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The Concept Directions of Development 21st Century Vocational Education

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Abstract: Education is believed to be a key factor in enhancing human knowledge, skills, and values essential for improving quality of life. Through literature studies from national and international journals and books, this research analyses the current state and future trajectory of Indonesian vocational education. This study aims to examine the concept and development directions of vocational education in Indonesia within the context of 21st-century challenges. The findings indicate that Indonesian education is evolving towards developing analytical, creative, and innovative thinking capacities. The business and industrial sectors have high expectations for educational outcomes, particularly regarding graduate competencies that can advance workplace missions. While the government has implemented supportive policies, including Presidential Instruction No. 9 of 2016 and Presidential Regulation No. 68 of 2022, alongside the implementation of the Merdeka Belajar curriculum, there remains a need for better direction and facility support at the regional level for effective program implementation. These reforms aim to strengthen industry collaboration, enhance teaching quality, and develop both technical and entrepreneurial skills among students. The research concludes that while progress has been made in aligning vocational education with industry needs and 21st-century skill requirements, continued focus on infrastructure development, teacher quality, and industry partnerships is essential for achieving optimal outcomes in Indonesian vocational education.

Keywords: Vocational education, 21st Century education, Educational development, Human resources

Introduction

Indonesia is a country that has great potential from existing Human Resources (HR), which of course cannot be separated from the field of education. Indonesia possesses significant potential in human resources, but faces challenges in education quality and workforce readiness. The mismatch between graduate competencies and labor market demands results in high unemployment rates (Indrayanto & Germanovna, 2020). Key issues include poor school management, inadequate research and training, a flawed education system, and low higher education participation (Sulisworo, 2016). The country's competitiveness is hindered by corruption and a lack of focus on character development in education (Sulisworo, 2016). To address these challenges, Indonesia needs to transform its education system by integrating Industry 4.0 concepts into the curriculum (Lukita et al., 2020).

This approach aims to develop strong competencies, particularly in technology, to meet global competition demands. Additionally, investing in education is crucial for building human resource capacity and forming national character to face the challenges of globalization (Huda, 2020). Education is something that can provide knowledge, attitudes and skills (Darmono, 2016).

Vocational education plays a crucial role in human development and economic growth by preparing students for careers in various fields (Alam, 2015). The learning process in vocational education involves both instructors and learners, with pedagogical strategies such as demonstration, practice, and feedback being implemented to facilitate learning (Mohaffyza Mohamad et al., 2012). To improve the quality of vocational education graduates, institutions focus on implementing effective teaching and learning processes, industrial training, and encouraging entrepreneurship (Ernawati, 2021). The rapid changes in industry and technology have significant implications for vocational education, necessitating adaptations in teaching practices to meet evolving workplace requirements (Mohaffyza Mohamad et al., 2012). Information and communication technology (ICT) has emerged as a powerful tool for accelerating the learning process in vocational education, enabling e-learning, distance education, and access to digital resources (Zulhaji et al., 2012). These advancements in ICT have brought about a paradigm shift in vocational education, enhancing accessibility and efficiency in the teaching and learning process.

The philosophy of pragmatism has significantly influenced vocational education in Indonesia, emphasizing practical skills and problem-solving abilities to meet industry demands (Hambali et al., 2020). This aligns with one of the three types of vocational education goals identified by (Darmono, 2016): pragmatism. The other two goals, essentialism and pragmatic reconstruction, are not explicitly mentioned in the provided abstracts. Pragmatism in education focuses on experience-based practices and values, enriching learning methodologies (Hidayat & Herwina, 2024). This approach is evident in vocational high schools and some Islamic-based schools in Indonesia. The implementation of pragmatism in vocational education aims to prepare students for the challenges of the 21st-century workforce (Hambali et al., 2020). Additionally, the Merdeka Curriculum in Indonesia incorporates elements of Ki Hajar Dewantara's educational philosophy, which emphasizes meeting students' needs and optimizing their potential through student-centered learning approaches (Irawati et al., 2022).

Vocational education in Indonesia has undergone significant changes to meet the demands of the Fourth Industrial Revolution (Industry 4.0). The government has implemented policies to revitalize vocational high schools (VHS) and improve teacher quality through professional teacher education programs (PPG) (Setiawan & Hamdani, 2021). However, challenges persist, including inadequate facilities, teacher shortages, and limited industry support (Suharno et al., 2020a). The industrial revolution 4.0 has created both challenges and opportunities for vocational education, necessitating adjustments in curriculum and teacher competencies to align with evolving skill requirements (Ridwan, 2021; Setiyawami et al., 2019). While vocational education struggles to meet current technological demands and ensure high employment rates for graduates, there are opportunities to enhance human resources by adapting to new skill sets and improving teacher quality based on professional standards (Setiyawami et al., 2019). Strengthening industry collaboration is crucial for developing work-ready graduates with relevant competencies (Suharno et al., 2020a).

