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Strategic Partnerships Between Vocational Education and Industry: A Systematic Review of Link and Match, Governance, and Digital Transformation

Widyatmike Gede Mulawarman[1], Akhmad[2], Indra Astuti[3]*, Suwartini[4], Sri Nor Handayani[5], Sulau[6], Didik Hartono[7], Hardono[8]
[12345678] *Faculty of Teacher Training and Education, Universitas Mulawarman, Indonesia*

Corresponding e-mail : indraastuti821@gmail.com

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ABSTRACT

Industry involvement in vocational education does not necessarily ensure competency alignment or sustainable institutional collaboration. This systematic literature review synthesises evidence on strategic education–industry partnerships, focusing on collaborative governance, link and match, and digital transformation. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020), Scopus and Web of Science were searched on 5 September 2026 for English-language, open-access journal articles published between 2022 and 2026. Of 796 records identified, 32 studies met the inclusion criteria. Thirty-one empirical studies were appraised using the Mixed Methods Appraisal Tool (MMAT 2018), while one descriptive-contextual study informed the contextual synthesis. Three overlapping partnership approaches emerged: collaborative governance, resource integration and joint value creation, and work-based learning. Effective link and match was characterised by jointly aligned curricula, authentic workplace tasks, structured supervision, and employer participation in competency assessment. However, improvements in student competencies did not necessarily demonstrate reciprocal institutional benefits or partnership sustainability. Digitalisation was substantively examined in only 13 studies (40.6%), mainly in teaching and assessment, with limited evidence of its contribution to institutional coordination. The review proposes a literature-derived framework linking governance, competency alignment, digital capabilities, and continuous evaluation. It distinguishes student-level outcomes from institutional partnership effectiveness and identifies operational indicators for future assessment. Methodological heterogeneity and restrictions to English-language, open-access literature indexed in Scopus and Web of Science limit generalisability; the proposed framework requires empirical validation.

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INTRODUCTION

Rapid technological change, evolving production systems, and the transition towards Industry 5.0 require vocational education institutions to develop technical, adaptive, and digital competencies that remain relevant to labour-market needs. Grip & Gustavsson (2026) and Mazlan et al. (2025) emphasise the importance of leadership support, learning-oriented work design, and cross-stakeholder collaboration in skills development. Nevertheless, industry involvement does not necessarily ensure that graduates possess competencies recognised by employers. Drawing on evidence from six low- and middle-income countries, Allais et al. (2025) found that technical and vocational education and training (TVET) qualifications were not consistently recognised in recruitment practices. The central challenge, therefore, is not simply to expand the number of cooperation agreements but to improve the alignment between occupational demands, educational provision, and the benefits generated by collaboration.

In this review, strategic partnerships between vocational education and industry are defined as institutional relationships built around shared objectives, clearly allocated responsibilities, resource commitments, and accountability for collaborative outcomes. This concept is distinct from collaborative governance, which concerns the processes through which partners coordinate activities, make joint decisions, and evaluate progress. By contrast, link and match refers to the operational alignment of curricula, learning experiences, and competency assessments with occupational requirements. Mende et al. (2025) highlight the diversity of institutional arrangements governing vocational education systems, while Smith et al. (2025) report that employers and training providers perceive partnership benefits differently. Collaborative governance may therefore connect institutional commitment with competency alignment, but this relationship should not be assumed to produce effective partnerships automatically.

The effectiveness of these arrangements depends on institutional conditions and the interests of the participating stakeholders. In Shenzhen, Yu et al. (2025) identified policy constraints, weak institutional commitment, and ineffective communication as barriers to education–industry integration. Rintala et al. (2026) likewise demonstrate that vocational education collaboration in Finland serves different purposes, including organising workplace learning, supplying skilled labour, and supporting sectoral development. These differing priorities may create trade-offs between industry's short-term productivity expectations and education's broader goals of transferable competence and long-term learner development. Accordingly, partnership effectiveness needs to be assessed through coordination quality, the balance of reciprocal benefits, and the continuity of collaboration, while accounting for institutional capacity and policy context.

At the implementation level, link and match encompasses joint curriculum development, work-based learning (WBL), work-integrated learning (WIL), structured supervision, and employer participation in competency assessment. Sutiman et al. (2022) underscore the importance of learner preparedness, interactions with workplace supervisors, and the integration of internship experiences into the curriculum. A realist review by Groenier et al. (2025) also identifies challenging authentic tasks, reflection, interaction, and guidance as conditions supporting the development of adaptive expertise. Consequently, link and match should not be judged solely by the number of internship placements or improvements in individual competencies. Such outcomes must be distinguished from direct evidence of reciprocal benefits and partnership effectiveness at the institutional level.

Digital transformation may support these processes through learning platforms, simulations, assessment systems, and information exchange. However, the adoption of educational technology should not be equated with improved partnership governance. Rauseo et al. (2022) show that digital transformation in vocational schools involves leadership, organisational arrangements, institutional culture, and teachers' capabilities, rather than technological provision alone. Its contribution to inter-organisational coordination and long-term partnership sustainability therefore warrants separate evaluation. In this review, digital transformation is conceptualised as a context-dependent enabling condition, without assuming that the evidence supporting its institutional effects is as extensive as that concerning governance and competency alignment.

Previous reviews have primarily examined vocational education governance (Mende et al., 2025), mechanisms of work-based learning (Groenier et al., 2025), and learning and skills development during industrial transitions Grip & Gustavsson (2026) as separate areas of inquiry. Less is known about how collaborative governance is translated into high-quality link and match practices and, subsequently, into sustainable institutional benefits across different vocational education systems. Addressing this gap requires a synthesis that distinguishes student, programme, and institution-level outcomes; considers differences in policy environments and stakeholder interests; and interprets findings in relation to the methodological strength of the available evidence.

To address this gap, the present study systematically reviews research published between 2022 and 2026 and is guided by four research questions:

1. What forms of strategic partnerships and collaborative governance arrangements between vocational education institutions and industry are reported in the literature?
2. How is link and match implemented through curriculum alignment, work-based learning, and competency development?

3. How does digital transformation support education–industry collaboration, and to what extent does the available evidence demonstrate its contribution to institutional coordination and partnership sustainability?
4. What enabling factors, implementation barriers, and proposed indicators are reported for assessing the effectiveness and sustainability of vocational education–industry partnerships?

This review contributes a literature-derived conceptual framework that proposes context-dependent relationships among collaborative governance, competency alignment, digital capabilities, and the continuous evaluation of reciprocal benefits. The framework distinguishes student learning outcomes from institutional partnership outcomes and treats institutional context as a condition that may shape these relationships. It is intended to guide future comparative and longitudinal research and should not be interpreted as an empirically validated causal model.

METHOD

Study Design

This study employed a systematic literature review (SLR) to identify, appraise, and synthesise evidence on strategic partnerships between vocational education institutions and industry. The review addressed four interrelated areas: collaborative governance, the implementation of link and match, digital transformation, and the factors influencing partnership effectiveness and sustainability. The identification and selection of studies were reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) (Page et al., 2021). The search strategy was also reported with reference to PRISMA-S recommendations (Rethlefsen et al., 2021). A narrative thematic synthesis was undertaken because the included articles differed in research design, institutional context, unit of analysis, and outcome measures. Methodological appraisal was conducted using the Mixed Methods Appraisal Tool (MMAT 2018) (Hong et al., 2018).

