VTE VOCATION, TECHNOLOGY & EDUCATION

CASE STUDY

# Transforming vocational higher education on the path toward Golden Indonesia 2045

Diaz Pranita[1,*], Budiman Mahmud Musthofa[1], Hadining Kusumastuti[2], Banu Muhammad Haidlir[3]

[1]Applied Social Humanities Department, Vocational Education Program of University of Indonesia, Depok 16424, West Java, Indonesia
[2]Applied Administration and Business Department, Vocational Education Program of University of Indonesia, Depok 16424, West Java, Indonesia
[3]Faculty of Economics, University of Indonesia, Depok 16424, West Java, Indonesia

**ABSTRACT**

Vocational education, especially at the higher education level, is highly valued these days since it is regarded as a means by which to reduce unemployment and increase national production—outcomes that both contribute to national wealth. Given Indonesia's demographic surplus, all stakeholders in the education system—particularly the government and institutions offering vocational higher education—should ensure the accessibility of vocational higher education and the quality of vocational curricula. Achieving this goal is expected to be a major turning point in Indonesia's development as a country. With consideration for these issues, this study examined Indonesia's options for transforming its vocational higher education sector on the basis of the literature and a case study. The findings indicate that the government must act immediately to persuade all relevant stakeholders, especially the business community, to collaborate with the vocational education sector and focus more intensively on elevating the quality of standards and curricula, bridging the skills gap, and promoting the growth and incubation of vocational programs in the industrial ecosystem. In addition, products and innovations can be incubated, tested, and accelerated for release into the market and society by using living laboratories as platforms and hubs for vocational and professional stakeholders. Based on Indonesia's success story, this study has practical implications for developing nations with little assistance and support from the private sector by serving as an alternative model for the development of vocational higher education.

**Key words:** talent gap, vocational higher education, living lab, industrial and business ecosystem, national productivity, Golden Indonesia 2045

## INTRODUCTION

Indonesia is projected to experience a demographic bonus from 2025 to 2045, during which there will be more people of working age than nonworking individuals (Warsito, 2019). The lowest dependency ratio of 47% is anticipated to occur in 2030, during which the dominant productive age group (15 to 64 years) will total 191.08 million people (Badan Pusat Statistik, 2021). This demographic bonus is regarded as a significant turning point, with many nations capitalizing on this phenomenon to progress from a developing to a developed status.

Examples of how demographic bonuses can be a major driver of economic progress are China, South Korea, India, and Brazil (Ragam info, 2024). China experienced a significant surge in its productive age population at the

***Corresponding Author:**
Diaz Pranita, Applied Social Humanities Department, Vocational Education Program of University of Indonesia, Kampus Baru UI Depok, Kukusan, Beji, Depok 16424, West Java, Indonesia. Email: d.pranita@ui.ac.id; https://orcid.org/0000-0002-3988-7265
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end of the 20th century, which increased the country's workforce and prompted the implementation of economic reforms in the 1980s. It has successfully leveraged this demographic bonus, enabling it to evolve into the world's manufacturing center. South Korea experienced a demographic bonus in the 1960s to 1990s, which motivated the government to invest heavily in education and infrastructure. The country's educated and skilled productive age populations became the main driver of industrialization, allowing for its rapid transformation from a developing country to one of the largest economies in the world (Ragam info, 2024).

In the Indonesian context, the young and productive generation accounts for 70.72% of the total population of 270.20 million people—a situation that, if appropriately exploited, has the potential to increase the economic growth, welfare, and global competitiveness of the country (Ichwanto *et al.*, 2020). In contrast, haphazard preparation can pose challenges to productivity, employment, and unemployment initiatives (Achmad *et al.*, 2024). Amid these realities, Indonesia needs superior, competitive, innovative, and adaptive human resources to navigate globalization, digitalization, and Industry 4.0 (Tayibnapis *et al.*, 2019). For 2045, which marks 100 years since the country's independence, its vision is to have evolved into a developed and modern country that is on par with its counterparts across the world. This vision laid the foundation for the conception of the initiatives called Golden Indonesia 2045. Golden Indonesia 2045 articulates the ideals that the country wants to pursue in various spheres, such as the sociocultural, economic, political, and governmental domains (Kartika, 2024). Golden Generation 2045 is an idea and discourse intended to shape members of the young generation into qualified, competent, and highly competitive citizens of the country (Indonesia Emas 2045, 2024). Realizing Golden Indonesia 2045, particularly the preparation of exceptional human resources to maximize the advantage of the demographic bonus, necessitates the involvement of higher education as an important and strategic agent (Kartika, 2024).

