

A STRATEGIC ANALYSIS OF THE VOCATIONAL EDUCATION SYSTEM IN INDONESIA: APPLYING PORTER'S DIAMOND AND TOWS APPROACH

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Abstract: Indonesia's vocational education system is undergoing a strategic transformation to meet the evolving demands of the global economy domestic labor market. This study employs Porter's Diamond framework and the TOWS Matrix to analyze the competitiveness and strategic positioning of vocational education in Indonesia. The research identifies key internal and external factors such as factor conditions, demand-side dynamics, industry collaboration, and institutional policies that influence the system's performance. While Indonesia benefits from a demographic dividend, increasing digitalization, and supportive government initiatives, persistent challenge remain. These include regional disparities in educational quality, limited industrial absorption capacity, and societal stigma toward vocational pathways. The dual-framework analysis reveals strategic opportunities to enhance stakeholder synergy, improve educator competencies, and align vocational curricula with market needs. Furthermore, the study emphasizes the importance of data-driven policy reform and impact-based evaluation to ensure sustainable development. By integrating theoretical insight with practical recommendations, vocational education in Indonesia can evolve into a cornerstone for national human capital development. The findings contribute to discourse on Technical and Vocational Education and Training (TVET) reform and offer a roadmap for strengthening Indonesia's position global skill landscape.

Keywords: *Vocational Education, Educational Transformation, Competitive Strategy, Porter, SWOT/TOWS*

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1. Introduction

Vocational education has evolved into one of the essential pillars in the strategy for human resource development across the globe, including Indonesia. Essentially, vocational education is an educational pathway focused on mastering practical and technical skills that are ready to be utilized in the workforce. Unlike academic education, which emphasizes theoretical development and analysis, vocational education prepares students to directly enter various industrial sectors through practice-based learning, industrial internships, and competency certification (Abd Majid et al., 2024). In Indonesia, the role of vocational education has been further strengthened by national policies such as Presidential Regulation No. 68 of 2022 on

the Revitalization of Vocational Education and Training. This policy marks the government's commitment to improving the quality, relevance, and governance of vocational education to align with the needs of the modern workforce. Program such as Vocational Excellence High Schools, Matching Funds, and the Independent Vocational Campus illustrate a policy direction that emphasizes the importance of collaboration between educational institutions and the industrial world (DUDI), strengthening the capacity of vocational teachers, and developing digital-based curricula and priority sectors (Njuki, 2023; Sarah, 2023). This study provides a historical and political analysis of vocational education in Indonesia, emphasizing how recent reforms aim to establish strategic partnerships between education and industry (Yasdin et al., 2023).

The number of vocational education institutions in Indonesia continues to increase and is projected to become the dominant pathway at both the secondary and higher education levels. The government even targets a vocational education ratio of 70% to support human resource readiness in facing the challenges of the Fourth Industrial Revolution and the digital era. However, challenges such as disparities in facilities between regions, uneven quality of educators, and societal stigma towards vocational pathways a “second choice” remain issue that need to be addressed with holistic and sustainable strategies (Suharno et al., 2025). To conduct a comprehensive analysis of the vocational education system in Indonesia, this research will apply Porter's Diamond model, which examines the competitive advantage of nations, and the TOWS matrix, which helps in formulating strategic options based on internal and external factor. By utilizing these frameworks, the study aims to identify the strength, weaknesses, opportunities, and threats within the vocational education landscape in Indonesia, offering commentary on how the system can be improved to better meet the demands of the labor market.

Globally, vocational education is also experiencing significant growth. Develop countries such as Germany, South Korea, Finland, and Australia have made vocational education the backbone to undergo theoretical learning in schools while directly working companies. In South Korea, the Meister Schools program creates a generation of youth skilled in high technology and manufacturing. Finland even emphasizes personalized learning and technology integration to create a flexible and responsive vocational system. Organization such as the International Labor Organization (ILO) and reducing the mismatch between graduates' skill and industry needs (Levin et al., 2023; Yang & Wu, 2024).