Data Sources and Literature Search Strategy

Literature searches were conducted on 5 September 2026 in Scopus and Web of Science (WoS). The search strategy combined two conceptual groups: (1) education–industry partnerships and collaboration, including work-based learning (WBL) and work-integrated learning (WIL); and (2) vocational education and training. Synonymous terms within each group were combined with OR, and the two groups were connected using AND. The Boolean search string was as follows:

> (("strategic partnership*" OR "industry partnership*" OR "industry-education collaboration" OR "education-industry collaboration" OR "school-industry collaboration" OR "school-industry cooperation" OR "industry-academia collaboration" OR "industry engagement" OR "industry cooperation" OR "public-private partnership*" OR "work-based learning" OR "work-integrated learning") AND ("vocational education" OR "vocational training" OR "technical and vocational education and training" OR "technical education" OR "TVET" OR "vocational school*" OR "polytechnic*" OR "vocational institution*"))

The initial searches identified 796 records: 366 from Scopus and 430 from WoS. The results were restricted to English-language, open-access journal articles published between 2022 and 2026. After these limits were applied, 239 records remained (Scopus = 148; WoS = 91). The open-access and language restrictions facilitated full-text assessment but may have excluded relevant studies not available in English or without open access.

Inclusion and Exclusion Criteria

Articles were eligible if they addressed vocational education or technical and vocational education and training (TVET), examined an education–industry relationship, and provided information relevant to at least one review question. Qualitative, quantitative, and mixed-methods studies were eligible. Missing information on a particular indicator did not automatically lead to exclusion when the study still offered traceable contextual evidence relevant to the synthesis. Eligibility decisions were made separately from assessments of methodological quality.

Table 1. Inclusion and exclusion criteria applied in the study selection process

Aspect	Inclusion criteria	Exclusion criteria
Publication year	Published between 2022 and 2026.	Published outside the 2022–2026 period.
Language and publication type	English-language journal articles.	Publications other than journal articles or articles not written in English.
Access	Full text available through open access.	Full text not available through open access.
Context and relationship	Addresses vocational education/TVET and education–industry relationships, including WBL/WIL, internships, or partnerships.	Outside the vocational education context or does not address education–industry relationships.
Relevance and data	Reports mechanisms, experiences, or findings relevant to at least one review focus and provides sufficiently traceable information.	Not relevant to the review or provides insufficient information for synthesis.

Literature Selection Procedure

After the initial year, language, publication-type, and access restrictions, 239 records remained; 557 records did not meet these initial requirements. A further 79 DOI-based duplicates were removed, leaving 160 unique articles for title and abstract screening. At this stage, 50 articles were excluded because they were outside the vocational education context (n = 15), did not examine education–industry relationships (n = 14), or were unrelated to the review focus (n = 21). Full texts of the remaining 110 articles were assessed. Seventy-eight were excluded because partnership mechanisms were insufficiently described (n = 23), competency alignment was not adequately addressed (n = 20), digitalisation content fell outside the scope of the review (n = 19), or the available information was insufficient for synthesis (n = 16). Thus, 32 articles were included in the final synthesis. The selection process is presented in the PRISMA 2020 flow diagram (Figure 1).

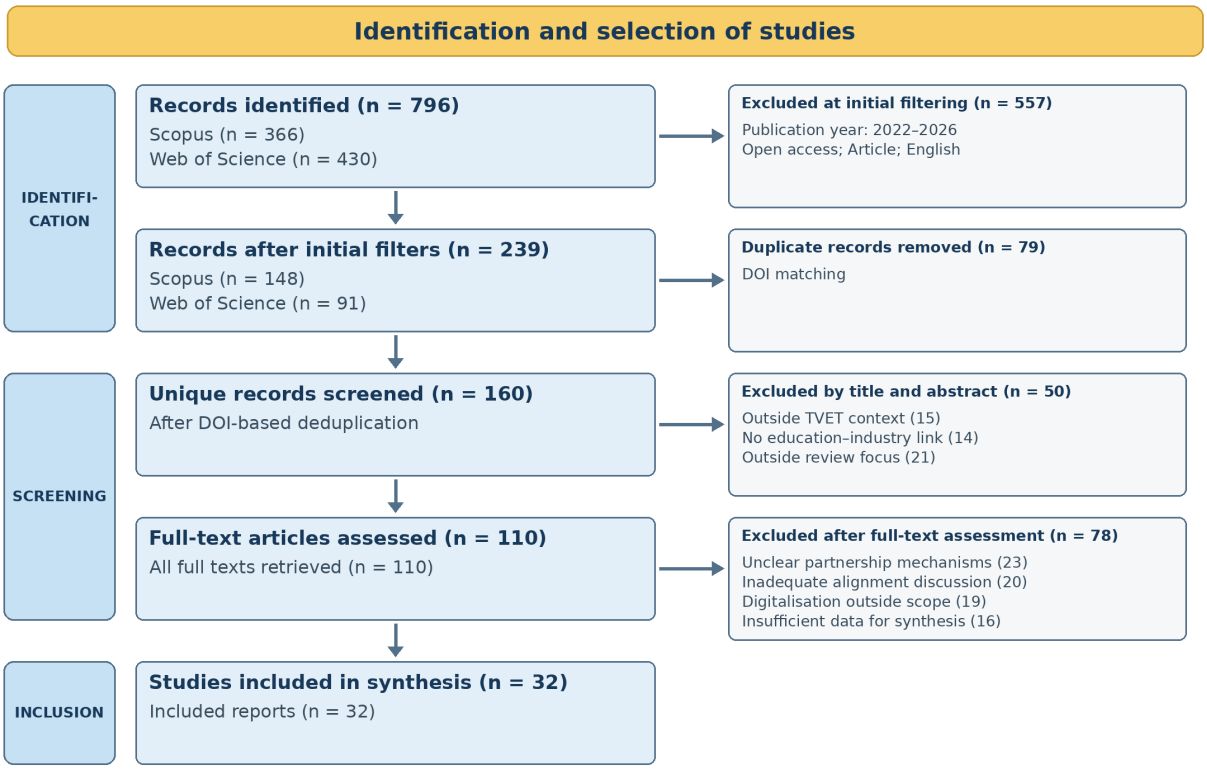


Figure 1. PRISMA 2020 flow diagram of literature selection

Eight authors participated in screening and verifying article eligibility using the same inclusion and exclusion criteria. Disagreements about eligibility were discussed until consensus was reached. This screening process was distinct from the methodological quality appraisal conducted using MMAT 2018.

Data Extraction and Thematic Synthesis

Data from the 32 included articles were recorded in an extraction matrix covering bibliographic information; country, policy, and institutional context; study aims and design; participants or data sources; forms of partnership; implementation of link and match; aspects of digital transformation; principal findings; and methodological or reporting limitations. Coding was conducted at the article level. For each theme, an article was classified as making a major contribution, a secondary contribution, or no substantive contribution. An article could contribute to more than one theme; consequently, thematic frequencies were non-mutually exclusive and were not expected to sum to 32.

The synthesis followed the stages outlined by Thomas & Harden (2008)): repeated reading of the findings, initial coding, development of descriptive themes, and cross-study comparison to generate analytical interpretations. Findings were organised into four themes: (1) partnership models and governance; (2) link and match, WBL/WIL, and competency development; (3) digital transformation; and (4) enabling factors and implementation barriers. Thematic frequencies were used to describe the extent of coverage in the literature, not to estimate effect sizes, establish the strength of evidence, or measure partnership effectiveness.

Contextual Comparison and Levels of Evidence

Cross-study comparisons considered country and policy environment, institutional type and education level, industry sector, resource capacity, forms of partner involvement, study design, and outcome measures. Findings were classified by their predominant level of analysis: (1) student or participant outcomes; (2) programme, curriculum, or implementation outcomes; and (3) institutional, policy, or partnership-system outcomes. These categories describe the focus of the evidence rather than methodological quality. Improvements in student competence, internship experiences, or work readiness were not assumed to demonstrate reciprocal institutional benefits or long-term partnership sustainability.

