partnership Models

6.3.1 MOUs and MOAs

PSMZA's collaboration approach relies on MoUs and CoCs for long-term participation. PSMZA has MoUs/CoCs for curricula, internships, staff attachments, joint events, and equipment donations. PSMZA signed CoCs for guest lectures and industrial placements with logistics, manufacturing, education, and utility partners on Industrial Empowerment Day 2023. The July 2023 Certificate of Collaboration (CoC) signing ceremony strengthened departmental partnerships with 13 agencies. Through cooperation with PKT Logistics, Seikou Systec, and MARii, PSMZA initiatives satisfy industry requirements. These agreements improve teaching and graduate employability via equipment, professional training, and embedded certificates. As an example, through PKT Logistics collaboration, PSMZA students secured scholarships to further their studies at Peninsula College in Penang, as shown in Figure 4. Structured MoUs encourage regular participation, keeping cooperation vibrant, impactful, and industry relevant.



Figure 4: Industry scholarship for the PSMZA students

6.3.2 Center of Excellence (CoE)

The 2015-opened Automotive Technology Centre (ATeC) is a PSMZA Center of Excellence. ATeC automotive instruction covers HEV technology, maintenance, alternative fuels, and road safety. A 2-Star Centre of Technology (CoT) and 2024 “Best Polytechnic (Automotive)” winner, ATeC shows how workshops, upskilling programs, and racing consultancy projects may boost industry collaboration as shown in Figure 15. The Automotive Reskilling and Upskilling Centre (RUC) under ATeC added specialized short courses to PSMZA in 2024. Beyond cars, PSMZA is a Premier Digital Tech Institution that teaches digital skills with Amazon Web Services. These CoEs improve TVET delivery and teach students and external trainees the newest technology by providing top-notch facilities and industrial exposure.



(a)



(b)

Figure 5: a) Formula Racing ATeC team b) FRATeC racing car

6.3.3 Start-up Support

PSMZA's public-private partnership encourages students and graduates to become entrepreneurs. In the year 2024, PSMZA and Suruhanjaya Syarikat Malaysia (SSM) hosted *Karnival Usahawan Muda* for mentors, investors, and entrepreneurs, teaching students' business registration, networking, and company growth. Students received incubation, funding, and microloans from SME Corp, MARA, and local entrepreneurship organizations. Young Innovators is a PSMZA entrepreneurial group run by industry mentors. Business modelling and invention competition workshops inspire student entrepreneurship (Jabatan Pendidikan Politeknik dan Kolej Komuniti, 2021). PSMZA promotes communication, financial literacy, and opportunity recognition through business ventures. TVET diversity enables graduates as job seekers and technopreneurs, boosting local economies.

7.0 Challenges in PPP and Industry Collaboration

Malaysia's Technical and Vocational Education and Training (TVET) institutions, including Politeknik Sultan Mizan Zainal Abidin (PSMZA), face significant constraints in fostering effective public-private partnerships (PPPs) due to infrastructural deficiencies, technological gaps, and limited funding. These limitations impede collaborative research initiatives, advanced skills training, and industry-aligned projects, thereby hindering the ability of TVET institutions to fully meet evolving industry demands. This misalignment is particularly evident in the tension between industry expectations—which prioritize immediate workforce readiness and profitability—and the pedagogical focus of polytechnics on holistic student development. Such divergent priorities may compromise curriculum relevance, internship efficacy, and applied research outcomes, necessitating strategic mediation to ensure mutually beneficial collaborations.

Furthermore, the rapid pace of technological advancement, as emphasized in Malaysia's Industry4WRD policy and National Fourth Industrial Revolution (4IR) Strategy, demands continuous curriculum modernization and facility upgrades within TVET institutions (Mukhuty et al., 2022; Ngatiman et al., 2023). Without timely revisions, academic programs risk obsolescence, producing graduates ill-equipped for the demands of a digitized workforce. To remain competitive and aligned with national economic agendas such as Ekonomi MADANI and the Twelfth Malaysia Plan, TVET institutions require sustained private-sector investment in cutting-edge training equipment, industry-relevant research, and educator upskilling. Addressing these challenges is imperative to ensure that Malaysia's TVET ecosystem can fulfill its role in cultivating a future-ready workforce, thereby supporting the nation's transition toward high-value, technology-driven industries. Thus, bridging infrastructural and financial gaps while fostering stronger industry-academia synergies remains critical to achieving the strategic workforce development goals outlined in Malaysia's key policy frameworks. Without such interventions, the disconnect between institutional capabilities and industry expectations may persist, undermining the nation's broader socioeconomic aspirations.

8.0 Recommendations

To enhance the effectiveness of public-private partnerships (PPPs) in Malaysia's Technical and Vocational Education and Training (TVET) sector, several strategic improvements can be implemented in alignment with national policies such as Ekonomi MADANI and the Twelfth Malaysia Plan. First, the establishment of standardized frameworks with clearly defined performance indicators, coupled with targeted fiscal incentives and institutional support mechanisms, would significantly increase corporate participation and foster deeper collaboration. This approach resonates with the National TVET Policy's emphasis on creating synergistic industry-academia linkages. Second, structured engagement platforms should be institutionalized to facilitate regular dialogue between TVET providers and industry stakeholders. Such forums would enable continuous feedback exchange, ensuring curriculum relevance to evolving labor market demands while building long-term trust – a critical factor highlighted in the *Hala Tuju Transformasi Politeknik 2023-2030* blueprint. Third, implementing systematic professional development programs for TVET educators, including mandatory industry attachments and technology upskilling initiatives, would maintain pedagogical alignment with current workplace practices, as advocated in the Malaysian Education Blueprint (Higher Education) 2015-2025.

Furthermore, robust monitoring and evaluation systems must be developed to quantitatively assess partnership outcomes, particularly in terms of graduate employability rates, industry satisfaction levels, and overall educational quality – key performance metrics underscored in national workforce development strategies. When combined, these measures – encompassing policy standardization, stakeholder engagement, educator capacity-building, and evidence-based assessment – would create sustainable TVET-industry ecosystems that effectively support Malaysia's transition toward knowledge-driven economic growth while addressing critical skills gaps identified in national development plans. This comprehensive approach directly contributes to the Malaysia MADANI vision of cultivating a competent, future-ready workforce through responsive education-industry collaboration, ultimately strengthening the nation's global competitiveness in alignment with its strategic socioeconomic objectives. The proposed framework ensures TVET partnerships remain dynamic, mutually beneficial, and capable of producing graduates who meet both current and anticipated industry requirements.

8.0 Conclusion

In conclusion, strong public-private partnerships and industry collaborations are vital in transforming TVET institutions into agile, industry-relevant education providers. This paper concludes that:

- PPP and industry collaboration are essential for advancing TVET in Malaysia.
- Strategic alliances enhance curriculum relevance, foster innovation, and improve graduate employability.
- The case of PSMZA demonstrates how dynamic partnerships can create impactful educational outcomes aligned with industry needs.
- Continued efforts are critical to strengthen collaborations and ensure TVET institutions produce a future-ready, highly skilled workforce.

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