

STRATEGIES FOR ALIGNING VOCATIONAL SCHOOLS WITH THE BUSINESS AND INDUSTRIAL WORLD IN THE ERA OF THE INDUSTRIAL REVOLUTION 5.0

Caca Andika¹, Rg Guntur Alam²

Universitas Muhammadiyah Bengkulu, Bengkulu, Indonesia

Master Of Pedagogy

e-mail : caandikaa@gmail.com

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Abstract

Aligning vocational schools with the business and industrial world is a crucial need in facing the dynamics of the Industrial Revolution 5.0, which is characterized by advances in smart technology and demands for an adaptive and innovative workforce. This study aims to analyze strategies for aligning vocational education with the needs of technology-based industries through a systematic literature review of 45 national and international articles published in 2015–2025. Articles were selected based on inclusion criteria relevant to the themes of vocational curriculum, industrial work practices, skills development, and school–industry partnerships. Contributions to novelty(**novelty**)This research emphasizes the integration of soft skills, digital literacy, and smart technology-based industrial partnerships in vocational alignment strategies. This focus complements previous research that generally still emphasizes aspects of the curriculum or conventional field work practices. The results of the study indicate that effective alignment includes four main aspects: developing a competency-based curriculum that is responsive to industry dynamics, implementing relevant internships and work practices, strengthening soft skills such as communication, leadership, and critical thinking, and building sustainable partnerships with the digital technology-based business world. Strong synergy between vocational schools and industry has proven to be a key factor in preparing graduates who are work-ready, globally competitive, and able to innovate in the era of advanced technology. This research recommendation emphasizes the need for an adaptive and sustainable alignment strategy, especially through the integration of digital literacy, 21st-century skills, and industry 5.0 collaboration networks, so that vocational education becomes increasingly relevant in supporting the development of superior human resources for the advancement of the national economy and industry.

Keywords:*Alignment strategy, vocational schools, business and industry, Industrial Revolution 5.0, competency-based education, industrial internships, soft skills, industrial partnerships.*

Introduction

Vocational schools play a strategic role in developing human resources capable of meeting the needs of the workforce. These institutions are designed to produce graduates who not only master technical skills but also possess competencies aligned with the real demands of industry. However, the reality is that the gap between vocational school curricula and the real needs of the business and industrial world remains a major issue.(Harahap, 2023)Rigid curricula, limited practical facilities, and suboptimal industry engagement often leave graduates underprepared for global competition. This raises concerns that vocational education is unable to keep pace with the fast-paced dynamics of industry. These challenges are becoming increasingly complex amidst the current of the Industrial Revolution 5.0, a phase that not only emphasizes digitalization and automation, but also demands harmony between intelligent technology and human values.(Judijanto & Aslan, 2025)In this context, the workforce is not only required to master technical skills; it is also required to possess creativity, critical thinking skills, effective communication, and high digital literacy. Therefore, aligning vocational education with the business and industrial world is no longer an option but an urgent necessity to ensure graduates are not left behind by the accelerating pace of change.(Harahap, 2023);(Purike & Aslan, 2025). While various previous studies have highlighted these alignment efforts, most have focused on curriculum aspects or fieldwork practices. The research gap lies in the lack of a comprehensive study integrating four key pillars: (1) designing an adaptive curriculum

based on industry competencies, (2) supporting policies from the government and institutions, (3) strengthening non-technical or soft skills, and (4) sustainable partnerships with the business world and industry. These four pillars, however, are a complementary unit in producing vocational graduates who are relevant to future needs. The need for a comprehensive strategy is increasingly felt because the business and industrial world is currently undergoing a transformation of digital-based business models, intelligent automation, and big data.(Hadi, 2024)These changes require a workforce that is not only agile in mastering technology, but also able to collaborate with machines, adapt quickly, and provide creative and innovative contributions to production and service processes.(Firmansyah & Aslan, 2025)Therefore, vocational schools need to strengthen collaboration with industry, whether through internships, joint curriculum development, or direct technology transfer.(Sutrisno & Widodo, 2023).