Higher education in Indonesia must be improved by focusing on the refinement of the skills and competencies of its graduates so that the knowledge instilled in them is practical and relevant to the world of work (Kartika, 2024). Another key factor for the success of Golden Indonesia 2045 is efforts to achieve correspondence between skill-based education and industrial needs given that the leading sectors for labor absorption in the country include forestry, agriculture, fisheries, manufacturing, and trade (Zaenuddin, 2024). This requirement calls for the involvement of the vocational education sector.

Vocational education graduates have effectively supported the needs of Indonesia's industrial workforce in the last 10 years. Such graduates, however, are still regarded by many companies as insufficiently capable of entering industry given the ongoing talent gap in the country, which remains a fundamental problem that must be addressed (Isnandar *et al.*, 2024; Ridwan Misbahudin & Asmaul, 2022; Suparyati & Habsya, 2024). This resolution is the starting point for improving industry-based learning, paving the way for vocational education to gain strong relevance to the needs of industry, business, and professional work. To begin with, the quality of vocational curricula should be enhanced, and the correspondence between vocational education and industry should be strengthened. Another challenge is the low levels of productivity amid increasing global competition, with Indonesia's average productivity and total factor productivity from 2005 to 2019 declining by 0.66, ranking it relatively far behind South Korea's 1.61 in the period 1971 to 1995 when it was transitioning toward a developed status and China's 1.60 from 2005 to 2019 (Indonesia Emas 2045, 2024). The poor productivity conditions in Indonesia stem from the significantly lagging quality of human resources, especially women; suboptimal productivity in the economic sector; deficient capacity for science, technology, and innovation; and weak laws and institutional structures, such as regulations, incentive systems, and legal certainty (Ollivaud, 2021).

Various studies on the limitations of vocational education have raised the awareness of stakeholders and the government about improving this sector in Indonesia. This endeavor was initiated specifically by President Joko Widodo's administration in 2014, during which vocational education became one of the flagship projects of the regime as well as the central focus of policy and government support (Joko Widodo, 2018). This improvement became the president's main concern that year, and in 2019, it was further strengthened by the establishment of a special institution called the Directorate General of Vocational Education.

In consideration of the issues discussed above, a case study was conducted on the development of vocational education in Indonesia to elucidate how, over the past 10 years, the sector has evolved into a core component of education that has received significant government support. This research also inquired into the sector's transition process in terms of the strategies, phases, and effects of the growth of vocational education in the country in relation to the achievement of Golden Indonesia 2045.

## TALENT GAP

In today's rapidly evolving business landscape, organizations are increasingly recognizing the need to align their

workforce development strategies with the needs of industry and society. In this respect, vocational education programs are competency-based models that combine education and training to prepare students for specific jobs and industries (Darmawan *et al.*, 2023). Accordingly, these initiatives bridge the gap between theoretical knowledge and practical expertise as well as enable a smooth transition from learning to work (Darmawan *et al.*, 2023). Currently, the discrepancy that needs to be addressed is that between the maturity of graduates and the demands of prospective careers (Suharno *et al.*, 2020).

