

Evaluating Performance in Vocational Education: Determinant Factors of Successful University-Industry (UI) Partnerships

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Abstract

Efforts to overcome the gap between graduate absorption capacity and market demand require collaboration between University-Industry (UI). So, collaboration between UI is important to improve the quality of graduates. This study aims to explore the success factors of UI partnerships, especially vocational education in improving the quality of graduates and field users. The research approach used is quantitative with a survey design. The research sample consisted of 450 participants including 173 lecturers and 277 industry practitioners with purposive sampling techniques. The PLS-SEM technique was used to test the structural model involving 10 variables, 50 constructs, and 25 hypotheses. The results showed that the success factors of UI partnerships can be explained by 72.90% to 93.20% of the partnership success indicators. Adaptability factors (93.20%), performance assessment (92.70%), facilities (92.20%), and continuous improvement (91.70%) are the main success factors, while the acculturation factor of industrial values has the lowest contribution (72.90%). The structural model can explain the impact of partnerships by 65.90% and 62.30% on the dimensions of UI partnership success. This study contributes to the adjustment, implementation, and standardization of industry-based curriculum needs, to increase the absorption of graduates in the industrial world. The novelty of this study lies in identifying specific factors that contribute significantly to the success of UI partnerships in the context of vocational education.

1. Introduction

Higher education has an important and strategic role if it is linked to the center of gravity of national development, namely the economic sector and human resources (Daryono et al., 2020; Rogers et al., 2021). Technical Vocational Education and Training (TVET) is one of the education programs implemented in higher education (Amrullah et al., 2025; Zheng et al., 2024). TVET aims to prepare and equip students with professional competencies and skills to be ready to work in certain fields (Farell et al., 2024; Hussain et al., 2021). The presence of tertiary institutions is expected to prepare students to develop professional attitudes, have abilities, skills, and develop themselves

according to their areas of expertise, become an independent workforce, and fill current and future industrial needs (Ćudić et al., 2022; Plummer et al., 2021). The existence of tertiary institutions is expected to be able to support national economic growth and graduates who can work in the industrial sector in facing the global era (Hariyanto et al., 2022; Salvador et al., 2021). Higher education graduates are said to be qualified if they can be absorbed by the industry according to their area of expertise and can even open employment opportunities (Batubara et al., 2025; Zhou et al., 2024).

Various factors have contributed to the persistently high unemployment rate among graduates. One of the main reasons is the ineffective collaboration between universities and industry (UI), which fails to adequately strengthen students' competencies and work readiness (Chukwuedo et al., 2024; Neroorkar & Gopinath, 2020). This condition is exacerbated by an oversupply of graduates in certain fields, leading to intense competition for a limited number of suitable job opportunities. Furthermore, there is a significant imbalance between educational outputs and actual labor market needs, where graduates' skills often do not align with what industries currently demand (Jaedun et al., 2024; Khan & Ali, 2024). The availability of formal employment continues to be limited, while the number of job seekers increases annually due to demographic pressures and the expansion of higher education. Compounding this issue, many graduates are not equipped with the practical skills and industry-relevant experience necessary to compete effectively in the workforce (Jonbekova et al., 2020). As a result, universities are perceived as falling short in responding to the dynamic and evolving demands of industry, which continuously innovate and require adaptable, high-quality talent.

Xu *et al.* (2025) and Kholifah *et al.* (2025) describes 3 indicators that are factors causing the mismatch of graduate competencies with the competencies needed by industry, namely (1), not all tertiary institutions produce graduates who are adaptive to the world of work or industry due to limited facilities and infrastructure to support the learning process, (2) many higher education educators are left behind updating the knowledge, attitudes, and skills needed in the 21st century so that they are only oriented towards the number of graduates and ignore the quality of graduates (3) the programs offered by higher education institutions are currently not able to answer challenges or industrial developments. Many efforts have been made for activities that are educational reform or innovation in higher education, one of which is through a pattern of collaborative cooperation between UI.