Recent research highlights the importance of developing 21st century skills in vocational education. Project-based learning has been identified as an effective approach for nurturing critical thinking, creativity, communication, and collaboration (4C) skills in vocational students (Samsudi et al., 2019). The implementation of Contextual Project Based Learning (CPjBL) has shown promise in improving critical thinking, creativity, and problem-solving skills, particularly in enhancing originality and problem understanding (Samani et al., 2019). To support these developments, teachers need to design and develop learning programs that foster core skills and employability skills (Permana et al., 2019). Additionally, there is a growing recognition of the need for comprehensive evaluation methods that assess both hard skills and soft skills, including the 4C competencies, to better prepare students for the digital-based work environment of the 4.0 revolutionary era (Made Sudana et al., 2019). These findings underscore the importance of adapting vocational education to meet the demands of 21st century workplaces.

The industrial revolution 4.0 has created a pressing need for competent human resources to meet the goals of the modern industrial world. Studies highlight the importance of adaptive thinking, virtual collaboration, and rapid response to change as key competencies for HR in this era (Mas'ud & Tenriyola, 2023). Research indicates a significant relationship between cognitive styles and HR competency levels, suggesting that these factors can predict performance in construction industries (Jamshidi et al., 2014). For Generation Z entering the workforce, intercultural skills, communication, cooperation, and continuous knowledge updating are crucial (Lubis et al.,

2019). To prepare quality human resources, particularly vocational school graduates, link and match programs between educational institutions and industries are recommended. These programs, including internships and industrial classes, help align competencies with workforce needs and improve work readiness in the face of Industry 4.0 (Unsudah & Irianti, 2020).

Method

The method used in this writing is a literature study, which draws from various national and international journals, as well as relevant books, to strengthen the analysis of the current conditions of the vocational education process in Indonesia. This technique involves searching for pertinent data and news related to the revitalization of vocational education. Additionally, the writing is supported by previous research to examine how vocational education has been implemented in Indonesia and to identify aspects that require further review. This ensures that the writing aligns with the contemporary conditions of vocational education. Furthermore, the literature review facilitated the identification of key themes and trends in vocational education, including challenges faced by institutions, pedagogical approaches, and the alignment of curricula with industry needs. This comprehensive analysis not only highlights existing gaps in the vocational education framework but also offers recommendations for future improvements, ultimately aiming to enhance the effectiveness of vocational training in Indonesia. The integration of diverse sources and a systematic approach to data collection underscore the significance of this study in contributing to the ongoing discourse on vocational education revitalization in the current era.

In this study, the researcher found 58 sources consisting of 49 articles and 9 government policy documents relevant to the topic of revitalizing vocational education. However, after going through a rigorous selection process, only 27 articles were selected for further study. This selection process is based on certain criteria, such as relevance to the issue under study, quality of research, as well as the contribution of the article to the understanding of the current condition of vocational education. By focusing on 27 articles and 9 selected government policy documents, the analysis can be more in-depth and comprehensive, so that the results are expected to provide clearer insights into the challenges and opportunities in vocational education in Indonesia. This approach also ensures that the resulting discussion remains relevant and reliable in the context of future vocational education policy development.

Results and Discussion

The Concept of Vocational Education

Vocational education plays a crucial role in preparing students for the workforce. Research indicates that vocational school graduates demonstrate good competency achievement, providing a foundation for entering the global job market (Sucita, 2019). Work readiness is influenced by factors such as industrial work practice experience and vocational skills (Putriatama et al., 2016). Career guidance is essential for vocational students, helping them make informed decisions about their future careers based on their talents, interests, and values (Istianingsih et al., 2021). While vocational education may reduce the likelihood of college attendance and subsequent employment in professional or managerial positions, it also serves as a safety net for students unlikely to pursue higher education. It decreases unemployment risks and increases chances of skilled worker employment, benefiting its clientele rather than acting as a mechanism of social exclusion (Arum & Shavit, 1995). Overall, vocational education equips students with valuable skills and knowledge for successful workforce entry.