Unfortunately, these collaborative practices still face many obstacles, ranging from ineffective communication, lack of modern facilities, to a low understanding of the ever-changing needs of the industry.(Putra & Lestari, 2022). Furthermore, teacher competency is another important factor that hasn't received full attention. Vocational teachers and lecturers must be continuously updated to master the latest technology and adapt learning methods to industrial contexts.(Santoso, 2022)Without improving the quality of teachers, it is difficult to achieve optimal alignment between theory and practice. An ideal alignment strategy should include a flexible curriculum (Dewi, 2023), project-based learning and problems that connect theory with real-world practice.(Rahmadani, 2024), strengthening soft skills such as communication, leadership, and problem solving(Yulianti, 2023), as well as continuous evaluation of the effectiveness of its implementation(Irawan, 2024)Thus, aligning vocational schools and industry is not only about improving the curriculum, but also involves policies, partnerships, and human resource capacity development. Based on this background, this study aims to identify and formulate strategies for aligning vocational schools with the business and industrial world in facing the Industrial Revolution 5.0. The research focuses on efforts to develop integrative, adaptive, and sustainable strategies so that vocational education is truly capable of producing superior graduates who are globally competitive, innovative, and relevant to the needs of dynamic industries.

Research methods

This study uses a Systematic Literature Review (SLR) approach to examine strategies for aligning vocational schools with the business and industrial world in facing the dynamics of the Industrial Revolution 5.0. SLR was chosen because it has the advantage of synthesizing knowledge in a comprehensive, transparent, and structured manner, so that it can fully describe the existing research map while identifying research gaps that have not been widely studied.(Tranfield et al., 2003);(Snyder, 2019)Unlike narrative literature reviews, which tend to be subjective, SLR prioritizes systematic, replicable methods based on internationally recognized reporting standards. Therefore, this study applies the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure traceability of the literature selection process from the identification stage to the final articles analyzed.(Moher et al., 2020);(Page et al., 2021). The SLR process in this study began with the literature identification stage. Article searches were conducted in several reputable international databases, namely Scopus, Web of Science (WoS), ProQuest, and ERIC (Education Resources Information Center). To enrich the secondary data, additional searches were conducted through Google Scholar, specifically to find relevant national articles and policy documents that are not always indexed in international databases. This database selection was carried out so that the scope of the literature was not limited to global-scale research but also included contextual studies related to the implementation of vocational education in Indonesia and other developing countries.

In the search stage, primary keywords were used, arranged by combining Boolean operators to obtain more targeted results. These keywords included the terms "vocational education" or "technical and vocational education and training (TVET)" which were then combined with the terms "industry partnership," "school-industry alignment," "curriculum alignment," "competency-based curriculum," "soft skills," "21st-century skills," and "Industry 5.0" or "human-centric technology." One example of a query used was: ("vocational education" AND "industry partnership" AND "Industry 5.0"). This search strategy was designed to capture literature that discusses the direct relationship between vocational schools and the business-industry world in the context of the latest technological changes. The publication period of the articles used as a reference is 2015–2025. This limitation was determined based on the consideration that over the past decade, the discourse on aligning vocational education and industry has become increasingly stronger along with the transition to the Industrial Revolution 5.0. Articles older than 2015 were considered less relevant because the context of change is still in the Industry 4.0 era. Furthermore, inclusion and exclusion criteria were applied to emphasize the relevance of the selected articles. Inclusion criteria included articles published in peer-reviewed journals, international conference proceedings, or official policy