Synergistic collaboration between universities and industries has been shown to significantly enhance students' mastery of professional competencies while simultaneously providing access to real-world industrial facilities, technical mentoring, and exposure to professional standards that collectively improve the quality of graduates (Arthars et al., 2025; Efendi et al., 2025). One of the most effective forms of such collaboration is the implementation of structured internship programs. When students undertake internships in industries equipped with adequate facilities and receive consistent technical guidance, their acquisition of practical expertise is significantly strengthened (Batubara et al., 2025; Oberman et al., 2021). These experiences not only develop technical skills but also foster soft skills such as adaptability, communication, and problem-solving, thereby increasing students' overall readiness and competitiveness in the job market. Moreover, UI partnerships can be expanded through the implementation of apprenticeship schemes, the ongoing development of educator competencies, and the integration of industry-based competency certifications into the university-to-workforce transition system (Banerjee et al., 2024; Gil-Mastalerczyk, 2020; Kebede et al., 2024). In this regard, educators are no longer seen solely as academic instructors, but as facilitators of industrial relevance, who must continuously innovate to align their teaching approaches with current and emerging labor market demands (Agyeman et al., 2024). Strengthening the capacity of educators to keep pace with industry developments is therefore a strategic priority in ensuring that TVET institutions produce graduates who are not only academically competent but also professionally agile.

From the observations between higher education and the world of work, there is still a lack of cooperation. Collaboration UI is still felt to be less effective in terms of time, curriculum, Memorandum of Understanding (MoU), and implementation. Students look for their industries to use for industrial practice and apprenticeships, the selected industries are sometimes still on a household scale, so they selected industries are not able to provide the expected additional knowledge, experience, and skills (Jonbekova et al., 2020; Salvador et al., 2021). The results of the preliminary study show that several TVETs in Indonesia have collaborated with 24 industries in the form of MoUs in various programs and have produced several graduates who have worked in the government and private sectors, but there are still many graduates who have not been absorbed into the world of work and are independent with various factors (Ahmed et al., 2024; Plummer et al., 2021). Thus, universities need to improve the quality of their graduates to optimally increase links and matches (Hussain et al., 2021; Kebede et al., 2024).

Several key variables underpin the success of university-industry (UI) partnerships in the context of vocational education. Adaptability refers to the capacity of both universities and industry partners to adjust to evolving labor market demands, ensuring that curricula and training remain relevant (Craps et al., 2022; Khan & Ali, 2024) Performance assessment involves structured evaluation mechanisms to monitor and improve the outcomes of collaboration, such as graduate readiness and program effectiveness. The availability of facilities, including industry-standard equipment and infrastructure, supports hands-on learning experiences that closely

simulate real workplace conditions (Chukwuendo et al., 2024; Zhang, 2024). Continuous improvement emphasizes iterative development and feedback systems to enhance partnership quality over time. Additionally, the acculturation of industrial values highlights the importance of embedding professional norms, work ethics, and industry culture into academic environments to better prepare students for integration into the workforce. These variables are crucial because they reflect both operational and cultural dimensions of partnership quality and collectively influence the alignment between educational outcomes and industry expectations.

Efforts to close the gap between graduate absorption and labor market demand require effective and sustainable collaboration between universities and industry (UI) (Ahmid et al., 2023; De Vos et al., 2021). Despite numerous initiatives, existing partnerships often lack systematic evaluation, leading to suboptimal alignment between educational programs and industry needs. This research aims to analyze and identify the determinant factors that contribute to the success of vocational university–industry partnerships in enhancing the quality and employability of university graduates. The expected contributions include the development of an industry-based curriculum, the formulation of infrastructure and facility standards aligned with industrial practices, and the improvement of internship programs that directly support graduate integration into the workforce. However, there remains a lack of empirical studies that comprehensively model the dimensions and interactions of partnership success in the context of TVET (Farell et al., 2024; Khan & Ali, 2024; Zheng et al., 2024). Therefore, this study addresses a critical gap by providing a quantitative and data-driven assessment using PLS-SEM analysis to examine multiple variables influencing partnership outcomes. The findings are expected to offer theoretical insights and actionable recommendations for universities, industries, and policymakers seeking to improve graduate readiness and workforce relevance in a rapidly evolving labor market.

2. Method

2.1 Research Design

This study uses a quantitative approach with a survey design to analyze the determining factors for the success of partnerships between universities and industry (UI). The quantitative approach was chosen because it allows for the systematic collection of large amounts of data, making it suitable for identifying patterns of relationships between complex and hidden latent variables in the data structure (Nguyen et al., 2022; Sidani & O'Rourke, 2022). The survey design allows researchers to reach participants from various institutional backgrounds and industrial sectors efficiently. PLS-SEM was chosen because it can accommodate complex research models, involving many latent constructs and indicators. In this case, 10 variables and 50 indicators cover three main dimensions: core concept, input, and outcome. In addition, PLS-SEM is very reliable in estimating causal relationships between variables, even when the data is not normally distributed or the sample size is relatively moderate (Hair et al., 2021; Sarstedt et al., 2020).