According to a report by the McKinsey Global Institute, the world is predicted to need well over 113 million skilled workers by 2030, making vocational education a primary strategy in global human resource development. With the support of strategic policies, industry partnerships, and the adaptation of technology and digitalization, vocational education increasingly demonstrates its central role in shaping a generation that is not only job-ready but also capable of innovating, being competitive, and actively contributing to national development.

The urgency of this research is due to the widening gap between the strategic importance of vocational education and the capacity of Indonesia to produce a skilled workforce that can adapt to the rapidly changing needs of industry and the labor market. The rapid progress of digitalization, automation, artificial intelligence, ecological transformation and international competition is changing job requirements and increasing the probability of skills mismatch of vocational graduates. Simultaneously, ongoing regional inequalities in educational infrastructure, instructor quality, industry connections, curriculum relevance, and societal attitudes toward vocational paths may constrain the impact of existing government reforms.

Previous studies have looked at specific elements of vocational education, but there is a need for a comprehensive strategic analysis that considers the factors affecting national competitiveness and the internal and external conditions influencing the vocational education framework. Therefore, the application of Porter's Diamond and the TOWS Matrix is timely and meaningful, as the former provides a systematic perspective of sources of competitive advantage, and the latter is a tool to turn the identified strengths, weaknesses, opportunities and threats into practical strategic options. Such analysis is crucial to provide support for evidence-based policy formulation, enhance the synergy between education and industry, minimize skill mismatches, and establish Indonesian vocational education as an important driver for sustainable human capital development and national competitiveness.

2. Literature Review

Definition and Role of Vocational Education

Vocational education, often referred to as Technical and Vocational Education and Training (TVET), is a form of education that prepares individuals for specific jobs or job group through the development of practical skills and technical knowledge. Unlike academic education, which emphasizes theory and research, vocational education is application-oriented, often involving workplace learning experiences such as internships, fieldwork, and industry simulations. The goal is to produce graduates who are job-ready, adaptable to technological changes, and capable of directly contributing to economic productivity (Abdullah et al., 2020). The role of vocational education is crucial in addressing the skill gap between labor supply and industry demand. Over 60% of vocational high school graduates in Indonesia experience horizontal mismatch, which is the discrepancy between the skills they possess and job requirements. Numerous studies reveal that vocational education curricula frequently neglect soft skills, despite their high demand in the labor market. This disparity contributes significantly to the employability gap (Ping Yong & Ling, 2023). The formation of vocational teacher identity is closely linked to prior occupational experience, which shapes their perspective and teaching approaches. Technical and Vocational Education and Training (TVET) institutions must legitimize the diverse backgrounds of learners through inclusive pedagogical practices. A systematic study by Antera & Teräs, (2024) also emphasizes the importance of inclusive approaches in TVET settings, particularly for individuals with disabilities, offering recommendations for policy reform and teacher training to foster equitable and empowering learning environments.

Global Trends and Successful Models of Vocational Education

Globally, vocational education continues to undergo transformation in response to megatrends such as the Fourth Industrial Revolution, digitalization, automation, and the transition to a green economy. Developed countries have developed various innovative models to strengthen their vocational systems, each reflecting their national social and economic context. According to (Li & Pilz, 2023), global TVET systems are increasingly shaped by national strategies that respond to technological and economic disruptions, with emphasis on adaptability and innovation. In Germany, the vocational education system is known for its dual education model, which integrates theoretical learning in vocational schools (Berufsschule) with practical training in companies (Ausbildungsbetrieb). This approach ensures that the curriculum remains directly relevant to industry needs, producing graduates with highly specific skills that are in demand in the labor market. The success of this model is supported by close partnerships between the government, industry sectors, and trade unions

that are actively involved in the development and oversight of vocational training (Somers, 2025). This model can be analyzed through Porter's Diamond framework, particularly in terms of factor conditions and firm strategy.