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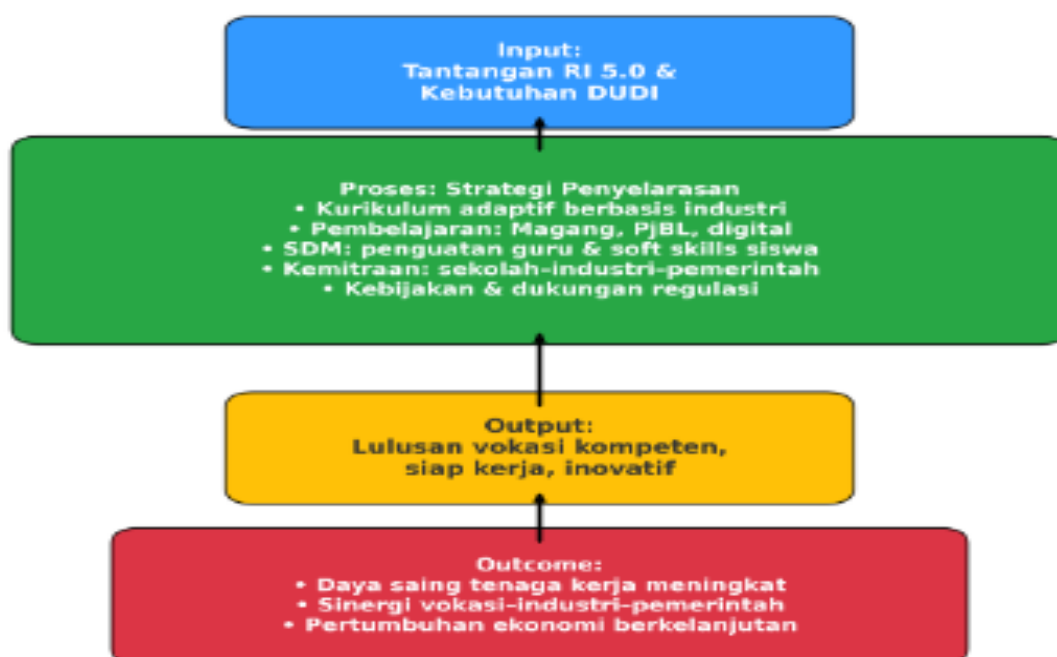
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documents that discussed the topic of aligning vocational education with industry, whether through curriculum, industrial work practices, strengthening soft skills, or sustainable partnerships. Meanwhile, exclusion criteria applied to articles in the form of opinion pieces, editorials, or publications that were not available in full-text form. The initial search of all databases yielded 612 articles. A screening process was then conducted based on titles and abstracts to eliminate articles that did not align with the research focus, leaving 189 articles. These articles then underwent an eligibility assessment by reading the full manuscripts and applying exclusion criteria. At this stage, several articles were eliminated because they did not directly contribute to the theme of vocational and industrial alignment. This process resulted in 74 articles deemed sufficiently relevant. Of these, after discussion and suitability assessment, it was finally decided that 45 articles would be the final sample for in-depth analysis.

All articles submitted to the final stage were analyzed using a critical descriptive approach. This analysis was conducted to examine key concepts, identify research patterns and trends, and examine challenges and solutions offered in the literature.(Ferrari, 2020)To strengthen the consistency of the analysis, a thematic coding process was conducted by grouping articles into four main themes: curriculum, soft skills, industry partnerships, and supporting policies. This coding process helped build a clearer conceptual framework regarding the strategy for aligning vocational schools with the business and industrial world in the era of the 5.0 Industrial Revolution. Furthermore, the validity of the findings was strengthened by involving two researchers who independently conducted the literature selection and analysis process. Their work was then compared, and any discrepancies were discussed until consensus was reached. This procedure aligns with recommendations.(Kitchenham, 2020)which emphasizes the importance of involving more than one reviewer to reduce subjective bias.