2.2 Participants

The target population in this study was lecturers of vocational colleges and industry practitioners who were directly involved in partnership activities between universities and industry (UI), especially in the vocational education sector in Indonesia. This population was chosen because they are the main actors who play a direct role in the implementation and assessment of the success of UI collaboration. The sample in this study consisted of 450 respondents, including 173 lecturers from various state and private universities, and 277 industry practitioners from various manufacturing sectors, including mechanical and automotive engineering, construction, mechatronics, and informatics. The selection of lecturer respondents focused on institutions that had been accredited as A and B, to ensure the quality of education delivery and active involvement in industry partnerships. Meanwhile, industry practitioners were selected from companies that already had a track record of cooperation with vocational education institutions in the form of internships, curriculum development, or joint training.

The sampling technique used was purposive sampling, which is a sampling technique based on certain considerations that are by the objectives of the study (Hericco et al., 2023; Singh et al., 2025). The inclusion criteria for lecturers were: (1) teaching in vocational or applied study programs, (2) having experience in partnership activities with industry, and (3) coming from a university with a minimum institutional accreditation of B. Meanwhile, for industry practitioners, the inclusion criteria were: (1) working in the related manufacturing industry sector, (2) being directly involved in cooperation programs with vocational universities, and (3) having experience in internship guidance, graduate recruitment, or training development. In terms of representativeness, the composition of respondents reflects the balance between academic and industry actors within the UI partnership framework. The number of samples has met the minimum requirements for PLS-SEM analysis, namely five to ten times the number of paths to endogenous constructs, as recommended by Hair *et al.* (2021) and Wang (2022). Thus, the number and distribution of samples are considered adequate to support the validity and reliability of the findings in this study.

2.3 Data Collection and Measurement

Data collection in this study was conducted using a questionnaire as the main instrument, which was distributed online via Google Forms to vocational education lecturers and industry practitioners in the manufacturing sector. This technique was chosen to reach respondents widely and efficiently, considering the diverse geographical distribution of institutions and industries. The instrument used was compiled based on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree), to measure the level of respondent agreement with each indicator. The compilation of indicators in the questionnaire refers to previous studies such as Brunetti *et al.* (2020), Ghobakhloo *et al.* (2021), and Jonbekova *et al.* (2020), which have studied the success factors of university-industry partnerships. Based on these references, the researcher developed an instrument consisting of 10 main variables with a total of 50 indicators as listed in Table 1. In addition, the researcher added several items based on field observations and discussions with stakeholders to adjust the local context of vocational partnerships in Indonesia. The process of developing this instrument was complemented by content validation and terminology alignment to ensure that it remains theoretically appropriate and practically relevant.

Table 1 Dimensions of success factors for university-industry (UI) partnerships

Variables	Constructs	Indicators	Related Studies
Partnership Concept	PC1	Shared vision/mission	(Brunetti <i>et al.</i> , 2020; Korneeva <i>et al.</i> , 2023; Pujun, 2025)
	PC2	Cooperation purpose	
	PC3	Work program relevance	
	PC4	Curriculum Alignment	
Program Planning	PL1	Condition analysis	(Jonbekova <i>et al.</i> , 2020; Plummer <i>et al.</i> , 2021; Salvador <i>et al.</i> , 2021)
	PL2	Accommodation needs	
	PL3	Provision of funds	
	PL4	Cooperation sops	
	PL5	Agreement (MoU)	
Partnership Strategy	PS1	Basic principles	(Ćudić <i>et al.</i> , 2022; Amrullah <i>et al.</i> , 2025; Kebede <i>et al.</i> , 2024)
	PS2	Strategic plan milestones	
	PS3	Build cooperation	
	PS4	Work program	
Partnership Principles	PR1	Communication	(Jonbekova <i>et al.</i> , 2020; Salvador <i>et al.</i> , 2021; Xie <i>et al.</i> , 2025)
	PR2	Service	
	PR3	Trust	
	PR4	Integrity	
	PR5	Excellence growth	
Partnership Impact	PI1	Improving the quality of education	(Efendi <i>et al.</i> , 2025; Mian <i>et al.</i> , 2020, Poschauko <i>et al.</i> , 2024; Widodo <i>et al.</i> , 2025)
	PI2	Upskilling/multi skilling	
	PI3	Attitude/culture change	
	PI4	Competitive advantage	
	PI5	Technology advances	
	PI6	Profitable growth	
	PI7	Graduation absorption	
Input Quality	IQ1	Practical skills	(Agyeman <i>et al.</i> 2024; He & Hamid, 2024; Kholifah <i>et al.</i> , 2025)
	IQ2	Theory ability	
	IQ3	Motivation	
	IQ4	Technology process capability	
Improvement Efforts	IE1	Periodic monitoring	(Ghobakhloo <i>et al.</i> , 2021; Khan & Ali, 2024; Plummer <i>et al.</i> , 2021)
	IE2	Performance assessment	
	IE3	Strategy assessment	
	IE4	Adaptability	
	IE5	Continuous improvement	