The contemporary environment is characterized by an increased availability of positions, but the problem is that job seekers lack the qualifications or skills necessary to excel in these jobs (Ridwan Misbahudin & Asmaul, 2022). This situation compels businesses to strive to satisfy these requirements, thus affecting local and national economies in general. Unsurprisingly, therefore, the development of the workforce and the talent gaps are the primary priorities of many governments all over the world (O'Leary & Agarwal, 2018). These priorities can be addressed through five strategies (O'Leary & Agarwal, 2018): (1) Governments should improve the delivery of training programs for job seekers using evidence-based approaches. (2) They should focus on lifelong learning, as almost half of college graduates are unprepared for the workplace and need reskilling due to technology shifts. This means that colleges and public universities need to revisit their education models to enable adult learners to adapt as well as defer and then resume their studies throughout their lifetimes. (3) Governments can also develop competencies that are specific to available jobs in a given industry. (4) Offer apprenticeships on middle-skill jobs so that companies can fill positions with people from diverse backgrounds. (5) implementing a matchmaking approach to the workforce ecosystem can reduce gaps by connecting job seekers, schools, and training institutions with one another.

## THE HISTORY OF VOCATIONAL HIGHER EDUCATION IN INDONESIA

The provision of vocational education, one of the domains subsumed within the higher education sector in Indonesia, is mandated by Law No. 20 of 2003 on the National Education System (Government of Indonesia, 2003). It is designed to equip students with certain applied skills and work abilities in accordance with established competency standards. Vocational education combines the functions of education and training through an education system designed to produce experts who can carry out a job professionally.

Vocational education, as a system, was established after World War II (Khurniawan, 2015), but in Indonesia, such development has historically been marked by periods of progress and decline. Vocational education in Indonesia emerged during the initiation of ethical politics (Etische Politic) in 1901 (Khurniawan, 2015), long before Indonesian independence. It was offered under colonial governance by the Dutch on a limited basis, that is, to meet the needs of the colonial government rather than educate the people. Some vocational schools that existed during this era included women's school, technical school, agricultural school, and trade school groups. Indonesia was then occupied by Japan from 1942 to 1945, during which a crafts school was reopened in addition to a secondary technical school, along with the usual women's school, technical school, and agricultural school groups (Khurniawan, 2015).

In 1945, the year Indonesia gained independence, the government exhibited an awareness of the magnitude of the problem of developing skilled workers and attempted to find solutions through education. Accordingly, vocational education continued to develop until the end of the 1980s, when the issue of alignment between education and industry emerged, which then stimulated curricular improvements, the revitalization of vocational education, and the strengthening of industrial cooperation. The growth of the national economy as well as the industrial and service sectors had increased the demand for workers. This development led to the establishment of vocational schools at the middle and high school levels, and vocational colleges were founded as polytechnic institutions along with job or skilled worker training centers to provide formal education to citizens. The year 1998 witnessed a global monetary crisis, triggering sociopolitical turmoil that was exacerbated by demands for a change in leadership (president). This year marked the birth of the reform era in Indonesia.

After the reform, entering the 2000s, vocational education continued to evolve, but society perceived such training as second-class schooling subordinate to academic education. Regionally, however, the vocational domain, especially vocational higher education, grew along with the advent of the Association of Southeast Asian Nations (ASEAN) Economic Community era, which began at the end of 2015, and with free trade for the Asia-Pacific region. Correspondingly, efforts were needed to improve workforce competency to increase the quality and variety of products that could compete in the free market. ASEAN competency standards are related to the movement of workers in ASEAN member countries, especially in the tourism sector. Such movement is facilitated by the ASEAN Mutual Recognition Arrangement on competencies that allow professionals to work across ASEAN member countries by recognizing their qualifications and skills, that could

help ASEAN countries employ competent workers (World Bank, 2020).

The next stage began with the establishment of many vocational higher education institutions on academic campuses, which were then called vocational schools, vocational education programs, or vocational faculties. These institutions offered Diplomas 3 and 4 certification programs as well as the applied master's and doctoral programs that were provided previously by polytechnic institutions. An example is the University of Indonesia's vocational education program, which was established in 2008. Despite these encouraging achievements, however, the development of vocational education programs was met with typical problems, such as the mismatch or talent gap between vocational education graduates and industry needs. These concerns were resolved by the government in 2014, with vocational education treated as a core component of development policy through the establishment of the Directorate General of Vocational Education. This success was subsequently undermined by the new Indonesian government, which, although acknowledging the importance of vocational education in 2024, simultaneously downgraded its management to the directorate level. Yet, although elementary, middle, and high school levels are distinct from higher education, there is a tendency for undergraduate programs to adopt an applied and practical approach to education. Thus, after 10 years of efforts to develop vocational education, substantial progress has been achieved, with this sector no longer relegated to second-class status and the talent gap potentially minimized.