Where findings differed or appeared contradictory, their interpretation considered variation in policy settings, participant characteristics, definitions of success, measurement procedures, and methodological quality. Studies using non-comparable contexts or indicators were not treated as providing equivalent estimates of effect. Given this heterogeneity, a quantitative meta-analysis was not conducted.

Methodological Quality Appraisal

The methodological quality of the included literature was examined using MMAT 2018 (Hong et al., 2018). All 32 articles were first assessed against two screening questions: whether the research question or objective was clearly stated (S1) and whether the collected data were adequate to address that question or objective (S2). Design-specific criteria were then considered in light of the screening results. Qualitative studies were mapped to Category 1 (criteria 1.1–1.5); non-randomised quantitative studies to Category 3 (criteria 3.1–3.5); quantitative descriptive studies to Category 4 (criteria 4.1–4.5); and mixed-methods studies to the relevant qualitative and quantitative criteria together with integration criteria in Category 5 (criteria 5.1–5.5).

The corpus comprised 13 qualitative studies, seven non-randomised quantitative studies, one quantitative descriptive study using secondary data, and 11 mixed-methods studies. Their distribution and corresponding MMAT categories are presented in Table 2.

Table 2. Distribution of the 32 included articles by study design and corresponding MMAT categories

Study design	Number of articles	MMAT categories applied
Qualitative	13	S1–S2 and Category 1 (1.1–1.5).
Non-randomised quantitative	7	S1–S2 and Category 3 (3.1–3.5).
Quantitative descriptive	1	S1–S2 and Category 4 (4.1–4.5).
Mixed methods	11	S1–S2; Category 1 for the qualitative component; Category 3 or 4 for the quantitative component; and Category 5 for integration.
Total	32	All articles were assessed using the S1–S2 screening questions.

In mixed-methods studies, each component was appraised according to its respective design. All 11 mixed-methods studies included a qualitative component and an integration component. Three studies used a non-randomised quantitative component, whereas eight used a quantitative descriptive component. Accordingly, the number of appraisal units at the component level was 24 qualitative components (13 qualitative studies plus 11 qualitative components from mixed-methods studies), 10 non-randomised quantitative components (seven non-randomised quantitative studies plus three components from mixed-methods studies), nine quantitative descriptive components (one quantitative descriptive study plus eight components from mixed-methods studies), and 11 mixed-methods integration units**.**

Table 3. Number of MMAT appraisal units and denominators by methodological component

MMAT appraisal unit	Number of units	Basis for the denominator
Qualitative components (1.1–1.5)	24	13 qualitative studies + 11 qualitative components from mixed-methods studies.
Non-randomised quantitative components (3.1–3.5)	10	7 non-randomised quantitative studies + 3 non-randomised quantitative components from mixed-methods studies.
Quantitative descriptive components (4.1–4.5)	9	1 quantitative descriptive study + 8 quantitative descriptive components from mixed-methods studies.
Mixed-methods integration (5.1–5.5)	11	11 mixed-methods studies.

Therefore, the denominator for each group of criteria represents the number of studies or components relevant to that group of criteria, rather than the total number of articles in the review corpus. The differences in denominators result from appraising the components of mixed-methods studies separately and do not indicate an inconsistency in the calculations.

Each criterion was assigned one of three responses: Yes (the criterion was met based on the information reported), No (the reported information indicated that the criterion was not met), or Can't tell (the available information was insufficient to determine whether the criterion was met). Can't tell was not treated as equivalent to No. In accordance with the MMAT 2018 approach, appraisal results were reported for each criterion and were not aggregated into a single overall quality score. The final matrix presents the decision for each article and criterion, the supporting evidence with PDF page references, and the rationale for each appraisal decision.

For the screening questions, all 32 articles received Yes for S1. For S2, 31 articles received Yes and one article, Kraja & Dedej (2022), received Can't tell. This article was retained in the review corpus because it provided relevant secondary data as a quantitative descriptive study. However, because the reporting of data sources, sampling strategy, target population, measurement operationalisation, response rate, and statistical analysis procedures was insufficient, all quantitative descriptive criteria (4.1–4.5) were rated Can't tell. This decision was documented transparently and was not changed to No in the absence of sufficient evidence.

The methodological quality appraisal was used to calibrate the strength of the interpretations in the synthesis, rather than serving as the sole basis for excluding articles that met the inclusion criteria. The complete appraisal results, page-level evidence, and criterion-specific rationales are provided in the MMAT 2018 appraisal matrix.

Methodological Limitations and Transparency

The scope of this review was limited by the use of Scopus and Web of Science, the restriction to English-language open-access articles, and the diversity of study designs and research contexts. These restrictions may have resulted in relevant evidence being overlooked and may limit the transferability of the findings across different vocational education systems. To support transparency and traceability, the data-extraction and coding matrix for the 32 articles, the PRISMA flow diagram, and the article- and criterion-level MMAT appraisal matrix are provided as supplementary materials. Theoretical and methodological sources used to explain the procedures or interpret the findings are distinguished from the 32 articles that constitute the core review corpus.

RESULTS AND DISCUSSION

RESULTS

This section synthesises 32 articles published between 2022 and 2026. The findings are organised into the characteristics of the included literature, methodological appraisal, thematic coverage, levels of evidence, findings across the four themes, and a cross-thematic synthesis. All 32 articles were retained in the synthesis and assessed using the MMAT 2018 screening and design-specific criteria. Theme frequencies describe the extent to which topics were addressed in the literature; they do not represent effect sizes or direct measures of partnership effectiveness. Evidence concerning institutional-level partnership outcomes is distinguished from student-level learning outcomes.

Characteristics of the Included Literature

The 32 articles were published between 2022 and 2026. The largest numbers were published in 2025 (12 articles; 37.5%) and 2026 (9; 28.1%), together accounting for 21 articles (65.6%). The remaining articles were published in 2022 (8; 25.0%), 2023 (2; 6.3%), and 2024 (1; 3.1%).

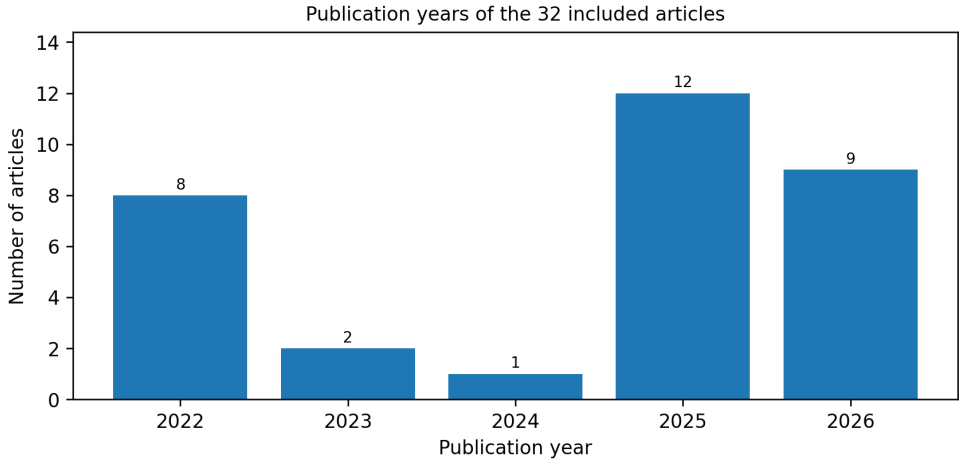


Figure 2. Distribution of publication years among the 32 included articles.