Variables	Constructs	Indicators	Related Studies
Partnership Management	PM1	Leadership	(Jonbekova et al., 2020; Li et al., 2024; Wang, 2024; Xie et al., 2024)
	PM2	Teamwork	
	PM3	Friendship	
	PM4	Time	
	PM5	Facility	
	PM6	Responsibility	
Partnership Benefits	PB1	Development cooperation	(Arthars et al., 2025; Jonbekova et al., 2020; Liu et al., 2025)
	PB2	Best class practice	
	PB3	Win-win solution	
	PB4	Sustainable partnership program	
Value relations	VR1	User satisfaction	(Batubara et al. 2025; Mian et al., 2020; Raffi et al., 2024)
	VR2	Stakeholder wealth	
	VR3	Safety/environment	
	VR4	Acculturation of industrial values	
	VR5	Innovations	
	VR6	Technology	

2.4 Data Analysis

The data collected were analyzed using the PLS-SEM approach. PLS-SEM was chosen because of its ability to handle complex models with many latent variables and indicators, as well as its ability to test causal relationships simultaneously (Daryono et al., 2024; Matin et al., 2024). The measurement model evaluation aims to ensure the validity and reliability of the constructs being measured. Convergent validity was tested using AVE and factor loading values, while discriminant validity was tested using the Fornell-Larcker criteria. Reliability was measured using CA, rho_A, and CR (Al-Fraihat et al., 2020; Hair & Alamer, 2022). After the measurement model met the established criteria, a structural model evaluation was conducted to test the proposed hypotheses. This includes path analysis to identify direct and mediating influences between variables in the model (Hair et al., 2021; Sarstedt et al., 2020). In addition, the R² and effect size tests were also conducted to assess the strength and significance of the relationships in the model.

3. Results and Discussion

3.1 Results

3.1.1 Measurement Model

The purpose of the measurement model evaluation is to ensure that the constructs used in the research model are measured accurately and reliably by the selected indicators. This involves testing convergent validity to ensure that the indicators are consistent in measuring the same construct (using factor loading and AVE), as well as testing internal consistency reliability to ensure that the indicators have good consistency. This evaluation is important to ensure that the data collected is reliable and the constructs in the model are valid.