## POLICY ON THE TRANSFORMATION OF VOCATIONAL HIGHER EDUCATION

Although the shortage of skilled workers in Indonesia has gradually diminished, the country still faces a skills gap. The majority of its workforce is currently dominated by low-educated workers (Anggina, 2024). For instance, the Central Statistics Agency data in 2020 (Badan Pusat Statistik, 2021) reported that of the 131.03 million workers in Indonesia, 38.90% are elementary school graduates, 17.93% are junior high school graduates, 18.34% are senior high school graduates, and 11.82% are vocational high school graduates. Workers with higher education degrees account for only 13.02%, among whom 10.23% achieved university education, and only 2.79% acquired vocational degrees (Diploma 1 to Diploma 3). These data point to the inequality in the composition of human resources absorbed into the Indonesian workforce.

The increasing number of workers with minimal education translates to a rise in workers with limited skills. Industry in Indonesia continues to grow, and the need for qualified personnel increases every year. To eliminate the talent gap, President Joko Widodo's administration issued a series of policies, such as that on prioritizing vocational education in the hope that it will produce an expert workforce that can satisfy the requirements of industry. This issuance accords with the 2020 to 2024 Indonesian National Medium-Term Development Plan to cultivate exceptional and competitive human resources who have character and are intelligent, adaptive, and innovative individuals. The government's earnest endeavors were also realized through the establishment of the Directorate General of Vocational Education at the Ministry of Education and Culture in 2019. The Directorate General is tasked with transforming vocational education in Indonesia (Sasongko & Agung, 2020).

To ensure the implementation of effective and efficient vocational education and training, Presidential Regulation No. 68 of 2022 was enacted (Database Peraturan, 2022), highlighting the objectives underlying the revitalization of vocational education and training. These objectives are as follows: (1) increasing the access, quality, and relevance of vocational education and training according to the needs of the labor market; (2) encouraging the development of specific advantages in each education and training institution; (3) strengthening the synergy between the central and regional governments, the business world, the industrial sector, the world of work, and other stakeholders in improving the quality and competitiveness of the Indonesian workforce; (4) equipping human resources with the competencies required to work and/or become entrepreneurs; and (5) encouraging the participation of the business, industrial, and professional industries in delivering vocational education and training.

Prioritizing the development of graduates' competencies and proficiencies is essential to raising the standards of higher education in Indonesia (Kartika, 2024). As previously stated, the government has set forth precise guidelines in Presidential Regulation No. 68 of 2022, which strongly emphasizes the promotion of vocational education given the increased need to produce skilled human resources who are competitive, productive, capable of starting their own businesses, and in demand by the labor market. The Coordinating Minister for National Development and Culture of the Republic of Indonesia issued Regulation No. 6 of 2022, which outlines the national strategy for vocational education and training, thereby allowing for the operationalization of the provisions in Presidential Regulation No. 68 of 2022.

Stakeholders must likewise strengthen the implementation of dual-system and needs-based vocational education, reskilling and upskilling, and the

integration of soft skills to help the workforce anticipate disruptions. This initiative should be guided by the principle of lifelong learning and involve the use of technology to produce resilient, adaptive, innovative, and competent human resources who can meet the demands of local and global job markets. The significance of vocational education is underscored in the policy directives of the Indonesian National Medium-Term Development Plan transformation, as outlined below: (1) The goal of the Sumatra Region Policy Direction is to create a "competitive and sustainable bioindustry and maritime chain". (2) The objective of the Java Region Policy Direction is to create a "superior, innovative, inclusive, integrated, and sustainable megalopolis". (3) The Bali-Nusa Tenggara Region Policy Direction is aimed at establishing an "international tourism and creative economy superhub for the archipelago". (4) The Kalimantan Region Policy Direction is intended to institute a "superhub of the archipelago economy". (5) The Sulawesi Region Policy Direction is designed to establish a "supporting the archipelago economic superhub and natural resources-based industry". (6) The Maluku Region Policy Direction is aimed at establishing a "blue economic hub". (7) The Papua Region Policy Direction is meant to develop a "healthy, smart, and productive Papua".