As a form of methodological transparency, this study also presents a PRISMA flow diagram to illustrate the number of articles at each stage of the selection process. The diagram shows that of the 612 articles identified, 189 were screened through titles and abstracts, 74 were fully evaluated, and finally, 45 articles were included in the final analysis. This diagram helps readers understand the systematic process followed by the researchers and ensures traceability of the SLR stages.(Page et al., 2021). With this rigorous method design, the research is expected to produce a synthesis that is not only descriptive but also provides theoretical and practical contributions. Theoretically, the SLR method allows researchers to identify research gaps, namely the absence of a comprehensive strategy that integrates adaptive curriculum, policies, soft skills strengthening, and sustainable partnerships. Meanwhile, practically, the results of this method can serve as a foundation for policymakers, educators, and industry stakeholders to design strategies for aligning vocational education that are relevant, applicable, and sustainable amidst the demands of the Industrial Revolution 5.0.

Kerangka Kerja Kajian: Penyelarasan Vokasi & Industri di Era RI 5.0



Source: Author's Analysis, 2025

Results and Discussion

This systematic review yielded several important findings, demonstrating that aligning vocational schools with the business and industrial worlds in the context of the 5.0 Industrial Revolution still faces significant challenges. The analyzed literature demonstrates consensus on the need for a more adaptive curriculum, workplace-relevant learning methods, increased human resource capacity for educators, and sustainable partnerships between educational institutions and industry. These findings are summarized in the following table, which serves as a primary literature map that forms the basis for further analysis.

Author Year	Research Focus	Approach Method	Key Findings	Implications for Vocational Studies
Jaedun (2024)	Human-centric in the Industrial Revolution 5.0	Conceptual study	Human-machine collaboration, the importance of soft skills and creativity.	The curriculum needs to balance hard skills & soft skills.
Lase (2019)	Vocational education and industrial needs	Policy analysis	The need to align the curriculum to be relevant to the global market.	The curriculum must be based on international industrial competencies.
Usman et al. (2022)	The role of cobots and occupational safety	Literature study	Human-machine collaboration improves productivity & safety.	Vocational materials must include cobots & safety training.
Wardina et al. (2019)	Sustainability of industry and education	Empirical study (survey)	Environmentally friendly technologies need to be integrated into the curriculum.	Vocational education must teach green skills and eco-friendly production.
Firdaus & Sari (2022)	Mass customization and production flexibility	Industry case studies	Production flexibility demands creativity & problem solving.	Students are trained project-based with a variety of market needs.
Gunawan & Hidayat (2023)	Manufacturing adaptation and productivity	Industrial experimental study	Reconfigurable manufacturing systems require adaptive human resources.	Vocational education must teach adaptability and rapid learning.
Popkova et al. (2021)	Industrial Revolution 5.0 in the education and service sectors	Global analysis (literature)	Integration of AI, IoT, and big data in education.	Vocational education must build digital literacy & smart technology.
Putra & Lestari (2022)	Industrial work practice	Field study (observation)	Effective internships improve job readiness.	Industrial partnerships should be institutionalized on a regular basis.
Rahmadani (2024)	Project-based learning (PjBL) in vocational education	Classroom experiments	PjBL improves students' critical thinking & innovation.	Vocational needs PjBL based on real problems from industry.
G. Santoso (2022)	Vocational teacher competencies	Qualitative study	Teachers need industrial training to stay updated.	Teacher upskilling programs must be industry-based.
Hadi (2024)	Industrial needs in the era of the Industrial Revolution 5.0	Industrial policy analysis	Digital competency (AI, IoT, big data) is a primary requirement.	Digital literacy must be a vocational competency standard.

Source: Author's analysis, 2025

Analysis of Results

The synthesis of the various literature above indicates that alignment strategies can be grouped into four main categories. First, curriculum strategies that demand flexibility and responsiveness to industry changes. Jaedun, (2024), Lase, (2019); Wardina et al., (2019) agreed that vocational curriculum should be based on industrial competencies, encompassing cutting-edge technological aspects such as artificial intelligence (AI), the Internet of

Things (IoT), and big data, while integrating sustainability values. Gunawan & Hidayat, (2023) adding that the curriculum needs to be designed adaptively so that graduates are ready to face manufacturing systems that can be reprogrammed according to market needs.