Government Regulation no. 19 of 2005 Article 26 paragraph 3 states that the aim of vocational education in Indonesia is to improve students' intelligence, knowledge, personality, noble morals and skills to live independently and undertake further education in fields appropriate to their vocation. Ability to live independently (life skills), having a strong work ethic, and advancing the profession through vocational education are the three main components of this goal. This statement is quite clear that someone with a vocational education background needs more than just work competency in the form of knowledge and skills. To be able to live in harmony with humans, the environment and God, work competence needs to be supported by good vocational character in the form of personality and work morality (Putu Sudira, 2016). On the other hand, (Putu Sudira, 2016) emphasized that vocational education needs to have soft skills which is certified in addition to strengthening hard skills.

Vocational education offers significant benefits for students, particularly those with disabilities and those unlikely to pursue college. It reduces absenteeism, dropout rates, and unemployment risk while increasing the likelihood of finding paid work and attending postsecondary vocational schools (Wagner, 1991). Although it may limit access to professional and managerial occupations, vocational education serves as a safety net, improving chances of employment as skilled workers (Arum & Shavit, 1995). The economic effects of vocational education vary, with male participants generally benefiting in terms of employment, earnings, and reduced criminal activity in the short to medium term (Dougherty & Ecton, 2021). However, there is a need to address the declining popularity of vocational education due to misconceptions about its suitability and lack of awareness (Kumar, 2020). Integrating skill-based education into higher education and adapting vocational programs to contemporary economic needs could enhance their effectiveness and appeal.

Thus, vocational education is expected to be anticipatory and adaptive. Along with the benefits mentioned above, (Putu Sudira, 2016) proposes that vocational education also has three main benefits: (a) for students, the benefits include increased self-esteem, more job opportunities, more entrepreneurial opportunities , increasing income, preparation for further education, preparation for society, nation and state, as well as the ability to adapt to change and the environment; (b) for the world of work, the benefits include access to high-quality labor, lower costs for the business world, and assistance to promote and develop the business world; and (c) for society as a whole, the benefits include increasing social welfare, increasing national productivity, increasing state income, and reducing unemployment. Education for vocational purposes has changed to keep pace with developments in science and technology. Of course, it is impossible to separate the existence of these advances from the opinions of those (experts) who research how technology develops in relation to vocational education. Experts have different opinions about vocational education, but the goals and intentions communicated through these differences are all aimed at the same goal.

Directions for the Development of 21st Century Vocational Education in Indonesia

The government provides various support and attention to vocational education, one of them is through Presidential Instruction (INPRES) number 9 of 2016 concerning the revitalization of Vocational High Schools to increase the competitiveness and quality of Indonesian Human Resources. The Governors, Head of the National Professional Certification Agency, and ministers are the targets of the Presidential Instruction. The President instructed the parties to take the necessary steps in accordance with their respective responsibilities, authorities and duties to revitalize vocational schools and improve the quality and competitiveness of Indonesia's human resources. In addition, the president instructed the preparation of a map of workforce needs for vocational school graduates in accordance with their responsibilities, authority and duties based on the vocational school development road map. According to Pracihara (2017), this Presidential Instruction is in collaboration with various Ministries, Ministers Coordinators, Institutions that have an impact on Vocational Schools, and Governors of Regional Governments throughout Indonesia to revitalize Vocational Schools. More precisely, the Ministry of Education and Culture seeks to: (1) create a vocational school development map; (2) perfecting and aligning the vocational school curriculum with competencies that suit the needs of graduate users (link and match); (3) increasing the number and quality of educators and vocational education staff; (4) deepening cooperation with Ministries/Institutions, Regional Governments, and the Business/Industrial World; (5) expanding access to vocational school accreditation and vocational school certification; and (6) forming a Vocational School Development Working Group. Thus, President Joko Widodo has emphasized the importance of vocational education in Indonesia's strategy to develop its human resources. The President stated that vocational education is a key component in preparing the Indonesian workforce to be more productive and competitive, especially during the current peak of the demographic bonus. The President also emphasized that vocational education is important for developing skills that can be applied directly to the world of work and complements the role of higher education in developing innovation and scientific knowledge.

President Joko Widodo and Vice President KH Ma'ruf Amin gave vocational education high importance throughout the second term of his administration. According to President Joko Widodo, initiatives to expand Indonesia's human resources must prioritise vocational education. The Republic of Indonesia's Presidential Regulation Number 82 of 2019 on the Ministry of Education and Culture provides additional details on how the government prioritises and promotes vocational education. The most notable modification to the Presidential Decree is the addition of the Directorate General of Vocational Education as one of the primary (echelon I) organisations within the Ministry of Education and Culture. The Directorate of Vocational and Professional Higher Education, the Directorate of Course Development and Training, the Directorate of Partnership and Alignment with the Business and Industrial World, and the Directorate of the Directorate General of Vocational Education Secretariat are the five echelon 2 units that make up the Directorate General of Vocational Education.