To support the social transformation pursued by Indonesia, access to and the quality of vocational education were enhanced in accordance with the potential of regions in Sumatra, Java, Bali-Nusa Tenggara, Kalimantan, Sulawesi, Maluku, and Papua. This enhancement was carried out by the government in 2024, through the Directorate General of Vocational Education, by setting four goals evaluated on the basis of seven performance indicators.

### *Increasing the number of graduates from higher education institutions that provide vocational education in accordance with the needs of the world of work*

To achieve this objective, the General Directorate of Vocational Training set the following indicator: the number of students enrolled in Diplomas 1 to 4 or undergraduate programs and undergoing skills upgrading or acquiring extracurricular experience. The programs intended to support the achievement of this indicator are as follows.

#### *Program for vocational higher education students who take the professional competency test*

This program has issued 4859 competency certifications to students, exceeding the previously established target of 4500. The recipients of this scholarship are distributed mostly in the western and central regions of Indonesia (Bandanadjaja, 2024).

#### *Vocational student creativity program*

This is a student's forum program designed to develop *higher-order thinking skills, creative thinking*, and *critical thinking* through the implementation of the three roles of higher education (Tri Darma of Higher Education). This program subsumes two funding schemes, namely, the Vocational Funding Scheme and the Vocational Incentive Scheme, which financed the education of 2042 students in 2023 (Bandanadjaja, 2024).

#### *Village community empowerment program*

This initiative is targeted at increasing the spirit of state defense and strengthening the character of Pancasila, the ideology and the outlook on life of the Indonesian people. through village community empowerment. It awarded funding to 2310 students across the nation under a Pentahelix approach to village community empowerment (Bandanadjaja, 2024).

### *Increasing vocational study programs that accord with the needs of the world of work*

To achieve this target, the Directorate General of Vocational Education set this indicator: the number of study programs that implement the Link and Match Curriculum to ensure relevance to professional settings. The programs that advance the achievement of this indicator are as follows.

#### *Technical guidance for the preparation of vocational higher education curriculum*

This initiative is directed at integrating the Vocational Higher Education Curriculum Guidelines into universities that organize vocational education programs. This program was carried out in two stages involving 245 universities spread throughout Indonesia.

#### *Project-based learning (PBL) implementation program in higher education institutions providing vocational programs in 2023*

The objective and key result (OKR) of this program is for 60% of courses in vocational higher education to be delivered using PBL methods in collaboration with business and industrial partners. However, the realization of this OKR is still far from the target, with the completion rate currently at only 25%.

### *Increasing the utilization of research results from vocational universities*

To achieve this target, the Directorate General of Vocational Education set two indicators.

#### *The volume of research produced by vocational higher education institutions through partnerships with industry/government*

The initiative that supports the achievement of this indicator is the Matching Fund 2023 Program, whose

purpose is to encourage mutually beneficial cooperation between universities and partners. A total of 296 *Matching Fund proposals* have been awarded funding (Bandanadjaja, 2024). However, distribution is concentrated in the western and central areas of Indonesia, with only 15% of funding granted to applicants from the eastern part of Indonesia (Bandanadjaja, 2024).

### *The number of intellectual property filings registered on the basis of the research and development results of vocational universities*

The initiative meant to facilitate realization is the Scientific Article and Intellectual Property Incentive Program for Vocational Lecturers. Under this program, the target of registering 162 intellectual property applications has been satisfied.

### *Increasing the quality of the research results derived in vocational higher education*

To realize this goal, the Directorate General of Vocational Education established the following indicator: the number of scientific papers that vocational universities have published in international journals. It is supplemented by the Research and Community Service Program, which has produced 565 research and community service proposals out of the target of 1350. Funding distribution in 2023 effectively covered the entire country.