Second, the learning strategy emphasizes direct practice through internships and industrial work practices. Putra & Lestari, (2022) shows that real work experience accelerates students' job readiness, whereas Rahmadani, (2024) emphasized that a project-based learning approach can improve critical and innovative thinking skills. Learning models based on real-world industrial cases are also recommended to allow students to practice more contextual problem-solving.

Third, the strategy of strengthening human resources for teachers and educational staff is a key factor. Santoso, (2022) highlighted that vocational teachers need to receive regular training from industry so that the material taught is always up to date. Usman et al., (2022) added that mastery of cobot technology and occupational safety aspects must be strengthened in teacher training, considering that the Industrial Revolution 5.0 emphasizes human-machine collaboration.

Fourth, the partnership strategy shows that successful alignment cannot be achieved by schools alone. Firdaus & Sari, (2022) emphasized the importance of ongoing collaboration between schools, industry, and government, particularly to support technology-based production flexibility. Hadi, (2024) reinforces this view by emphasizing the need for government policy support in the integration of digital technology in vocational schools.

A closer look at the literature reveals a common view regarding the urgency of competency-based curricula and industry partnerships. However, there are also differences in focus. For example, Jaedun, (2024) emphasizes human-centric and soft skills, while Hadi, (2024) more emphasis on technical digital competencies. Putra & Lestari, (2022) and Rahmadani, (2024) focuses on learning models, whereas Wardina et al., (2019) highlighting environmental sustainability issues. This difference shows that previous studies tend to be partial, discussing one specific aspect without integrating all dimensions.

Thus, the findings of this study fill a research gap by presenting a comprehensive strategic alignment framework. Four strategic categories—curriculum, learning, human resources, and partnerships—need to be implemented simultaneously to ensure vocational schools are truly capable of meeting industry needs in the Industrial Revolution 5.0 era. This integrative approach is expected to produce graduates who are not only technically competent but also adaptive, innovative, and globally competitive.

Conclusion

Aligning vocational schools with the business and industrial world is a strategic necessity that cannot be negotiated in facing the challenges of the Industrial Revolution 5.0. Integrating a competency-based curriculum developed in collaboration with industry players ensures that graduates possess relevant technical and soft skills, ready to adapt and contribute to the dynamic and high-tech workplace. Close collaboration between educational institutions and industry is necessary through internships, the development of modern practice facilities, and the application of innovative learning methods such as project-based learning, to produce adaptable, creative, and innovative graduates. The theoretical contribution of this research is the development of a strategic framework for vocational-industry alignment in the Industrial Revolution 5.0 era, which includes four main dimensions: (1) an adaptive curriculum based on industrial competencies, (2) applied learning through internships and real projects, (3) strengthening the capacity of vocational teachers to be able to adopt the latest technology, and (4) sustainable partnerships between schools, industry, and the government. This framework can serve as a conceptual basis for further studies in developing a vocational education model that is responsive to changing times.

Practically, this research offers several recommendations. For vocational schools, it is crucial to update their curricula, provide modern practical facilities, and integrate soft skills training. For industry, an active role in providing curriculum feedback, providing internship programs, and supporting competency certification is crucial. For the government, regulatory support, funding, and incentive policies will create a more responsive, competitive, and sustainable vocational education ecosystem. However, this study has limitations because it is based solely on a literature review and is not supported by empirical data from the field. Therefore, further research is needed to include case studies, surveys, and experiments in vocational schools and the industrial sector to test the effectiveness of the proposed strategy. With the right alignment strategy, vocational schools are not only able to produce a ready-to-use workforce that meets the latest industry standards, but also play an active role in encouraging innovation, strengthening national competitiveness, and driving inclusive and sustainable economic growth in accordance with the demands of the Industrial Revolution 5.0.

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