The Ministry of Education and Culture's Regulation Number 9 of 2020 on Amendments to Regulation Number 45 of 2020 concerning the Organisation and Work Procedures of the Ministry of Education and Culture serves as the basis for this information.

In response to industry demands, the Directorate General of Vocational Education was modified by Minister of Education and Culture Regulation Number 28 of 2021 about Organization and Work Procedures of the Ministry of Education, Culture, Research, and Technology. The Directorate of Vocational High Schools, the Directorate of Courses and Training, the Academic Directorate of Vocational Higher Education, the Directorate of Institutions and Resources for Vocational Higher Education, and the Directorate of Partnership and Alignment with the Business and Industrial Worlds are the six units that make up the Directorate General of Vocational Education, according to the regulation. Furthermore, the Directorate General of Vocational Education oversees seven technical implementation units (UPT), five state community academies, and forty-four state polytechnics (Ditjen Diksi, 2021). Wikan Sakarinto, the Director General of Vocational Education at the time, created a programme to ensure that graduates of Vocational High School (VHS) were not only workers or craftsmen but were also adequately equipped to start their own businesses as a follow-up to the government's support and focus on vocational education.

The Entrepreneurial Printing School (SPW) is one of the programs, which functions as a place to test products made by vocational school students and has developed into start-up companies for vocational school students in Indonesia. Teachers must be able to create graduates with basic principles soft skills to improve character and spirit, as well hard skills needed to do assignments, by applying this curriculum for independent learning. The conditions and needs of students and society must be considered when developing the curriculum. Efforts must be made to provide a way out for local governments or schools to develop the curriculum, especially the vocational school curriculum, before developing a new curriculum. Design a new curriculum, which uses a learning paradigm Project Based Learning (PjBL), is not binding because the project conclusion will be determined by the creativity of the teachers. Teachers can search for projects and switch from teaching to coaching. As a result, these teachers must discover new concepts. In fact, teachers can collaborate with each other to form teaching teams/ team teaching (Directorate General of Diction, 2021).

Presidential Regulation (Perpres) Number 68 of 2022 concerning the Revitalisation of Vocational Education and Vocational Training was introduced on Tuesday, February 21, 2023, as one of several measures the government has taken to further encourage the expansion of vocational education. According to the Special Report for Vocational Magazine Edition 2 (2023), it is hoped that Presidential Decree No. 68 of 2022 will accelerate the transformation of vocational education by enhancing cooperation between the government, vocational education and training institutions, and the business and industrial world (DUDI). This will allow for more harmonious coordination between stakeholders. At the launch event, Minister of Education, Culture, Research, and Technology Nadiem Anwar Makarim expressed his belief that Presidential Decree Number 68 of 2022 will accelerate the transformation of vocational education and strengthen cross-sector and cross-institutional collaboration, enabling us to jointly create superior human resources through vocational education revitalisation. The government is working to create better and more competitive human resources. Additionally, Presidential Instruction number 9 of 2016 regarding the revitalisation of vocational schools is expanded upon by this Presidential Decree. This most recent regulatory framework governs the revitalisation of vocational schools as well as all official and informal vocational education programs.

In line with the idea and framework of 21st century skills learning, vocational education is currently implementing the Merdeka Belajar curriculum in both vocational colleges and Vocational High Schools (VHS) in order to realise the development of superior and competitive human resources in the industrial era 4.0. The Independent Learning Policy of the Ministry of Education and Culture Research Technology aims to make learning fun for both educators and learners. Merdeka Belajar is the adoption of a curriculum that places an emphasis on creating a friendly learning environment and encouraging more creative thinking in both teachers and students. The Merdeka Belajar curriculum is expected to spark fresh ideas that could revolutionise the nation's education system, which at the moment seems dull (Yusuf & Arfiansyah, 2021). Students have the choice to select their educational path since the Merdeka Belajar curriculum aims to improve students' character and competency, speed up the digital transformation of the education sector, and give the community back control over education management.

The Ministry of Education and Culture's Merdeka Belajar agenda, which links academic institutions with the commercial and industrial sectors, includes the Merdeka Campus. The Independent Campus program allows students to select their own courses of study in compliance with Minister of Education and Culture Regulation Number 3 of 2020 about National Higher Education Standards (Kemendikbud, 2020). One version of the

program is that students can opt to spend one semester taking courses outside of their study program and two semesters engaging in extracurricular activities. The programmes are (1) Student exchange; (2) research; (3) entrepreneurial activities; (4) independent studies/projects; (5) humanitarian projects; (6) teaching assistance in educational units; (7) industry field work practice/internships; and (8) building villages/Thematic Real Work Lectures (KKNT) are among the activities offered by the Independent Campus program (Susilawati, 2021).