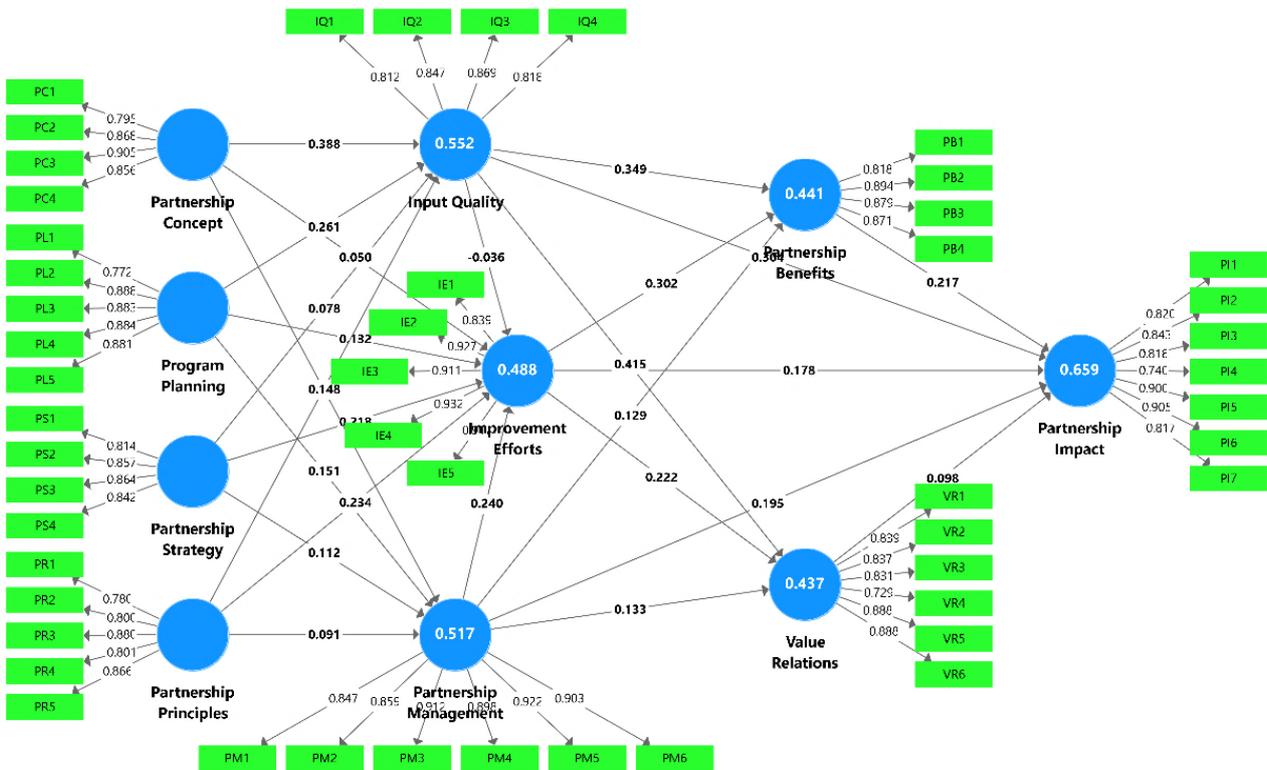


Fig. 1 Results of measurement model

The output of the outer model test in Table 2 shows that all variables have strong convergent validity, indicated by factor loading values above 0.70 (0.729 to 0.932) and AVE above 0.50 (0.683 to 0.821). The AVE value indicates that each variable is able to explain more than 50% of the variance of its items, which is an indication of good validity. In terms of internal consistency reliability, all are above 0.70, with Cronbach alpha values ranging from 0.857-0.948, rho_A ranging from 0.857-0.948, and composite reliability ranging from 0.903-0.958, which means that all variables have high reliability. This indicates that the research instrument used to measure the determinants of university-industry partnerships has met the criteria for adequate validity and reliability, so that the research results can be considered credible and reliable.

Table 2 Convergent validity: factor loading and AVE

Variables	Construct	Convergent Validity		Variables	Construct	Convergent Validity	
		FL	AVE			FL	AVE
Partnership Concept	PC1	0.795	0.734	Input Quality	IQ1	0.812	0.700
	PC2	0.868			IQ2	0.847	
	PC3	0.905			IQ3	0.869	
	PC4	0.856			IQ4	0.818	
Program Planning	PL1	0.772	0.793	Partnership Benefits	PB1	0.818	0.750
	PL2	0.888			PB2	0.894	
	PL3	0.883			PB3	0.879	
	PL4	0.884			PB4	0.871	
	PL5	0.881		Value Relations	VR1	0.839	
Partnership Principles	PR1	0.780	0.713	VR2	0.837		
	PR2	0.800		VR3	0.831		
	PR3	0.880		VR4	0.729		
	PR4	0.801		VR5	0.888		
	PR5	0.866		VR6	0.888		

Variables	Construct	Convergent Validity		Variables	Construct	Convergent Validity	
		FL	AVE			FL	AVE
Improvement Efforts	IE1	0.839	0.821	Partnership Impact	PI1	0.820	0.699
	IE2	0.927			PI2	0.843	
	IE3	0.911			PI3	0.818	
	IE4	0.932			PI4	0.740	
	IE5	0.917			PI5	0.900	
Partnership Management	PM1	0.847	0.683	Partnership Strategy	PS1	0.814	0.745
	PM2	0.859			PS2	0.857	
	PM3	0.912			PS3	0.864	
	PM4	0.898			PS4	0.842	
	PM5	0.922					
	PM6	0.903					

Fornell-Larcker criterion is a technique used to evaluate discriminant validity in PLS-SEM models. The Fornell-Larcker table shows that the correlation value between latent variables is compared to the square root of the AVE of the variable itself. If the square root of the AVE of a variable is greater than the correlation with other variables, then the discriminant validity is met. In the Table 3, we can see that the diagonal value (for example, IE = 0.906) is higher than the correlation with other variables in the column, indicating that each construct better explains its own indicator variable than other variables. This indicates that discriminant validity has been met.