Meanwhile, South Korea has made significant investment in vocational education focused on high technology and advanced manufacturing. The Meister Schools program is designed to produce skilled workers in strategic fields such as robotics, artificial intelligence, and semiconductors. The curriculum is highly responsive to technological developments, and the government provides substantial financial support for the procurement of advanced facilities and equipment to enhance the learning process (Kakamega County & Zablon Eshirumba, 2021). Analyzing this model through the TOWS matrix could reveal opportunities for Indonesia to enhance its vocational education system. Finland adopts an approach that emphasizes personalization and flexibility in its vocational system. Students are given the freedom to design their own learning pathways based on their interests and career goals, focusing on the development of core competencies and transversal skills.

The integration of digital technology in the learning and assessment processes is a hallmark of this system, allowing for rapid adaptation to changing labor market needs (Rahma Rahma et al., 2024). This adaptability is critical factor that can be explored further in the context of Indonesia's vocational education challenges. Australia has developed a comprehensive National Qualifications Framework (AQF), ensuring recognition and transferability of vocational qualifications accross the country. The vocational system in Australia is heavily industry-driven, with industry boards actively involved in developing competency, standard and curricula. This approach ensures that the training provided is relevant to the real needs of the economic sectors and support national labor mobility (Noonan et al., 2019). The lessons learned from Australia can inform strategic recommendation for Indonesia's vocational education system.

At the international level, various organizations also promote this strengthening of vocational education. The International Labor Organization (ILO) but consistently highlights the role of TVET in addressing youth unemployment and promoting decent work. The ILO emphasizes the importance of social dialogue between governments, employers, and workers in designing effective and inclusive TVET policies (Mayombe, 2024). UNESCO views TVET as a strategic instrument for sustainable development social inclusion and lifelong learning. Through its global strategy for 2022 - 2029 UNESCO supports screw member country in designing TVET systems that are responsive to technological and social changes, as well as promoting a fair transition to a green and digital economy (Bathla et al., 2023). The McKinsey Global Institute report further reinforce the urgency of developing vocational education by projecting a massive global need for skilled labor in the future, particularly in technology-driven sectors.

Vocational education is positioned as a primary strategy for preparing the global workforce to face complex and dynamic economic challenges and opportunities (Asiedu & Tenakwah, 2025). In conclusion, the literature highlights the role of vocational education in addressing labor market needs and promoting social inclusion. By applying Porter's Diamonds and TOWS frameworks. this research aims to identify strategic opportunities and challenges with Indonesia's. vocational education system, ultimately contributing to the development of a more effective and responsive educational framework.

The Situation of Vocational Education in Indonesia

Vocational education in Indonesia is undergoing strategic transformation through various national policies. One noteworthy event is the issuance of Presidential Regulation No. 68 of 2022 on the revitalization of professional education and training. This regulation emphasized that revitalization aims to improve access, quality, and relevance of vocational education in accordance with labor market needs as well as equip their workforce with competencies for employment and/or entrepreneurship (JDIH BPK RI). According to (Yasdin & Muksin, 2024), this regulation reflects a paradigm shift in vocational education policy, aligning national priorities with global competitiveness and inclusive development goals. As a concrete implementation, the Ministry of Education, Culture, Research and Technology, through the Directorate General of Vocational Education, has launched the Vocational Excellent High School.

This program aims to make vocational high schools center of industry-based learning and national reference. By 2025, total of 1,851 vocational high schools are expected to be part of this program, with budget support of IDR 390 billion for strengthening facilities, curricula, and industry partnership. This initiative seeks to enhance the infrastructure and resources available for vocational higher education, collaboration with the business and industry sector is strengthened through the Vocational Matching Fund Program. With a multi-year funding scheme, this program fosters applied research and the establishment of teaching factories. In 2023, more than 1,000 proposals were submitted, involving 1,292 lecturers and 5,370 students, resulting in an increase in the University Industry Collaboration score in Indonesia from 53.5 to 87.4 (Kemendikbudristek). This collaboration reflects the “related and supporting industries” aspect of Porter’s model, highlighting the importance of partnership in enhancing educational outcomes (Grant, 1991).