Table 4. Publication year of the included articles.

Publication year	Number of articles (n)	Percentage
2022	8	25.0%
2023	2	6.3%
2024	1	3.1%
2025	12	37.5%
2026	9	28.1%
Total	32	100.0%

The articles covered 13 national contexts: Indonesia, China, Malaysia, Finland, South Africa, Thailand, Taiwan, Tanzania, Norway, Albania, the United Kingdom, Australia, and Germany. Cross-national or regional studies addressed Indonesia and Malaysia, six low- and middle-income countries, European Union policy, and public–private TVET partnership initiatives in Russia, India, and China. The geographical distribution, educational levels, policy settings, and industrial structures were uneven; therefore, comparisons across studies require attention to contextual differences.

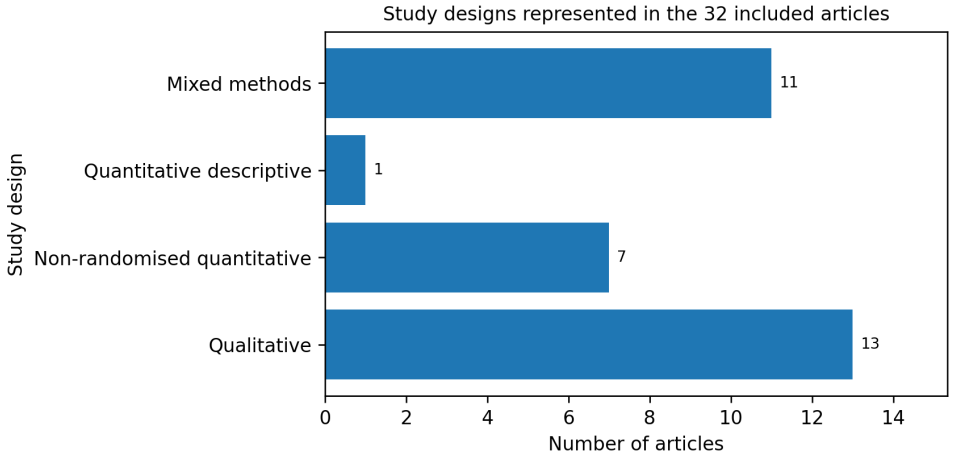


Figure 3. Distribution of the 32 included articles by reported study design.

At the article level, 13 studies used qualitative approaches (40.6%), seven used non-randomised quantitative approaches (21.9%), one used a quantitative descriptive approach based on secondary data (3.1%), and 11 used mixed methods (34.4%). The quantitative descriptive study was Kraja & Dedej (2022), which presented secondary statistical data and contextual discussion. Its inclusion and MMAT treatment are described below.

Table 5. Distribution of the included articles by study design and corresponding MMAT appraisal.

Reported study design	Articles (n)	Percentage	MMAT appraisal applied
Qualitative	13	40.6%	Category 1 for 13 qualitative studies; qualitative components of mixed-methods studies were assessed separately (total qualitative components: 24).
Non-randomised quantitative	7	21.9%	Category 3 for 7 studies, plus 3 non-randomised quantitative components from mixed-methods studies (total: 10).
Quantitative descriptive	1	3.1%	Category 4 for 1 study, plus 8 quantitative descriptive components from mixed-methods studies (total: 9).
Mixed methods	11	34.4%	Category 5 for integration (11 studies); qualitative and quantitative components were assessed using their respective design-specific criteria.
Total	32	100.0%	All 32 articles received the MMAT screening questions (S1–S2).

Methodological Quality Appraisal

The MMAT 2018 screening questions were applied to all 32 included articles. All 32 received Yes for S1 (clarity of the research question or objective), while 31 received Yes and one received Can't tell for S2 (adequacy of the data to address the research question or objective). The article by Kraja & Dedej (2022) received Can't tell for S2 because the full text did not sufficiently identify the primary data sources or explain the selection of datasets, sampling procedures, measurement operationalisation, nonresponse, or analytical procedures. The article was retained as contextual and descriptive evidence and assessed using the quantitative descriptive criteria; all five criteria in Category 4 (4.1–4.5) were rated Can't tell.

Table 6a. MMAT 2018 screening-question results.

Screening question	N	Yes, n (%)	No, n (%)	Can't tell, n (%)
S1. Clear research question or objective	32	32 (100.0%)	0 (0.0%)	0 (0.0%)
S2. Data adequate to address the research question	32	31 (96.9%)	0 (0.0%)	1 (3.1%)

The 11 mixed-methods studies contributed one qualitative component and one integration component each. Three included a non-randomised quantitative component, while eight included a quantitative descriptive component. Accordingly, the component-level denominators were 24 qualitative components (13 qualitative studies plus 11 mixed-methods components), 10 non-

randomised quantitative components (seven standalone studies plus three mixed-methods components), nine quantitative descriptive components (one standalone study plus eight mixed-methods components), and 11 integration components. These counts overlap at the article level and should not be summed to obtain the number of unique articles.

Table 6b. MMAT results for qualitative components (n = 24).

Criterion	N	Yes, n (%)	No, n (%)	Can't tell, n (%)
1.1. Appropriateness of the qualitative approach	24	24 (100.0%)	0 (0.0%)	0 (0.0%)
1.2. Adequacy of qualitative data collection	24	22 (91.7%)	0 (0.0%)	2 (8.3%)
1.3. Findings adequately derived from data	24	18 (75.0%)	0 (0.0%)	6 (25.0%)
1.4. Interpretations substantiated by data	24	20 (83.3%)	0 (0.0%)	4 (16.7%)
1.5. Coherence of data sources, collection, analysis, and interpretation	24	18 (75.0%)	0 (0.0%)	6 (25.0%)

Table 6c. MMAT results for non-randomised quantitative components (n = 10).

Criterion	N	Yes, n (%)	No, n (%)	Can't tell, n (%)
3.1. Representativeness of participants	10	3 (30.0%)	6(60.0%)	1 (10.0%)
3.2. Appropriateness of outcome and exposure measurements	10	6 (60.0%)	0 (0.0%)	4 (40.0%)
3.3. Completeness of outcome data	10	3 (30.0%)	0 (0.0%)	7 (70.0%)
3.4. Consideration of confounding factors	10	1 (10.0%)	7 (70.0%)	2 (20.0%)
3.5. Implementation of intervention/exposure as intended	10	2 (20.0%)	1 (10.0%)	7 (70.0%)

Table 6d. MMAT results for quantitative descriptive components (n = 9).

Criterion	N	Yes, n (%)	No, n (%)	Can't tell, n (%)
4.1. Relevance of the sampling strategy	9	5 (55.6%)	0 (0.0%)	4 (44.4%)
4.2. Representativeness of the sample	9	0 (0.0%)	3 (33.3%)	6 (66.7%)
4.3. Appropriateness of measurements	9	2 (22.2%)	0 (0.0%)	7 (77.8%)
4.4. Risk of nonresponse bias	9	0 (0.0%)	0 (0.0%)	9 (100.0%)
4.5. Appropriateness of statistical analysis	9	8 (88.9%)	0 (0.0%)	1 (11.1%)

Table 6e. MMAT results for mixed-methods integration (n = 11).