Table 3 Convergent validity: Fornell-Larcker

Variables	IE	IQ	PB	PC	IM	PM	PR	PS	PL	VR
Improvement Efforts (IE)	0.906									
Input Quality (IQ)	0.503	0.837								
Partnership Benefits (PB)	0.552	0.586	0.866							
Partnership Concept (PC)	0.556	0.670	0.603	0.857						
Partnership Impact (IM)	0.613	0.708	0.662	0.668	0.836					
Partnership Management (PM)	0.575	0.653	0.531	0.685	0.663	0.890				
Partnership Principles (PR)	0.601	0.609	0.659	0.642	0.667	0.560	0.826			
Partnership Strategy (PS)	0.596	0.586	0.673	0.681	0.671	0.578	0.648	0.844		
Program Planning (PL)	0.528	0.596	0.582	0.514	0.630	0.514	0.619	0.568	0.863	
Value Relations (VR)	0.507	0.613	0.660	0.584	0.621	0.531	0.564	0.591	0.548	0.837

3.1.2 Structural Model

The R^2 illustrates how much variation in endogenous (dependent) variables can be explained by exogenous (independent) variables. For example, Input Quality (IQ) has an R^2 value of 0.552, indicating that 55.2% of the variation in this variable can be explained by the model. R^2 values are generally classified as low, medium, or high depending on the context of the study. Meanwhile, the f^2 (effect size) shows the effect size or relative influence of exogenous variables on endogenous variables. For example, the Partnership Management (PM) variable has an effect size on the Partnership Impact (PI) variable of 0.124, which indicates that PM has a moderate influence on PI. The f^2 value is interpreted as 0.02 (small), 0.15 (medium), and 0.35 (large).

3.1.3 Path Analysis and Hypothesis Testing

The purpose of path analysis and hypothesis testing is to evaluate the direct and mediation effects between constructs in the model. This involves testing the significance of the path coefficients to determine whether the hypothesized influence between constructs is statistically significant (Ashraf & Ahmed, 2022; Rodriguez-Delgado et al., 2022). In addition, mediation analysis is used to evaluate whether the relationship between two constructs is mediated by a third construct. This analysis is important to understand the complex mechanisms in the model and provides deeper insight into the dynamics of the relationship between variables.

Table 4 Results of path analysis and hypothesis testing

Hyp.	Path	Variables	β -values (+)/ (-)	T-statistics (>1.96)	ρ -values (<0.05)	Decision
H1a	PC → IE	Partnership Concept → Improvement Efforts	0.050	0.815	0.415	Rejected
H1b	PC → IQ	Partnership Concept → Input Quality	0.388	6.914	0.000	Accepted
H1c	PC → PM	Partnership Concept → Partnership Management	0.473	7.398	0.000	Accepted
H2a	PL → IE	Program Planning → Improvement Efforts	0.132	2.245	0.025	Accepted
H2b	PL → IQ	Program Planning → Input Quality	0.261	5.473	0.000	Accepted
H2c	PL → PM	Program Planning → Partnership Management	0.151	3.036	0.003	Accepted
H3a	PS → IE	Partnership Strategy → Improvement Efforts	0.218	3.593	0.000	Accepted
H3b	PS → IQ	Partnership Strategy → Input Quality	0.078	1.375	0.170	Rejected
H3c	PS → PM	Partnership Strategy → Partnership Management	0.112	1.581	0.115	Rejected
H4a	PR → IE	Partnership Principles → Improvement Efforts	0.234	4.283	0.000	Accepted
H4b	PR → IQ	Partnership Principles → Input Quality	0.148	2.725	0.007	Accepted
H4c	PR → PM	Partnership Principles → Partnership Management	0.091	1.670	0.096	Rejected
H5a	IQ → IE	Input Quality → Improvement Efforts	-0.036	0.708	0.479	Rejected
H5b	IQ → PB	Input Quality → Partnership Benefits	0.349	6.985	0.000	Accepted
H5c	IQ → PI	Input Quality → Partnership Impact	0.304	6.457	0.000	Accepted
H5d	IQ → VR	Input Quality → Value Relations	0.415	8.650	0.000	Accepted
H6a	IE → PB	Improvement Efforts → Partnership Benefits	0.302	6.203	0.000	Accepted
H6b	IE → PI	Improvement Efforts → Partnership Impact	0.178	3.941	0.000	Accepted
H6c	IE → VR	Improvement Efforts → Value Relations	0.222	4.522	0.000	Accepted
H7a	PM → IE	Partnership Management → Improvement Efforts	0.240	4.089	0.000	Accepted
H7b	PM → PB	Partnership Management → Partnership Benefits	0.129	2.335	0.020	Accepted
H7c	PM → PI	Partnership Management → Partnership Impact	0.195	4.107	0.000	Accepted
H7d	PM → VR	Partnership Management → Value Relations	0.133	2.684	0.008	Accepted
H8	PB → PI	Partnership Benefits → Partnership Impact	0.217	4.979	0.000	Accepted
H9	VR → PI	Value Relations → Partnership Impact	0.098	2.292	0.022	Accepted