Additionally, the Independent Vocational Campus Program provides opportunities for students to undertake industrial internship for one to two semesters, with recognition equivalent to 20 credits (SKS). This program is designed to strengthen work skills and expand the professional networks of vocational students (Polban). However, challenges remain, particularly regarding the social stigma surrounding vocational education. Vocational graduates are often considered a “second choice” compared to academic education, despite having more practical skills that are ready for the workforce. To address this, KADIN Indonesia continues to encourage industry involvement in curriculum development and competency certification as part of the link and match strategy between education and labor market needs (KADIN).

Conceptual Framework

Theories for Strategic Planning Analysis

In an increasingly competitive global environment, vocational education plays a strategic role as a driver of national competitiveness. Vocational education policy in Indonesia has evolved to align with global demands, emphasizing its role in economic development and workforce readiness (Yasdin et al., 2023). To understand how vocational education can become a competitive advantage for a country or region, Porter’s Diamond Model (Robert M. Grant, 1991) offers a relevant analytical framework. This theory explains four main determinants that shape national industrial competitiveness: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry. Factor conditions in vocational education encompass the availability of skilled labor, efficient training systems, and practical learning infrastructure.

As (Suharno et al., 2025) emphasize, strengthening these foundational elements such as teacher competencies, facilities, and curriculum relevance is essential for vocational institutions to contribute to national competitiveness. Meanwhile, demand conditions reflect local needs for labor with specific skills that drive vocational institutions to innovate their curricula. (Yasdin et al., 2023) highlight that vocational education policies in Indonesia are increasingly responsive to regional labor market demands, encouraging schools to adapt their programs accordingly. Additionally, the presence of related and supporting industries, such as SMEs and partner companies, plays a role in enhancing students' learning experiences through internship and business collaborations. According to (Yoto et al., 2024), industry-linked learning models like Teaching Factory have proven effective in bridging the gap between school and workplace expectations.

The structure and competition among educational institutions encourage vocational providers to continuously improve teaching quality, program flexibility, and industry relevance. This theory also acknowledges the role of government as an external variable that can influence the main determinants through education policies, investment incentives, and labor regulations. For instance, the government can promote a dual education system like that in Germany, where vocational schools and companies collaborate directly (Nurtanto et al., 2022). As discussed by (Li & Pilz, 2023), such collaboration fosters professional identity development and ensures that vocational graduates possess competencies aligned with industry standards. This system demonstrates how strategic partnerships between education and industry can create competitive advantages that are difficult for other countries to replicate.

Furthermore, (Heriyati & Abror, 2023) discuss how the international transfer of vocational education systems can occur by considering local contexts, including adaptations to Porter's determinants. This study indicates that the success of transferring vocational system from one country to (Yasdin et al., 2023) another is significantly influenced by the quality of industry relationships with educational institutions and government support in developing training infrastructure. Successful transfer necessitates the contextualization of vocational models, particularly in coordinating the curriculum with local labor demands and institutional capabilities. Conceptually, this approach can be combined with SWOT analysis, allowing vocational education strategies to be formulated by considering internal strengths and weaknesses as well as external opportunities and threats. SWOT analysis is a strategy formulation methodology that can be developed within the TOWS matrix, serving as a tool for designing more adaptive and competitive vocational education policies.

Recent studies by Nurtanto et al. in (Bakan & Doğan, 2012) and (Suharno et al., 2025) have applied SWOT-TOWS frameworks to vocational education planning in Indonesia, demonstrating how institutional strengths such as teaching factory models and digital learning platforms can be leveraged against external challenges like technological disruption and skill mismatch. By employing Porter's Diamond theory and SWOT analysis, vocational education research can not only explain the internal strengths of the learning system but also how vocational institutions can respond to global challenges such as technological changes, labor marker disruptions, and industry demands for new skills. This integrative approach is increasingly used in comparative TVET studies, where strategic mapping helps identify policy gaps and innovation opportunities. This strategic analysis will provide insights into how Indonesia can enhance its vocational education system to better align with global trends and labor market needs. Aligning vocational education with global standards requires not

only curriculum reform but also institutional agility and sustained government-industry collaboration.