In the meanwhile, a number of schools have put this program into place for the Independent Curriculum in Vocational Schools. Teachers can modify their instruction to be more in-depth in order to fit the requirements of their pupils, foster creativity, and help them think more freely by using the Merdeka Curriculum program. Producing innovative students who can thrive in the industrial age is the primary goal of the Independent Vocational School Curriculum. According to Minister Nadim Makarim's assertion (in Cholilulloh, 2022), the Independent Curriculum offers the following three (three) benefits: First off, all of the courses in the Independent Curriculum are more straightforward and fundamental in terms of the instructional resources offered to pupils. In addition, each educational unit's learning materials are better tailored to the students' skill levels. Second, in line with its motto, "Freedom to Learn," the Merdeka curriculum gives students additional chances to discover their interests and potential. Third, the Merdeka Curriculum is more up to date with contemporary advancements and more dynamic in its execution. Teachers are no longer at the centre of learning activities; students are. Thus, the ability of students to think more freely and creatively is hoped for. Project-based learning and raising Pancasila's visibility in the Independent Curriculum help to support this.

Recently, The Vocational Centre of Excellence (VHS CoE) is the most significant Independent Curriculum product for Vocational Schools. One of the top priorities of the Ministry of Education, Culture, Research, and Technology's Directorate General (Ditjen) of Vocational Education (Kemendikbudristek) is the VHS CoE program. This program's goal is to assist students in vocational schools in gaining the skills they need to be qualified and prepared to enter the workforce. The VHS CoE program is an extension of the Centre of Excellence (CoE) and vocational school revitalisation initiatives that were previously implemented. Local governments and vocational colleges serve as supporting players in the VHS CoE program's collaboration operations with the Business and Industrial World (DUDI). The primary goal of all program activities at VHS CoE is the development of Indonesian human resources. From the explanation related to the development of vocational education policy in Indonesia, it can be illustrated briefly in the following table.

Table 1. Vocational education development policy in Indonesia

Year	Government's Policy
2016	The issuance of Presidential Instruction (INPRES) No. 9 emphasized the revitalization of Vocational High Schools (VHS) to improve the quality and competitiveness of Indonesian human resources. This instruction involved various stakeholders, including governors and relevant ministries, to map workforce needs aligned with VHS development.
2019	Presidential Regulation No. 82 on the Ministry of Education and Culture strengthened the position of the Directorate General of Vocational Education as a key organization within the ministry, highlighting the government's commitment to prioritizing vocational education.
2021	The Minister of Education and Culture Regulation No. 28 modified the structure of the Directorate General of Vocational Education to be more responsive to industry demands, including the establishment of new units focused on vocational education and training.
2022	Presidential Regulation No. 68 on the Revitalization of Vocational Education and Training aimed to enhance collaboration between the government, vocational education institutions, and the business sector, facilitating the transformation of vocational education and improving stakeholder coordination
2023	The implementation of the Merdeka Curriculum introduced a more flexible and creative learning approach, linking educational institutions with the industrial sector. This policy aims to develop superior human resources ready to face challenges in the 4.0 industrial era.

Overall, the evolution of vocational education policies in Indonesia has progressed from efforts to revitalize VHS to strengthening industry collaboration and implementing innovative curricula, all aimed at improving the quality and relevance of vocational education to labor market needs.

The Role and Challenges of Vocational Education in Indonesia

Vocational education plays a crucial role in Indonesia's economic development by preparing a skilled workforce aligned with industry needs (Aris Ichwanto et al., 2020; Subiyantoro et al., 2023). It contributes to reducing

unemployment, fostering entrepreneurship, and enhancing innovation (Subiyantoro et al., 2023). The objectives of vocational education encompass developing basic human qualities, instrumental skills, national identity, and global competitiveness (Aris Ichwanto et al., 2020). It aims to produce graduates with appropriate skills and good character, enabling them to compete fairly in the job market (Setiyawami et al., 2020). Vocational education is particularly significant in emerging sectors like the halal industry, where it prepares graduates with soft skills, hard skills, work experience, and entrepreneurial urgency (Achta Pratama, 2022). Overall, vocational education is essential for human development in Indonesia, supporting economic growth by providing a ready-to-use workforce and encouraging innovation across various industrial sectors (Setiyawami et al., 2020; Subiyantoro et al., 2023).