Criterion	N	Yes, n (%)	No, n (%)	Can't tell, n (%)
5.1. Rationale for using a mixed-methods design	11	9 (81.8%)	0 (0.0%)	2 (18.2%)
5.2. Integration of the study components	11	9 (81.8%)	0 (0.0%)	2 (18.2%)
5.3. Interpretation of integrated findings	11	7 (63.6%)	0 (0.0%)	4 (36.4%)
5.4. Handling of divergences between components	11	1 (9.1%)	0 (0.0%)	10 (90.9%)
5.5. Quality of each component within its methodological tradition	11	0 (0.0%)	0 (0.0%)	11 (100.0%)

The appraisal results varied across methodological designs. All 24 qualitative components met criterion 1.1, while criteria concerning the derivation of findings (1.3) and coherence between data sources, collection, analysis, and interpretation (1.5) each received six Can't tell ratings. Among the 10 non-randomised quantitative components, representativeness was rated No in six components (60.0%), and confounding was not adequately addressed in seven (70.0%). Outcome-data completeness and intervention fidelity were also frequently unclear, with seven Can't tell ratings for each criterion (3.3 and 3.5).

The nine quantitative descriptive components showed substantial reporting limitations. None met criterion 4.4 concerning nonresponse bias; all nine were rated Can't tell. Sample representativeness (4.2) and measurement appropriateness (4.3) also received six and seven Can't tell ratings, respectively. Although statistical analysis was rated Yes in eight components (4.5), this did not compensate for limitations in sampling and measurement reporting.

For the 11 mixed-methods studies, the rationale for using mixed methods and the integration of components were rated Yes in nine studies each (5.1 and 5.2). However, the handling of

divergences between qualitative and quantitative findings was rated Can't tell in 10 studies (5.4), and the quality of each component within its methodological tradition could not be established in any of the 11 studies (5.5). Overall, the appraisal indicates that the evidence is more consistently reported in relation to the appropriateness of research approaches than in relation to sampling, confounding, nonresponse, intervention fidelity, and mixed-methods integration. These limitations constrain causal inference and require cautious interpretation of claims about partnership effectiveness.

Several article-specific reporting issues further informed the interpretation. Wahyudin et al. (2025) did not clearly report the final sample and several procedures; Cai & Xu (2026) reported 110 institutions in the methods section but 120 in the abstract/results; and the quantitative sample and cycle-level participants reported by R. Wahyuningsih et al. (2025) were not fully reconciled. Smith et al. (2025) was published in 2025, although its fieldwork was conducted in 2016. These issues were retained as source-level caveats rather than resolved through assumptions.

Thematic Coverage and Article-Level Coding

Each article was coded for each theme as making a major contribution, a secondary contribution, or no substantive contribution. A major contribution indicated that the theme was central to the article, whereas a secondary contribution indicated relevant discussion that was not the article's main focus. Incidental references were not counted. Because an article could contribute to more than one theme, thematic categories were non-exclusive across the four themes.

Table 7. Non-exclusive thematic coverage based on the article-level coding matrix.

Theme	Major contribution	Secondary contribution	Substantive contribution (major + secondary)	No substantive contribution
Strategic partnerships and governance	19 (59.4%)	12 (37.5%)	31 (96.9%)	1 (3.1%)
Link and match / WBL / competency alignment	29 (90.6%)	3 (9.4%)	32 (100.0%)	0 (0.0%)
Digital transformation	5 (15.6%)	8 (25.0%)	13 (40.6%)	19 (59.4%)
Enabling factors and implementation barriers	23 (71.9%)	9 (28.1%)	32 (100.0%)	0 (0.0%)

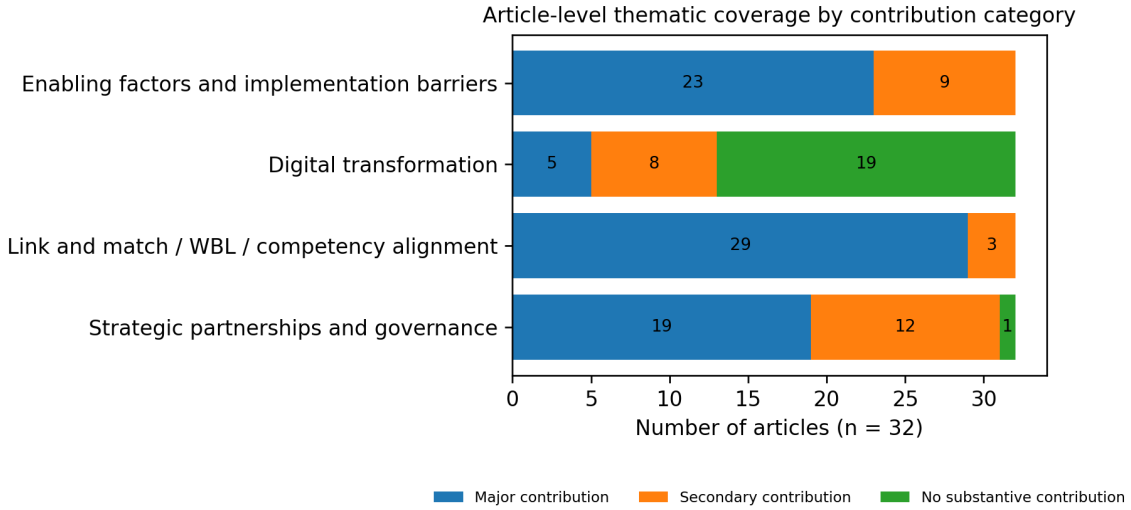


Figure 4. Major, secondary, and non-substantive contributions across the four themes in the 32 articles.

Link and match was substantively addressed in all 32 articles, with a major contribution in 29. Enabling factors and implementation barriers were also addressed substantively in all 32 articles. Strategic partnerships and governance were substantively addressed in 31 articles (96.9%). By comparison, digital transformation was substantively addressed in 13 articles (40.6%): five as a major contribution and eight as a secondary contribution. The remaining 19 articles did not discuss

digital transformation substantively. These frequencies indicate thematic coverage, not the strength or effectiveness of the practices reported.

Table 8. Article-number traceability for the thematic coding (the full author-and-year matrix is provided in Supplementary Table S2).

Theme	Article numbers with a major contribution	Article numbers with a secondary contribution	No substantive contribution
Strategic partnerships and governance	1, 3, 5, 6, 9, 10, 11, 16, 17, 18, 20, 23, 24, 25, 26, 27, 28, 31, 32	2, 4, 8, 12, 13, 14, 15, 19, 21, 22, 29, 30	7
Link and match / WBL / competency alignment	1–17, 19–22, 24–25, 27–32	18, 23, 26	None
Digital transformation	2, 7, 8, 23, 32	1, 6, 9, 12, 25, 27, 28, 31	3, 4, 5, 10, 11, 13–22, 24, 26, 29, 30
Enabling factors and implementation barriers	1, 3, 5, 6, 9, 10, 12, 13, 15–18, 20–25, 27, 28, 30–32	2, 4, 7, 8, 11, 14, 19, 26, 29	None

Levels of Evidence

Each article was assigned one dominant level of evidence based on its primary unit of analysis and main outcomes: (1) institutional, policy, or partnership-system level; (2) student or participant level; and (3) programme, curriculum, or implementation level. This classification maps the focus of the evidence rather than methodological quality and helps distinguish individual outcomes from institutional partnership effectiveness.