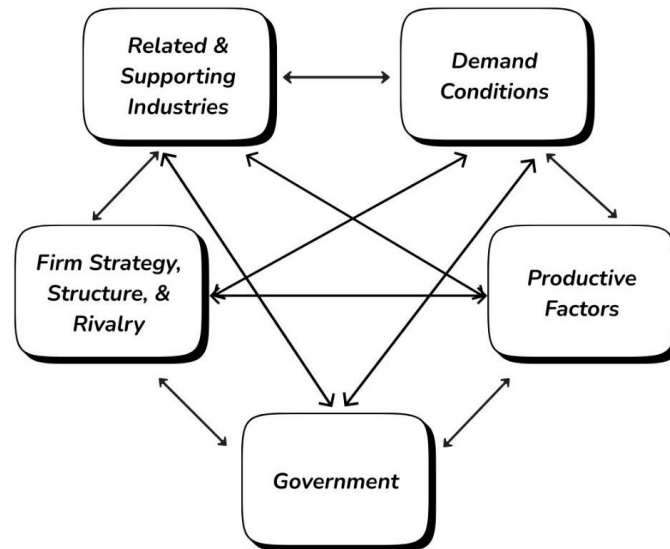


Figure1. Porter Diamond Model of National Competitive Advantage (Grant, 1991)

3. Research Method

This research was conducted through a series of systematic steps to achieve the stated objective. First, a literature review was conducted to understand the development of vocational education, the current state of vocational education in Indonesia models of determinants of competitive advantage, Porter's Diamond theory (Robert M. Grant, 1991), and a SWOT/TOWS analysis. This review aimed to identify factors influencing the vocational education systems and its relevance to labor market needs. Next, a research design was developed based on the research objective and the result of literature review. This design ensured that the approach used was appropriated to the context and needs of the analysis. The collected data will be analyzed to identify relevant patterns and relationships. This analysis will include identifying key factors influencing vocational education in Indonesia, as well as the strengths and weaknesses of the national vocational education system through a competitive analysis.

Furthermore, a SWOT analysis will be conducted to evaluate the implementation of vocational education in Indonesia (Horas et al., 2026; Ganap et al., 2025; Tan et al., 2025). After the data is analyzed, the result will be interpreted and summarized to draw conclusion and provide strategic recommendations. These recommendations will be based on the integration of the analysis results with Porter's Diamond model and the TOWS matrix, which will assist in the formulating more effective vocational education development strategies. Qualitative research methods were applied in the study with the data with data collected through secondary data analysis, including academic journals, scientific articles, educational websites, and policy report from relevant research institution. The study by (Pesantren dalam Implementasi Kebijakan Pendidikan Vokasi melalui Balai Latihan Kerja, 2025) provides insights into the transfer of vocational education systems between countries and their relevance to national competitiveness, while the article by (Suharno et al., 2025) was used to enrich the methodological approach and implementation strategies for vocational education. This research aims to identify the factors that influence the competitiveness and development

of Indonesia's vocational education system, using the determinants of Porter's Diamond theory, and to formulate strategies for strengthening vocational education in Indonesia by integrating Porter's Diamond model with SWOT/TOWS analysis.