Vocational education and training (VOCED) is seen as a potential solution to various social and economic challenges, including youth unemployment and economic growth (Psacharopoulos, 1997). However, its effectiveness has been questioned, prompting calls for reforms to make it more relevant to the labor market (Schuetze, 2019; Psacharopoulos, 1997). Research suggests that vocational education should provide both theoretical and practical knowledge, equipping students with adaptable skills for changing work environments (Schuetze, 2019). Studies indicate that workers with vocational education tend to have flatter age-employment profiles compared to those with academic education (Carruthers & Jepsen, 2021). While secondary vocational education is associated with improved early-career outcomes, the effects of large-scale tracking changes are less clear (Carruthers & Jepsen, 2021). Vocational education aims to prepare individuals for occupations that societies require and through which people often define themselves (Billett, 2011). To be effective, vocational education must balance personal and social goals.

On the other hands, Vocational education in Indonesia faces numerous challenges in implementation. These include inadequate communication during public testing and socialization, inconsistent interpretation by trainers, and limited teacher participation in training (Ramdan Mala et al., 2020). The mismatch between academic curricula and industry needs, as well as rapid industrial development, further complicates adaptation (Setiyawami et al., 2020). Integrating a dual vocational education and training system presents additional hurdles, requiring close cooperation among stakeholders and a deep understanding of contextual conditions (Wibowo et al., 2022). Historical changes in vocational education, such as merging specialized schools into a single system and altering the ratio of general to vocational schools, have led to difficulties in job placement for graduates (Suharno et al., 2020b). Insufficient facilities, lack of industry support, and theoretical approaches that are less relevant to the labor market continue to pose significant challenges for vocational education in Indonesia.

The Programmes of Vocational Education in Indonesia

The system of vocational education in Indonesia consists of three main types: Vocational High Schools (VHS), higher vocational education, and non-formal vocational training. Vocational High Schools (VHS) provide secondary education that equips students with practical skills and knowledge tailored to specific careers, allowing them to enter the workforce or pursue further education. Higher vocational education encompasses post-secondary programs offered by polytechnics and vocational colleges, focusing on advanced skills and specialized training in various fields. Additionally, non-formal vocational training includes short-term courses and workshops designed to enhance specific skills and competencies, often provided by government agencies, private institutions, and industry partners. Together, these components create a comprehensive vocational education system aimed at improving the employability and skill levels of Indonesia's workforce

Vocational High Schools System in Indonesia

Vocational education in Indonesia has a long history, dating back to before independence (Suharno et al., 2020a). The system aims to prepare students for the workforce through partnerships between educational institutions and employers (Priowirjanto, 2000). Despite efforts to expand vocational education, challenges persist, including high unemployment rates among graduates (Aziz, 2019). The government has implemented revitalization programs to address these issues, involving multiple ministries and standardization efforts (Triyono & Mateeke Moses, 2019). Key aspects of the system include the development of demand-driven curricula, competency-based training, and flexible delivery methods (Priowirjanto, 2000). However, problems remain, such as inadequate facilities, insufficient industry support, and a mismatch between skills taught and labor market needs (Suharno et al., 2020a). To improve outcomes, recommendations include enhancing

planning and implementation systems, providing targeted fiscal support, and mapping leading economic sectors to better align education with employment opportunities (Aziz, 2019).

Vocational high schools (VHS) in Indonesia offer both three-year and four-year programs to prepare students for the workforce. Studies have shown that graduates of four-year programs generally demonstrate higher competencies in academic, technical, and employability skills compared to those from three-year programs (Amiruddin & Baharuddin, 2023; Soenarto et al., 2018). The longer duration allows for extended internships, providing students with more practical experience and problem-solving skills (Soenarto et al., 2018). Indonesia's vocational education system has evolved significantly since its pre-independence origins, with the government aiming to increase the ratio of vocational to general high schools (Suharno et al., 2020a). However, challenges persist, including inadequate facilities, teacher shortages, and limited industry support. Efforts to address these issues and align curricula with labor market needs are ongoing (Suharno et al., 2020a). Additionally, international partnerships, such as those with Japan's KOSEN system, offer opportunities for further development and enhancement of vocational education in Indonesia (Siswanto et al., 2020).