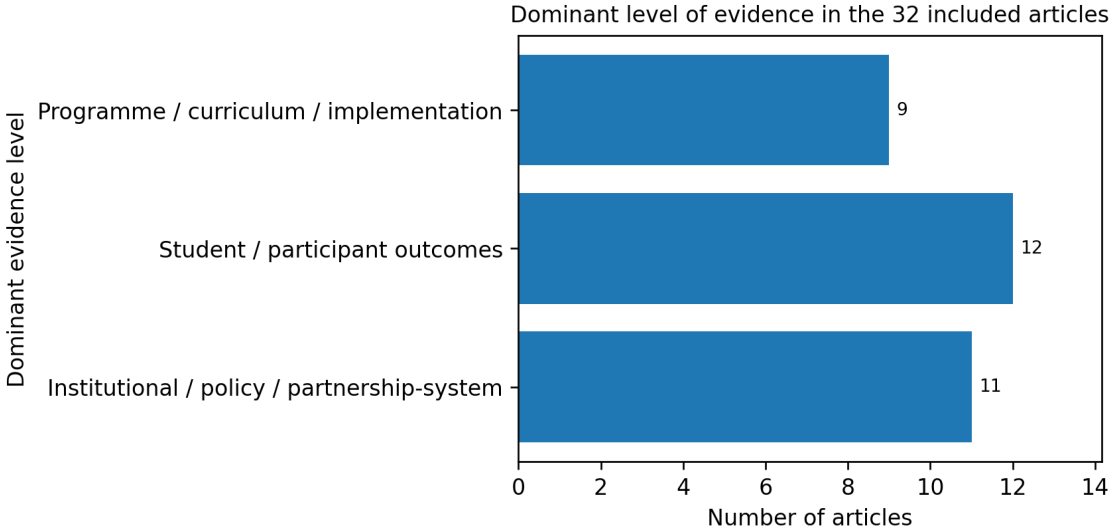


Figure 5. Dominant level of evidence represented in the 32 included articles.

Table 9. Comparison of evidence at the institutional, student, and programme levels.

Dominant level of evidence	Articles (n)	Article numbers	Main focus	Limits on inference
Institutional, policy, or partnership-system level	11 (34.4%)	10, 11, 16, 17, 18, 20, 26, 27, 28, 31, 32	Governance, employer engagement, policy, benefits to partners, coordination, and sustainability.	Does not in itself demonstrate reciprocal benefits or sustainability. Article 26 provides contextual evidence and no direct empirical measurement of partnership effectiveness.
Student/participant-level outcomes and experiences	12 (37.5%)	2, 4, 7, 9, 13, 14, 15, 19, 21, 22, 29, 30	Competencies, work readiness, career adaptability, WBL experiences, feedback,	Supports conclusions about individual outcomes or experiences, but not direct conclusions about

			well-being, and workplace learning.	institutional governance or partnership sustainability.
Programme-, curriculum-, or implementation-level evidence	9 (28.1%)	1, 3, 5, 6, 8, 12, 23, 24, 25	Model development, curriculum alignment, Teaching Factory/WIL implementation, competency frameworks, and digital assessment systems.	Can explain mechanisms and implementation processes, but does not necessarily test partnership effectiveness at the system level.

Institutional-level evidence addressed governance, policy, and employer engagement; student-level evidence focused on competencies, work readiness, experiences, and well-being; and programme-level evidence described models, curricula, and implementation. These forms of evidence are not interchangeable. Improvements in learning outcomes or student experiences do not, in themselves, demonstrate reciprocal benefits or the sustainability of a partnership.

Findings by Theme

Strategic Partnership Models and Governance

The partnerships described in the articles formed a continuum, ranging from the provision of work placements, work experience, and recruitment pathways to shared responsibility for defining competencies, developing curricula, providing facilities, supervising learning, assessing performance, and evaluating outcomes. Three interrelated patterns emerged: (1) governance and public–private partnership arrangements; (2) resource integration and joint value creation; and (3) learning partnerships delivered through work-based learning (WBL), work-integrated learning (WIL), apprenticeships, and production-based learning.

Governance-focused studies emphasised role clarity, leadership, management capacity, and sustained industry involvement. Subri et al. (2022), drawing on a survey of 115 technologists in Malaysia, and Sohimi et al. (2022), based on 87 respondents from TVET associations, government, and industry, highlighted the importance of managerial capacity and institutional collaboration. Yu et al. (2025) identified 12 barriers to education–industry integration in Shenzhen, organised into five levels and 16 influence pathways. These included policy constraints, weak institutional commitment, and ineffective communication.

Partnership arrangements were also shaped by sectoral and policy contexts. Maltseva et al. (2025) identified differences in centralisation, governance, and scale across public–private partnership initiatives in Russia, India, and China. Rintala et al. (2026) identified four employer discourses in Finland: organising WBL, supplying skilled labour, developing workplaces, and sustaining the vocational education sector. Smith et al. (2025) found differing perceptions of partnership benefits: employers emphasised skills development and flexible training, whereas training providers also highlighted staff development and financial benefits. Reciprocal benefits therefore need to be assessed from the perspectives of both parties.

Yuan et al. (2026) described a three-layer collaboration model at Shenzhen Polytechnic University: a physical layer (shared laboratories, micro-factories, and training facilities), an institutional layer (curricula, certification, shared responsibilities, and quality assurance), and a cognitive layer (shared goals, curriculum development, and innovation). The model illustrates a shift from resource sharing towards coordination and joint knowledge creation. However, because the study focused on one institution and did not include cross-institutional comparisons or longitudinal evaluation, it explains a collaboration mechanism rather than long-term effectiveness.

Formal engagement does not necessarily result in effective partnerships. Allais et al. (2025), in a six-country study, found that employer involvement was not always accompanied by broad recognition of TVET qualifications in recruitment. Kraja & Dedej (2022) discussed university–business collaboration in the context of vocational education in Albania. However, the full text mainly presented secondary INSTAT data on unemployment and vocational education enrolment, OECD data on business–university collaboration, and discussion of literature and policy; primary data sources and analytical procedures were not described. The article was therefore used as contextual evidence, not as direct empirical evidence of partnership effectiveness. Overall, partnership quality

depends on shared responsibilities, sustained participation, and demonstrable benefits for the partners.

Link and Match through Curriculum and Competency Alignment

Link and match was the most frequently discussed theme. Alignment involved curriculum relevance, the quality of workplace learning, and the competencies being assessed. Industry contributed by identifying occupational needs, updating practical modules, and assessing learning outcomes. Yuan et al. (2026) described the intjalinusegration of company input, certification standards, practical modules, and multi-stakeholder assessment. Based on interviews with 14 education and automotive-industry practitioners in Indonesia, Sutiman et al. (2022) highlighted student readiness, internship orientation, interaction with workplace supervisors, and the integration of work experience into diploma curricula.

The WBL/WIL models examined included CWILE, which comprises curriculum development, planning, learning processes, and evaluation (Jewpanya et al., 2023); an industrial internship model for prospective automotive teachers (Suyitno et al., 2022); and PRIGEL, which combines pre-internship preparation, dual supervision in the workplace, and post-internship evaluation (S. E. Wahyuningsih et al., 2026). Wahyudin et al. (2025) examined the Teaching Factory as a means of bringing production processes into vocational learning. Differences in context, together with incomplete reporting of samples and implementation procedures, mean that these models should not be treated as directly equivalent or interchangeable.

Competency alignment also included non-technical skills. Based on input from six academics and five industry experts in Malaysia, Mazlan et al. (2025) identified 21 components of Industry 4.0-related talent across cognitive, operational, individual, and professional domains. Massi et al. (2026) found that vocational curricula in Tanzania placed greater emphasis on technical skills than on digital literacy, communication, leadership, adaptability, and financial management.

Several studies reported student-level outcomes. Wahyuningsih et al. (2026) reported increases of 23% in technical skills, 18% in communication, and 15% in problem-solving following WIL. Mahfud et al. (2024), in a survey of 476 vocational students in Indonesia and Malaysia, identified associations among WBL, curriculum relevance, institutional support, career self-efficacy, and career adaptability. Hung et al. (2026), in a three-wave study of 860 TVET interns in Taiwan, found that school support weakened the relationship between hindrance demands and exhaustion. Deutscher et al. (2026), following 458 commercial trainees in Germany, found that task relevance, autonomy, feedback, and school–company cooperation made different contributions to competency development.