4. Results and Discussion

4.1. Results

Competitive Advantage of Nation Analysis

Table 1 summarizes the competitive advantage of the vocational education sectors in Indonesia, featuring 30 key findings derived from secondary data analysis. These findings were classified according to Porter's Diamond model, which will serve as a foundation for the upcoming SWOT analysis. The assessment of the national vocational education system is framed through these four determinants:

Table 1: The competitive advantages of nation on Vocational Education in Indonesia

Aspect of CAoN	Advantages	Disadvantages
Factor Conditions	A large population of working-age individuals provide significant potential for human resource development through education.	Disparities in education quality across regions, especially between urban areas and 3T (frontier, outermost, and underdeveloped) regions.
	Advancements in digital infrastructure and internet access support the implementation of online learning.	Shortage of qualified teachers in terms of both quantity and competence.
	Growth in higher education and vocational institutions	Limited educational facilities and infrastructure.
Demands Conditions	Public awareness of the importance of education is increasing.	Mismatch between graduates and job market needs.
	High demand for technology-based education and Industry 4.0 skills.	Lack of commodity participant in non-formal education.
	Inclusive on vocational education programs are increasing.	Fluctuating interest in certain educational programs.
Related and Supporting Industries	Partnerships between education and industry (link and match).	Limited capacity of local industry to absorb vocational graduates.
	Support for educational technology, such as digital platforms.	Suboptimal industrial support for research and innovation.
	International cooperation to encourage student exchange and research.	Price and access to educational technology remain barriers in underdeveloped regions.
Institutional Strategy, Structure, and Competition	The diversity of educational institutions creates healthy competition.	Inequality in funding between educational institutions.
	The Independent Learning and Independent Campus policies provide curriculum flexibility.	Governance and bureaucratic challenge in state institutions.
	Global competition drives quality improvement and accreditation.	Competition between institution does not yet focus on graduate quality.
Government	The education budget is 20% of the state budget.	Mismatch between central government policies and regional implementation.
	National scholarships such as the	Obstacles to transparency and

	KIP Kuliah and LPDP.	accountability in the in the distribution of educational assistance.
	School digitization and teacher training programs.	Minimal evaluation of the program's impact on graduate competitiveness.
Source(s): Table by Authors (2025).		

SWOT Analysis

The findings presented in Table 1 are further classified into internal and external factors the competitive advantages of the vocational education sector in Indonesia. Each factor is then mapped into four categories within the SWOT analysis framework: Strengths (S) as beneficial internal factors; Weaknesses (W) as detrimental internal factors; Opportunities (O) as favorable external factors; and Threats (T) as unfavorable external factors, as listed in Table 2.

Table 2: SWOT Analysis of Vocational Education in Indonesia

	Strengths (Internal Factors)	Opportunities (External Factors)
Favorable Factors	<i>Production Factor</i> S1. Large productive-aged population and increasing public awareness of the importance of education. S2. Digital infrastructure, digital platforms and school digitalization strengthen modern education. S3. Development of inclusive and vocational education. <i>Related and Supporting Industries</i> S4. Demand for Industry 4.0 and education-industry collaboration create synergy. <i>Firm Strategy, Structure, and Rivalry</i> S5. Global cooperation and competition improve quality and accreditation. <i>Government</i> S6. Government commitment through education budgets and scholarship programs. <i>Firm Strategy, Structure, and Rivalry</i> S7. Growth of educational institutions and flexible curricula encourage healthy competition.	<i>Production Factor</i> O1. Technological advances and industrial needs drive educational transformation. <i>Government</i> O2. Globalization and donor support strengthen educational cooperation and reform. <i>Production Factor</i> O3. Demographic growth and urbanization increase the need for education.
Unfavorable Factors	<i>Weaknesses (Internal Factors)</i>	<i>Threats (External Factors)</i>
	<i>Production Factor</i> W1. Disparities in quality, facilities, and funding between regions.	<i>Related and Supporting Industries</i> T1. Local industry is unable to absorb graduates and support for innovation is

	W2. Shortage of competent teachers. Firm Strategy, Structure, and Rivalry W3. Mismatch between graduates and the workforce and institutions lack of focus on quality. W4. Public education bureaucracy is inefficient. Demand W5. Non-formal education is less popular among the public.	low. Production Factor T2. Access to technology is expensive and difficult to access in the 3T (frontier and outermost) regions. Government T3. Unsynchronized policy implementation and minimal transparency of aid. Demand T4. Changing interest in study programs and weak evaluation of educational programs.
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Source(s): Table by Authors (2025).