In the hypothesis testing H1a (Partnership Concept → Improvement Efforts), the β -value is 0.050, indicating a very weak relationship between the two variables. The T-Statistics value of 0.815 and P-Values of 0.415 indicate that this result is not statistically significant (rejected). Meanwhile, for hypothesis H2a (Program Planning → Improvement Efforts), the β -value is 0.132 with T-Statistics of 2.245 and P-Values of 0.025, indicating a weak but statistically significant relationship (accepted). In H4a (Partnership Principles → Improvement Efforts), the β -value is 0.234 with T-Statistics of 4.283 and P-Values of 0.000, indicating a positive and significant relationship (accepted). Hypothesis H5a (Input Quality → Improvement Efforts) is rejected because it has a negative β -value (-0.036), T-Statistics of 0.708, and P-Values of 0.479.

Overall, the results of the four hypotheses tested indicate that not all variables have a significant influence on Improvement Efforts in the context of university and industry partnerships in vocational education. Significant results were found in hypotheses H2a and H4a, which indicate that program planning and partnership principles play an important role in improving improvement efforts. However, the concept of partnership and input quality were not proven to be significant in influencing improvement efforts based on the results of testing H1a and H5a.

3.2 Discussion

Based on the results of data analysis it was found that in general, this study revealed the success factors of TVET's partnership with the industry. This research confirms that the first dimension of UI cooperation needs to be

implemented to increase the relevance of educational programs and align curriculum with the needs of the world of work. With close cooperation, the gap between UI programs can be reduced, and at the same time, the role of vocational higher education as a link between students and the world of work or industry can be increased. The previous study by Brunetti *et al.* (2020) and Zheng *et al.* (2024) is consistent with our research that UI partnerships provide relative information regarding forms of cooperation in skills upgrading training, curriculum development, and apprenticeship implementation. This research supports study Mian *et al.* (2020) that some of the goals of UI partnerships are pursued as information exchange, synchronization and implementation of competency tests and certification, equalizing the relevance of learning, practical industrial work, special job fairs, and recruitment.

In terms of curriculum alignment, tertiary institutions have collaborated with the industry in compiling industry-based curricula with reference to the guidelines of the Ministry of education. However, based on the H1a hypothesis, it is rejected because it has not maximized partner involvement with the industry. The results of this study are consistent with the results of Daryono *et al.* (2020) and Zeng *et al.* (2025) which concluded that the implementation of curriculum synchronization was dominated by higher education management but had not been well planned. This has an impact on the participation of the industry is not maximized. Both UI are expected to sit together from the start of compiling the curriculum with the material so that the competencies mastered by students are in sync with the competencies and skills demanded by the industry. Situations and circumstances like this can be improved, among others, by strengthening coaching in internship programs.

This research is inconsistent with the study of Poschauko *et al.* (2024) which illustrates that the synchronization of the tertiary curriculum with the demands of the world of work in the government sector and the private or industrial sector is not optimal. However, the results of another study by Pujun (2025) provide reverse information that supports this research, namely that the forms of UI partnerships in majors are quite varied and carried out routinely through joint curriculum review and adjustment activities with industry and the implementation of internships for students. In improving the quality of higher education, the UI in establishing partnerships requires a second dimension that is disclosed in this study, including condition analysis, accommodation needs, provision of funds, cooperation SOPs and agreements (MoU). This research reveals that universities have cooperated with the world of work but have not expanded and followed up regarding the MoU. Collaboration can increase the cost of implementing and developing TVET. The need for agreement and awareness that cooperation or MOU between universities and industries is in line with the results of a study by Amrullah *et al.* (2025) and Efendi *et al.* (2025) which is a model of education in an effort to increase the professionalization of human resources. Inconsistent empirical studies according to a study by Batubara *et al.* (2025) and Xie *et al.* (2025) concluded that UI partnerships were manifested in the form of an agreement between the two parties (MoU) related to the implementation of internships, guest speakers, competency tests, audiences, and other seminars to enhance the development of TVET partnerships with industry.