The vocational high school curriculum in Indonesia aims to produce graduates who are productive, creative, and innovative, with a focus on both work readiness and academic preparation (Sulaeman, 2014). The curriculum emphasizes the integration of affective attitudes, skills, and knowledge to meet labor market needs and contribute to economic development (Sulaeman, 2014). It includes entrepreneurship education as a compulsory subject, supplemented by internships to provide real-world experience (Sunyoto & Setiyawan, 2021). The curriculum is designed to develop both soft and hard skills that align with industry requirements, ensuring graduates can adapt to technological advancements in the workplace (Rosina et al., 2021). However, implementing this comprehensive curriculum presents challenges, including higher operational costs compared to general education (Mulyadi & Sumarto, 2009). Overall, the vocational education curriculum in Indonesia strives to balance educational objectives with industrial needs and economic development goals.

Higher Vocational Education in Indonesia

The curriculum of vocational higher education in Indonesia is designed to equip students with practical skills and theoretical knowledge necessary for the workforce, aligning closely with the needs of various industries. Governed by the Ministry of Education and Culture (Kementerian Pendidikan dan Kebudayaan) and the Ministry of Manpower (Kementerian Ketenagakerjaan), the curriculum adheres to the national education standards known as Standar Nasional Pendidikan (SNP). It is structured around several key components, including core competencies, field-specific competencies, general education subjects, practical training, and research and development (Kementerian Pendidikan dan Kebudayaan, 2016). Core competencies encompass essential skills such as communication, teamwork, and problem-solving, while field-specific competencies are tailored to various vocational areas, including hospitality, automotive engineering, information technology, and health sciences. General education subjects provide a well-rounded foundation, covering topics like mathematics and social sciences, which are crucial for holistic development.

Practical training is a significant aspect of the curriculum, emphasizing hands-on experience through workshops, laboratories, and internships, which are vital for skill acquisition (Sari & Rachmawati, 2020). This competency-based education (CBE) approach focuses on the outcomes that students must achieve, ensuring that they can apply their skills in real-world contexts. Assessment methods include practical exams, project work, and theoretical examinations, all aligned with the established competencies. Various types of institutions offer vocational higher education in Indonesia, including polytechnics, vocational schools and specialized academies and institutes, each contributing to the diverse landscape of vocational training (Rahman & Supriyadi, 2019).

Non-Formal Vocational Training in Indonesia

Non-formal vocational training in Indonesia has a long history, dating back to pre-colonial times and continuing to evolve (Ahmad et al., 2023). The system includes various types of education, such as literacy programs, citizenship courses, and vocational education (Ahmad et al., 2023). Vocational education curricula aim to develop both soft and hard skills that align with industry needs (Rosina et al., 2021). Non-formal education plays a vital role in human resource development by providing organized and systematic activities outside the traditional schooling system (Hasan & Nurhayati, 2012). Islamic boarding schools (pesantren) are an example of non-formal education institutions that have significantly contributed to Indonesia's Islamic civilization (Junaidi, 2017). These schools employ both classical and non-classical teaching systems, with curricula covering various

religious subjects (Junaidi, 2017). Overall, non-formal vocational training in Indonesia aims to improve the quality of life and dignity of its citizens while addressing the country's human resource development challenges (Ahmad et al., 2023; Hasan & Nurhayati, 2012).

In Indonesia, non-formal vocational training is delivered through various types of programs, including kursus (short courses), pelatihan kerja (job training), and community development programs. These programs are often shorter in duration compared to formal vocational education and are designed to be responsive to the immediate needs of participants and employers. For instance, Badan Nasional Sertifikasi Profesi (BNSP) oversees the certification of vocational training programs, ensuring that they meet national competency standards (BNSP, 2020). Additionally, local governments and non-governmental organizations (NGOs) frequently collaborate to provide training programs that target specific community needs, such as agricultural skills in rural areas or digital literacy in urban settings. These initiatives contribute to increasing employability and fostering entrepreneurship among participants, thus addressing the skills gap in the Indonesian labor market (World Bank, 2019).

The effectiveness of non-formal vocational training in Indonesia is further enhanced by its integration with formal education pathways, allowing participants to transition to higher levels of education if desired. This flexibility not only supports lifelong learning but also helps individuals adapt to the rapidly changing job market. As the Indonesian government continues to prioritize vocational training as a means of economic development, the non-formal sector will likely play an increasingly significant role in equipping the workforce with the necessary skills and competencies to thrive in various industries (Ministry of Education and Culture, 2013). From the explanation of the vocational education system, it can be illustrated briefly in the following table.