The quality of workplace experiences was also shaped by supervision, feedback, readiness, and inclusion. Rohanai et al. (2025) reported a moderate level of perceived WBL effectiveness at one institution in Malaysia. Karkkulainen et al. (2026) examined feedback for vocational students with learning difficulties, while Kärkkäinen et al. (2025) investigated WBL involving migrant students and teachers. Hanssen & Utvær (2022) identified personal, social, and workplace resources that supported interns, whereas Green et al. (2022) examined student experiences in a diagnostic radiography degree apprenticeship, although the response rate was limited. Work placements alone are insufficient without guidance, meaningful tasks, and supportive connections between educational institutions and workplaces.

The studies used different outcome measures, including self-reported perceptions, competency tests, career adaptability, work readiness, and internship experiences; these measures should not be treated as equivalent. Improvements in individual competencies are also not direct evidence that a partnership is reciprocal or sustainable.

Digital Transformation and the Scope of the Evidence

Digital transformation was a major focus in five articles and a secondary focus in eight. Overall, 13 of the 32 articles (40.6%) addressed digitalisation substantively, making it less frequently examined than governance and link and match.

Major contributions included digital literacy as a mediator of the relationship between WIL and employability competencies (Fu et al., 2026); gamified programming instruction through a digital platform (Jalinus et al., 2025); digital and Industry 4.0 competencies (Mazlan et al., 2025); the

E-PKG system for more efficient and consistent teacher assessment (Waluyo et al., 2025); and digital twins, virtual simulations, and online–offline platforms to support collaboration (Yuan et al., 2026).

Secondary contributions included the digital context of WIL (Jewpanya et al., 2023); Industry 4.0 technologies in the Teaching Factory and work-integrated learning for lecturers (Mesuwini & Mokoena, 2023; Wahyudin et al., 2025); digital literacy in the curriculum (Massi et al., 2026); digital elements in the PRIGEL WIL model (S. E. Wahyuningsih et al., 2026); hardware and software constraints (Yu et al., 2025); technology in public–private TVET partnerships (Maltseva et al., 2025); and technological resources in university–industry collaboration (Cai & Xu, 2026). These contributions are not equivalent to evaluations of digitally enabled partnership governance.

Technology and digital competencies supported learning, assessment, and some institutional processes. However, the evidence was not sufficiently consistent to conclude that digital transformation improves governance, reciprocal benefits, or partnership sustainability. This remains a developing area that has not yet been widely evaluated.

Enabling Conditions, Implementation Barriers, and Research Gaps

Recurring enabling conditions included institutional commitment and leadership, communication, resources, clear role allocation, and supervisor support. Subri et al. (2022) and Sohimi et al. (2022) emphasised governance and management capacity, while Yu et al. (2025) showed how policy constraints, weak commitment, and ineffective communication interact. Differences in how employers and training providers perceive partnership benefits (Smith et al., 2025) also point to the need for dialogue and alignment of expectations.

Practical barriers included access to workplaces, facilities, supervision, and task relevance. Mesuwini & Mokoena (2023) found that TVET lecturers' access to industrial technologies was constrained by orientation, supervision, and machine availability. Wahyudin et al. (2025) reported resource and continuity constraints in the Teaching Factory, while Allais et al. (2025) showed that employer participation did not guarantee recognition of TVET qualifications. Establishing a partnership therefore needs to be distinguished from ensuring that it works effectively in practice.

Studies involving students with learning difficulties, migrant students, and interns highlighted feedback, workplace relationships, school support, stereotyping, and well-being (Hanssen & Utvær, 2022; Horne & Majola, 2025; Hung et al., 2026; Kärkkäinen et al., 2025; Karkkulainen et al., 2026). Access to placements needs to be accompanied by guidance, meaningful tasks, and an inclusive learning environment.

Four research gaps emerged: (1) limited longitudinal and cross-institutional evaluation of partnership sustainability; (2) a lack of integrated measures of reciprocal benefits for education providers and industry; (3) a stronger focus on digitalisation in relation to literacy, pedagogy, and assessment than on governance, coordination, or long-term employment outcomes; and (4) limited and inconsistent attention to student inclusion, well-being, and supervision quality in partnership evaluations. These gaps limit the extent to which broad claims about partnership sustainability can be generalised.

Cross-Thematic Synthesis

The four themes were interrelated, although the supporting evidence was uneven. Governance provides the basis for shared goals, responsibilities, resources, and joint decision-making. Link and match translates these arrangements into curricula, competency standards, workplace tasks, supervision, and assessment. Digital technologies can support learning, assessment, and coordination, but their contributions to governance and sustainability have rarely been evaluated. Partnership evaluation should therefore measure learning outcomes alongside reciprocal benefits for educational institutions and industry.

Table 10. Cross-thematic synthesis and proposed operational indicators for future evaluation.

Synthesis component	Suggested operational indicators based on the evidence	Outcomes to monitor	Evidence limitations
Governance and commitment	Shared goals; leadership; clear role allocation; partner participation;	Participation and continuity; reciprocal benefits; joint decisions.	Agreements and participation do not, by themselves, demonstrate

	resource coordination; joint decision-making.		reciprocal benefits or sustainability.
Curriculum and competency alignment	Joint curriculum review; occupational standards; authentic tasks; supervision; certification; employer feedback.	Curriculum relevance; technical and non-technical competencies; work readiness; graduate transitions.	Student outcomes are not a substitute for measures of institutional partnership effectiveness.
Digital capabilities and systems	Digital literacy; simulation; gamified learning; digital assessment; online–offline infrastructure.	Digital competencies; assessment efficiency; technology-supported learning and coordination.	Evidence on digital governance and long-term sustainability remains limited.
Ongoing evaluation and partnership sustainability	Multi-stakeholder monitoring; feedback; review of benefits; student support; partnership continuity.	Benefits for institutions and industry; learning quality; graduate outcomes; inclusion and well-being.	Few studies combine institutional reciprocal benefits with student-level outcomes.

The four-component framework is a synthesis of the literature, not a causally validated model. It proposes that governance and commitment support curriculum alignment and WBL; relevant digital capabilities may enable implementation; and ongoing evaluation can assess learning quality and reciprocal benefits. Further testing requires comparative and longitudinal studies across different vocational education systems.

DISCUSSION

The synthesis of 32 studies indicates that the effectiveness of vocational education–industry partnerships cannot be assessed solely by the existence of formal agreements or the level of industry participation. Rather, it should be examined in terms of governance quality, the distribution of responsibilities, competency alignment, and reciprocal benefits. This finding can be further contextualised by Mende et al. (2025), who identified six dimensions of VET system governance, including multilevel coordination, stakeholder participation, the balance between skills supply and demand, funding, and the quality and attractiveness of vocational education. Compared with Mende et al.'s framework, the present review places greater emphasis on partnership mechanisms at the institutional level. The implication is that partnership evaluation should also consider funding, inclusive access, and programme quality, rather than focusing exclusively on communication and role clarity. Weis et al. (2026) further found that works council representation was associated with a greater likelihood of firms providing training and with higher apprentice retention; however, stronger success by works councils in advancing their agendas was associated with lower graduate retention. Although the context of works councils in German companies is not identical to school–industry partnership governance, these findings caution that stronger participation does not necessarily produce uniform benefits. Partnerships should therefore assess who participates, which decisions participants can influence, whose interests are represented, and how conflicts of interest are resolved.