The third dimension of UI partnership disclosed in this study is basic principles, strategic plan milestones, building cooperation, and work programs. The results of Liu *et al.* (2025) and Widodo *et al.* (2025) prove that synergistic cooperation simultaneously contributes to mastery of student competencies and support for industrial facilities, technical guidance, and competencies contribute to the quality of graduates. In addition, research by Ćudić *et al.* (2022) emphasizes that internships in the industry supported by facilities and technical guidance will contribute to the competence and expertise of students. The fourth dimension, encompassing communication, service, trust, integrity, and excellence growth, is identified as a key success factor for university-industry (UI) partnerships. Effective and continuous communication aligns educational concepts with industrial needs, fostering collaboration. Studies by Jonbekova *et al.* (2020) emphasize that strong communication enhances collaboration by facilitating the exchange of ideas, evaluations, and conflict resolution, ultimately improving productivity and creating a professional and conducive partnership environment. Meanwhile, the fifth dimension focuses on practical skills, theoretical ability, motivation, and technology capability. Hypotheses H3b and H3c are rejected due to the lack of a significant relationship between partnership strategy and input quality or partnership management. A gap identified in this study is that universities often overlook Industry 4.0 skills when setting partnership goals, which is essential for sustainable innovation as argued by Raffi *et al.* (2024).

The sixth dimension of UI partnerships, involving regular monitoring, strategy assessment, performance appraisal, and continuous improvement, highlights that hypothesis H5a is rejected, as input quality is not significantly linked to improvement efforts. This aligns with Li *et al.* (2024), who found that while large-scale industries regularly evaluate apprenticeships, small-scale industries require more binding agreements, such as MoUs, for effective monitoring. Monthly evaluations are recommended to track student progress during apprenticeships. The seventh dimension sees hypothesis H4c rejected, indicating that partnership principles do not significantly impact partnership management. This suggests that collaboration between universities and industries, particularly regarding industry-based infrastructure, remains suboptimal. This finding contradicts studies by He & Hamid (2024) and Khan & Ali (2024), which assert that higher education facilities generally meet industry standards. To address this gap, the study recommends enhancing cooperation to improve infrastructure, especially for industrial practice programs, to better align with graduate quality improvement goals.

The eighth dimension of UI partnerships focuses on developing cooperation, best practices, mutual benefits, and sustainable partnership programs. This study supports findings from Ghobakhloo *et al.* (2021), demonstrating that partnerships offer mutual benefits, such as providing industries with skilled workers and benefiting from TVET internships. The ninth dimension highlights that strong cooperation enables TVET institutions to stay updated with technological innovations and industrial practices, ensuring that academic teachings align with real-world industry standards. Finally, the tenth dimension emphasizes that partnerships help TVET institutions achieve their goals by improving education quality, multi-skilling, and facilitating the transition from campus to the workforce. Studies by Plummer *et al.* (2021), confirm that collaboration accelerates students' readiness for work, helping them adjust, choose suitable careers, and develop professionally.

4. Conclusion

In enhancing partnerships, a more prominent commitment is needed from the four main actors in the national innovation system: the government, universities, industry, and the entire local community. The collaboration of the four parties will produce positive synergies to increase innovation and community welfare. The UI partnership provides mutual benefits for investing in the employability and skills development of graduates. Higher education institutions can increase the absorption of graduates in employment and meet labor market demands. So, it has an impact on national economic growth. This research recommends that UI partnerships can build knowledge-based industries so that innovation can be achieved. Higher education as an educational institution can provide an increase in a knowledge-based economy through mutually beneficial cooperation with industry. The impact is expected to be felt by the community through small and medium-scale industries. In achieving the success and benefits of establishing a UI partnership, the support and role of the government are indispensable. Industry plays an important and dominant role in supporting the strength of the national economy so appropriate government policies in industrial development are indispensable.

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Conflict of Interest

The authors declare no conflict of interest regarding the paper's publication.

Author Contribution

The authors confirm their contribution to the paper as follows: **study conception and design:** K.S. Wahyudi; H. Sofyan; Wagiran; **data collection:** P K.S. Wahyudi; **analysis and interpretation of results:** K.S. Wahyudi; **draft manuscript preparation:** K.S. Wahyudi; H. Sofyan; Wagiran; N.B.A. Samad. All authors reviewed the results and approved the final version of the manuscript.

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