Table 2. The Systems of vocational education programmes in Indonesia

Aspect	**Vocational High School**	**Higher Vocational Education**	**Non-formal Vocational Training**
Education Level	Secondary	Higher (Diploma)	Non-formal
Duration	3 years	1-4 years	Varies
Curriculum	Structured theory and practices	In-depth theory and practices	Flexible, practice-oriented
Graduates	Ready to work or futher study	Ready for managerial/technical roles	Job-ready

Human Resource Needs in the Era of Industrial Revolution 4.0

The emergence of the fourth industrial revolution has an impact on human existence in several ways, including social, economic, related to the speed and ease of obtaining and sharing information as well as modifying job summaries (Rohmah, 2019). The digitalization of education has also been impacted by this development. Unlike in the past, when learning resources could only be found in books and from teachers, now learning resources can be found online. Competency demands that must be met by educators, students and other stakeholders in educational development in line with the increasing fourth industrial revolution. According to Harto (2018), competence is the culmination of a person's mastery of attitudes and values shown in his thoughts and behavior that are consistent with his responsibilities. A person's ability to carry out their responsibilities and functions in accordance with performance quality standards is another definition of competence.

In improving human resources in the industrial era 4.0, apart from mastering and updates regarding digitalization, in conditions like this we must also be able to adapt to the problems and issues that exist in the world of education, including 4C. As explained by Samsudi, et al (2019), vocational education is related to conditions currently namely in the concept and context of 21st century skills learning, productive vocational school learning programs can be designed as a mainstream for the development of four student skills (4C), namely: communication, collaboration, critical thinking, and creativity. These four skills (4C) are core of soft skills and student entrepreneurship. In accordance with Samsudi, et al. (2019), 4C is explained as follows: (1) Communicative, Students must understand, control, and produce effective oral, written, and multimedia communications in a variety of formats. When discussing ideas with friends or solving problems with teachers, students are given the opportunity to practice their ability to communicate ideas; (2) Collaborative, in these traits, students demonstrate their capacity for teamwork and leadership, adapt to different roles and responsibilities, work well with others, put empathy in the right place, and respect different points of view.

Additionally, learners demonstrate personal accountability and adaptability in their interpersonal, professional, and communal interactions; they also set and meet high expectations for themselves and others and can tolerate uncertainty. Cooperative learning in groups teaches students how to work together. Apart from that, this is also to instill social skills and control of ego and emotions; (3) critical thinking, in this field, students attempt to explain complex concepts and make defensible decisions by understanding how various systems are interconnected. In addition to using their skills to try to solve problems on their own, students can also collect, express, analyze, and solve problems; (4) Creative and Innovative, students with these qualities are able to generate, practice, and share new ideas with others. They also easily accept new points of view. Teachers must create an environment where students can express their creativity. Create an environment where students are appreciated for contributions or accomplishments no matter how small. This is intended to inspire students to continue to get better at what they do. Because each student is different, the teacher's role is limited to that of a facilitator, assisting each student in their learning process.

Conclusion

The development of vocational education in Indonesia in the 21st century shows significant progress through various government initiatives and policies. The government's commitment is evident through Presidential Instruction No. 9 of 2016 and Presidential Regulation No. 68 of 2022 regarding the revitalization of vocational education, which aims to improve the quality and competitiveness of Indonesian human resources. The implementation of the Merdeka Belajar curriculum in vocational education represents an important step in adapting to the demands of the industrial era 4.0. This curriculum emphasizes creating a friendly learning environment that encourages creative thinking among both educators and students. The focus on linking academic institutions with the business and industrial sectors through various programs, such as student exchanges, research opportunities, entrepreneurial activities, and industry internships, demonstrates a comprehensive approach to preparing work-ready graduates. Additionally, the establishment of the Directorate General of Vocational Education and programs like the Entrepreneurial Printing School (SPW) shows the government's serious commitment to developing vocational education that not only produces skilled workers but also creates entrepreneurs. Despite these positive developments, challenges remain in areas such as facility adequacy, teacher quality, and industry support.

Recommendations

Indonesian vocational education appears to be headed in the correct path to fulfil the demands of the workforce of the twenty-first century, as seen by the ongoing emphasis on enhancing industry collaboration, putting project-based learning methodologies into practice, and developing both hard and soft skills. After completing their studies, graduates of vocational high schools have a wide range of options. The subject of expertise or study program chosen during vocational school has a significant impact on the choice of career and future educational path. Graduates of vocational schools can pursue employment, further education, and entrepreneurship, which is commonly shortened to BMW. In order to improve the quality of output, it is necessary to verify that students possess strong competency, hard skills, and soft skills in addition to their enthusiasm, potential abilities, and interests.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPESS Journal belongs to the authors.

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