Correspondence Analysis and TOWS Matrix

This study applies correspondence analysis using the TOWS matrix to connect the relationship between SWOT factors and formulates strategies. Furthermore, these correlated factors can be used to formulate appropriate matching strategies. Therefore, the results are shown in Figure 2. There are four types of matching strategies using TOWS matrix, namely SO, WO, ST, and WT. Internal factors (S and W) related to the same competitive advantage from the aspect of the nation or then formed into factor groups, such as (S1 to S7) or (W1 to W5). Internal factors actively align with external factor (O and T), demonstrating a high degree of correlation among them. Forming factor groups can help reduce complexity in correspondence analysis and facilitate further integrated strategy formulation. By using the TOWS matrix as shown in Table 3, finally the six results are correlated between SWOT factors and formed with the competitive advantage of the nation.

SWOT		Strengths (S)							Weaknesses (W)				
Opportunities (O)	SW	S1	S2	S3	S4	S5	S6	S7	W1	W2	W3	W4	W5
	OT	(P)	(P)	(P)	(R)	(F)	(G)	(F)	(P)	(P)	(F)	(F)	(D)
	O1	▲	▲	▲	●	●	●	●	▲	▲	●	●	●
	O2	●	●	●	●	●	▲	●	●	●	●	●	●
	O3	▲	▲	▲	●	●	●	●	▲	▲	●	●	●
Threats (T)	T1	●	●	●	▲	●	●	●	●	●	●	●	●
	T2	▲	▲	▲	●	●	●	●	▲	▲	●	●	●
	T3	●	●	●	●	●	▲	●	●	●	●	●	●
	T4	●	●	●	●	●	●	●	●	●	●	●	▲

Note :

1. P = Production factor, R = Related and supporting industries, F = Firm strategy, structure, and rivalry, D = Demand factor, G = Government

2. ▲ Denotes high correlation and ● Denotes no/low correlation

Figure 2: Mapping of TOWS Matrix Analysis

Source(s): Figure by Authors (2025).

Table 3. Correlation Between SWOT Factors and Formed to The Competitive Advantages of Nation

	Strengths (S)	Weaknesses (W)
Opportunities (O)	SO1 : (S1 to S3, O1) Productive Factors SO2 : (S1 to S3, O3) Productive Factors	WO1 : (W1, W2, O1) Productive Factors WO2 : (W1, W2, O3) Productive Factors
Threats (T)	ST1 : (S1 to S3, T2) Productive Factors	WT1 : (W1, W2, T2) Productive Factors
Source(s): Table by Authors (2025).		

4.2. Discussion

Based on the result of the SWOT analysis of the vocational education sector in Indonesia, followed by an analysis using the TOWS matrix, it was found that the production factor shows correlation across all four aspects: strengths, opportunities, weaknesses, and threats. As illustrated in Figure 2, the production factor categorized under strength category (S1, S2, S3) is correlated with the first opportunity factor (O1). Furthermore, within the same strength category (S1, S2, S3), a correlation is also observed with another opportunity factor, namely O3. When shifting to the threat aspect, it is evident that the strength factors (S1, S2, S3) are also correlated with the second threat factor (T2).

In the weakness aspect each production factor (W1, W2, W3) is found to be correlated with the first opportunity factor (O1) within the same sector. A similar correlation is also observed between the production weaknesses (W1, W2, W3) show a correlation with the second threat factor (T2). The combined SWOT and TOWS analysis reveals that the production factor in vocational education plays a consistently strategic role across various analytical dimensions. The strength components (S1, S2, S3) within production demonstrate positive correlations with opportunities (O1 and O3) and can respond adaptively to threats (T2). On the other hand, the weakness components (W1, W2, W3) also show potential to be linked with opportunities (O1 and O3), while strategically addressing threats (T2).