Vocational graduates in Indonesia are expected to commence working immediately, either by creating jobs or working for corporations (Masykar, 2019). However, competing for desired work positions necessitates that job searchers possess the competencies or capabilities required by a given sector (Dwiharyadi *et al.*, 2021). The problem is that universities update and incorporate these necessary abilities more slowly than the business world demands (Jackson, 2021). Superior and competitive vocational graduate competencies are required because competition in the labor market has become more stringent and complex. In the last decade, the Indonesian government has exerted various efforts to bridge the talent gap through an independent learning program (Merdeka Belajar Campus Merdeka [MBKM]), partnerships between business and industry (correspondence between academia and the industrial sector), and various other initiatives carried out on a massive scale.

## Independent learning program (MBKM)

Through this program, educational transformation in Indonesia has become more open, relevant, and innovative in the approach to preparing future talents and satisfying future demands for skills in various fields. The Minister of Education, Culture, and Research Technology explained that the vocational education program targets these objectives: (1) reforming previously rigid and inflexible education into one that is more receptive to innovation; (2) ensuring learning that is integrated with industry and regions; and (3) building safer, more inclusive, and more empowering education. University and vocational levels of education produce the fastest impact on the development of human resources because the graduates of these institutions immediately enter the workforce, which directly influences the expansion of the Indonesian economy (Kompas dan Kemendikbudristek, 2024).

Policy on independent learning in Indonesia is the first in history to inspire considerable flexibility, experience, and funding by the government. Emphasis is also placed on research and innovation through the Matching Fund program, thereby sharply increasing research collaboration between universities and industry. For example, the number of research proposals received by universities from companies increased from 1200 in 2021 to 5600 in 2023. Research funding has also increased by 420%, which is one of the driving factors of Indonesia's ranking in the Global Innovation Index from 87th in 2021 to 61st in 2024 (Kompas dan Kemendikbudristek, 2024).

In the past five years, improvements have reflected not only a strengthening of the quality of educational institutions but also increased correspondence with the industrial and global arenas. One of the main pillars of the MBKM program is internships or off-campus learning, which now involves 57% of universities and polytechnic institutions throughout Indonesia. From 2019 to 2024, 1.55 million students completed internships or off-campus learning programs for one semester or more. The impact is significant, with students involved in such initiatives securing jobs 2.4 months faster and receiving an average salary 1.4 times higher than that earned by nonparticipating individuals (Kompas dan Kemendikbudristek, 2024).

The positive impact generated by the transformation of higher education is also reflected in the ranking of Indonesian universities in the world, with the country's position sharply increasing in the Quacquarelli Symonds World University Rankings (QS WUR) over the past five years. The 2025 QS WUR ranking, for example, included as many as three Indonesian universities in the list of 300 best campuses in the world. Then, two universities from Indonesia were included in the list of 500 best campuses globally (Kompas dan Kemendikbudristek, 2024).

## Partnerships with business and industrial organizations

An important strategy in the transformation of

vocational education is the strengthening of partnerships with business and industrial organizations (Setiawan *et al* ., 2024). These alliances go beyond internships or work practices to include the involvement of industry in the learning process in vocational high schools and vocational colleges. Programs such as the Teaching Factory have been implemented in many vocational high schools and polytechnic institutions to create a learning environment that approximates the real world of work. Vocational education that is integrated with industry and based on technology is key to creating a competitive and innovative workforce (Muttaqin, 2024).

The alignment between vocational education and industrial needs has effectively increased the absorption of graduates into the workforce, as it entails the formulation of curricula according to the requirements of industry, the enhancement of the quality of teaching, the provision of internship programs by companies, and the issuance of competency certification that guarantees exceptional expertise among graduates, thereby easing employment and entrepreneurship among them (Kompas dan Kemendikbudristek, 2024).