Regarding link and match, the findings of this review emphasise the importance of jointly developed curricula, authentic workplace tasks, structured supervision, reflection, and industry involvement in competency assessment. Groenier et al. (2025) support the importance of challenging work experiences, reflective practice, interaction, guidance, and learner characteristics in the development of adaptive expertise. However, their review focuses on work-based learning in higher education; therefore, its mechanisms should not be treated as direct evidence of the institutional effectiveness of TVET partnerships. In contrast, Guest (2026) identified tensions between companies' productivity demands and apprentices' learning needs in Australian food-trades apprenticeships, indicating that operational priorities may displace learners' developmental needs. This difference suggests that authentic workplace tasks and industry involvement do not automatically guarantee high-quality learning experiences. The implication is that partners should agree on learning outcomes, protect time for learning, clarify supervisors' responsibilities, and ensure that production tasks remain relevant to the competencies learners are expected to acquire.

The advantages of industry-based learning models should also be assessed in relation to the type of outcome being pursued. Using Swiss administrative data and a causal identification strategy,

Lüthi (2025) found that firm-based vocational education was more effective in helping graduates enter employment, whereas graduates from school-based pathways were more likely to progress to higher education. This finding does not support the assumption that one learning model is universally superior; rather, each model has advantages depending on the intended outcome and context. For vocational education–industry partnerships, the implication is the need for more flexible pathways: work-based learning can be strengthened to support school-to-work transitions, while credit recognition, opportunities for further qualifications, and progression routes to higher education should also be maintained. Evaluations of link and match should therefore consider not only employment placement but also further study and graduates' career mobility.

Successful completion of training does not necessarily guarantee a sustained employment relationship. Based on panel data on apprentices in Germany, Weißmann & Roth (2025) found that workplace conflict was associated with a lower likelihood of successful apprenticeship completion, whereas support was associated with a higher likelihood of completion. However, support did not eliminate the negative association between conflict and completion. In addition, graduate retention within the training company was lower particularly when conflict was high and support was low; the authors' analysis indicated that this pattern was more closely related to the absence of a job offer from the company. These findings extend the present review's distinction between learner competencies and institutional effectiveness: learning achievement, programme completion, a job offer, acceptance of that offer, and retention within the company are distinct outcomes. The implication is that schools and industry partners should establish conflict-resolution and mentoring mechanisms. Partnership evaluation should also track each stage of this transition and examine the benefits received by both partners.

In the digital dimension, only 13 of the 32 studies (40.6%) addressed digitalisation substantively, primarily in teaching and assessment; evidence of its contribution to partnership governance and sustainability remains limited. **Grip & Gustavsson (2026)** broaden this perspective through their review of Industry 5.0, which identifies five enabling conditions for operator learning: redesigning work to support human–robot collaboration, using immersive technologies for training, supportive leadership, opportunities to experiment with new technologies and roles, and partnerships for skills development. However, they also note that the reviewed literature is dominated by technical perspectives and does not explicitly address the green transition. Thus, digitalisation in vocational education–industry partnerships should not be limited to the use of platforms, simulations, or digital assessment. The implication is that digital transformation should encompass the development of digital and green competencies, infrastructure readiness, leadership, learner and worker participation, and information-sharing systems for coordinating curricula, supervision, and evaluation. Nevertheless, the contribution of technology to partnership sustainability still requires direct empirical examination.

Overall, comparison with external studies enriches the conceptual framework of this review by showing that partnerships are shaped by the distribution of authority, potential conflicts of interest, the objectives of educational pathways, workplace learning conditions, and digital readiness. Accordingly, the four dimensions of the framework—collaborative governance, curriculum and competency alignment, digital capabilities, and continuous evaluation—should be understood as interconnected components that do not operate automatically or uniformly across contexts. Potential evaluation indicators include stakeholder representation in decision-making, clarity of roles and resources, curriculum and workplace-task relevance, supervision quality, training completion, transitions into employment and further study, the use of digital systems for coordination, reciprocal benefits, and continuity of collaboration. These indicators are proposals derived from the synthesis, not a validated measurement instrument. The methodological limitations of studies in the review corpus and the contextual differences among the external comparison studies also require the relationships between these components to be interpreted cautiously. Longitudinal and comparative research involving educational institutions, industry, learners, and workers is needed to test the proposed framework and indicators.

CONCLUSIONS

This systematic review of 32 studies published between 2022 and 2026 indicates that effective vocational education–industry partnerships require more than formal agreements or workplace

placements. Their quality depends on collaborative governance, meaningful employer participation, alignment between curricula and occupational competencies, and demonstrable benefits for both educational institutions and industry. Link and match is most meaningful when curriculum collaboration is translated into relevant workplace learning, structured supervision, and employer involvement in competency assessment. However, improvements in student competencies should not be interpreted as direct evidence of institutional partnership effectiveness or long-term sustainability. Likewise, although digital technologies support learning and assessment, the evidence on their contribution to partnership governance and continuity remains limited.

The main contribution of this review is a literature-derived conceptual framework that connects four interrelated dimensions: collaborative governance, curriculum and competency alignment, digital capabilities, and continuous partnership evaluation. The framework distinguishes partnership processes from student-level outcomes and institutional outcomes, while recognising that their relationships are shaped by policy, organisational capacity, and industry context. To make the framework operational, partnership quality should be examined through a set of priority indicators: (1) employer participation in joint decision-making and curriculum or assessment processes; (2) clarity of roles, responsibilities, and resource contributions; (3) the quality of workplace supervision and learning experiences; (4) graduate transitions into employment or further education; (5) reciprocal benefits for education providers and employers; and (6) continuity of collaboration. Digital information-sharing and coordination may be considered supporting indicators, but their contribution to long-term partnership effectiveness requires further testing. These indicators are proposed for future assessment and have not yet been validated as a measurement instrument. The framework should therefore be understood as a conceptual synthesis of the literature, not as an empirically established causal model.

In practical terms, vocational institutions should prioritise joint curriculum reviews, learner preparation, workplace supervision, and systematic monitoring of graduate outcomes. Industry partners should contribute to occupational standards, authentic learning opportunities, competency assessment, and the evaluation of reciprocal benefits. Policymakers should strengthen institutional capacity and promote equitable access to industry collaboration, while allowing partnership arrangements to respond to differences in sectoral and institutional contexts. These conclusions should be interpreted in light of the review's limitations, including its restriction to English-language, open-access publications indexed in Scopus and Web of Science, methodological heterogeneity among the included studies, and limited longitudinal evidence. Future research should test and refine the proposed indicators through comparative, longitudinal, and multi-stakeholder studies. Such research should examine how governance, competency alignment, digital coordination, employer involvement, reciprocal benefits, and collaboration continuity relate to both learner outcomes and institutional partnership effectiveness across different vocational education systems.

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AUTHOR CONTRIBUTION STATEMENT

WM: Supervision, conceptualization, and critical review of the manuscript. AK: Methodology, research validation, and critical revision. IA: Conceptualization, literature search, data analysis, and original draft preparation. SW: Literature screening, data collection, and manuscript review. SH: Data extraction, thematic analysis, and interpretation of findings. SU: Literature identification, data organization, and research documentation. DH: Data validation, synthesis of findings, and manuscript editing. HA: Review of research findings, manuscript editing, and final revision. All authors reviewed and approved the final version of the manuscript.

AI DISCLOSURE STATEMENT

The authors used ChatGPT (OpenAI) to assist with language refinement, grammatical correction, and improving the clarity and readability of the manuscript. All AI-assisted suggestions were carefully reviewed, verified, and revised by the authors to ensure academic accuracy and consistency with the research findings. The authors take full responsibility for the originality, accuracy, integrity, and final content of the publication.

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