These findings indicate that the production factor is a key element in the designing strategies to strengthen vocational education. The consistent correlations between the production factors and various elements of SWOT and TOWS underscore the need to focus on resource development, training infrastructure, and industry partnership as the foundational pillars for enhancing the competitiveness of vocational education in Indonesia.

The findings also confirm the importance of Porter's Diamond model particularly the importance of factor conditions for establishing competitive superiority. For vocational education, the influencing elements are not only the physical facilities but also skilled teachers, technology, training environments, curriculum materials, and the opportunities for industry experience (Habibi et al., 2023). Such resources assume strategic importance when developed in response to emerging opportunities and used to counter external threats. The TOWS analysis shows that the competitiveness of Indonesian vocational education lies in the availability of resources and the ability of the system to improve and use the resources strategically. This analysis supports Porter's contention that advanced and specialized factor conditions are more important for sustained competitiveness than basic resources alone. Thus, to improve the vocational education system in Indonesia, it is imperative to concentrate

on investing in technical skills, contemporary training equipment, digital skills, and robust linkages between education and industry.

5. Conclusion

Strategic analysis of Indonesia's vocational education system shows that the country has huge potential due to its productive age population, digital advancement and strong policy support. However, structural and social challenges continue to present significant barriers to competitiveness. The results show that the Porter's Diamond framework implies that the factor conditions, demand conditions, related and supporting industries and institutional strategies play a diverse role in the competitiveness of vocational education. The TOWS Matrix also aids in the development of strategic alternatives by matching internal strengths with external opportunities and by countering weaknesses and threats. The resulting strategic priorities include strengthening education–industry collaboration, improving educator competencies, accelerating digital transformation in learning, upgrading training infrastructure, and developing evidence-based policies supported by impact evaluation. Overall, an integrated and data-driven approach can strengthen the capacity of vocational education to become a central pillar of national human capital development and to respond effectively to the changing requirements of the digital and global economy.

Some limitations are worth mentioning in interpreting the findings of this study. Firstly, the analysis is based entirely on secondary data from academic literature, policy documents and institutional reports. The lack of primary data from students, educators, industry representatives, and policymakers may limit the extent to which findings reflect current conditions and experiences of stakeholders at the operational level. Second, the use of Porter's Diamond and the TOWS Matrix is largely conceptual and strategic. The relationships and strategic priorities identified are not statistically validated and cannot be interpreted as causal relationships. Third, country-level analysis may limit the generalizability of the results because conditions of vocational education are drastically different from one Indonesian region to another due to differences in infrastructure, institutional capacity, industry structure, economic development, and characteristics of the labor market. Fourth, while major government programs and policies are discussed, this study does not quantitatively evaluate their effectiveness in improving graduate competencies, employment outcomes or industry absorption. Finally, some of the strategic conditions may change with time due to the rapidly changing nature of digital technologies, artificial intelligence, industrial requirements and education policies.

Future research should address these limitations through empirical and mixed-method approaches, combining quantitative surveys, qualitative interviews, and field observations with key stakeholders of vocational education. Comparative studies across provinces or regions will also be useful to identify contextual differences and to know if the proposed strategies are applicable across different vocational education environments. Longitudinal designs could also be employed by future researchers to examine changes in the competitiveness of vocational education over time, and to explore the long-term effects of government interventions on graduate employment and graduate absorption by industry. Moreover, the quantitative methods such as the structural equation modeling, multi-group analysis or other methods of policy evaluation could be used to empirically test the relationships identified through the Porter's Diamond and TOWS analysis. Future studies should also examine emerging issues such as artificial intelligence, green skills, Industry 5.0, digital learning, micro-credentials, and evolving industry competency requirements. Such

research would provide stronger empirical evidence for continuously updating Indonesia's vocational education strategy and ensuring that policy interventions remain relevant, inclusive, and responsive to future labor-market demands.

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