Collaboration with large companies, such as Google, Telkom, and Microsoft, has also enriched students' experiences with technology and innovation. The Practitioner Teaching Program, which is part of MBKM, brings together more than 12,000 industry practitioners and 30,000 lecturers who teach topics on innovation and entrepreneurship. This collaboration is aimed at narrowing the gap between the theories taught on campus and the actual needs of the workplace. As a result, higher education graduates are better prepared to confront industry challenges and adapt quickly to changes in the labor market (Kompas dan Kemendikbudristek, 2024).

The transformation of vocational education has had a tangible impact on students, schools, and the industrial world. The Central Statistics Agency (Badan Pusat Statistik, 2021) reported that the labor force participation rate of vocational high school and diploma graduates continues to increase every year. This increase reflects that vocational education graduates are progressively in demand by the industrial world. From 2020 to 2023, the open unemployment rate for vocational high school graduates decreased by 4.24%, while the labor force participation of vocational high school and diploma graduates increased by 4.24% and 3.29%, respectively.

### *The experience of vocational higher education at University of Indonesia*

The history of vocational higher education at University of Indonesia dates back to the establishment of a Diploma 3 program at the faculty level to fulfill industry needs. In 2010, however, University of Indonesia's mission to evolve into a research university advanced the unification of all faculty diploma programs with vocational higher education or their elimination. Finally, the year 2011 saw a vocational higher education program clustered into three departments: (1) The applied health department, which offers the physical therapy (diploma 4), occupational therapy (diploma 4), and hospital administration (diploma 3) programs. (2) The applied social humanities department, which delivers vocational education on tourism business management (diploma 4), archive and record management (diploma 4), media production (diploma 4), public relations (diploma 3), multimedia broadcasting (diploma 3), and creative advertising (diploma 3). (3) The applied business and administration department, which offers programs in accounting (diploma 3), taxation (diploma 3), applied actuarial science (diploma 3), banking (diploma 3), insurance (diploma 3), and creative business (diploma 4).

In 2024, the Vocational Education Program of University of Indonesia launched the applied master's degree in creative industry program given that work from creative experts who support the country's aim of building a creative economy accounts for 11% of the gross domestic product (GDP; World Bank, 2020).

The university's vocational education program has also paved the way for the establishment of a living laboratory as a platform for creativity and innovation. The laboratory is aimed at the development, testing, and introduction of new goods, regulations, or solutions to the market and industry to boost output (Feurstein *et al.*, 2008). As living laboratories are expected to serve as hubs for all stakeholders (government; business organizations; communities; academicians, including students and scholars; and local communities), they also function as avenues for the diffusion of innovative ideas. This allows all stakeholders to come together, share information, and collaborate to solve industry problems and innovate to produce a breakthrough in actual industry and work settings.

Through living laboratories, as well, students can experience actual industry conditions and its ecosystem, complete with the obstacles that confront different sectors. The living laboratory of University of Indonesia is composed of teaching factories that were established at the study program level as actual operating facilities where students can interact with clients, comprehend their issues, and offer goods or services to address these issues. The laboratory also helps vocational education students better grasp the competencies and abilities required in the workplace. The government must therefore support and intervene in living laboratories through policies and regulations that promote collaboration between businesses and vocational education

institutions in incubating, testing, and accelerating innovation as well as increasing industry productivity. Additionally, under industry norms and oversight, schools and industry can work together to innovate while pursuing actual projects.

## CONCLUSION

The transformation of vocational education requires continuous support from all stakeholders. The government needs to sustain the promotion of policies that advance vocational education, including the provision of incentives for companies that partner with educational institutions. To keep pace with the most recent advancements in the field, educational institutions must constantly update their curricula and instructional strategies. For vocational students to have access to training and internship possibilities, industry must actively provide training and internship opportunities to vocational high school students. Golden Indonesia 2045 is an important milestone that must be achieved through superior vocational education.

Yet, the reality is that many nations, including Indonesia, struggle with the disparity between the industrial and educational sectors. Indonesia is working to address this issue by transforming vocational education in higher education—a mission pursued by implementing a number of comprehensive programs, including independent learning endeavors, the establishment of autonomous campuses, partnerships with business and industry (linking campuses and industries), curricular improvements, the construction of educational facilities and infrastructure, and the provision of incentive programs, including research funding. This initiative has produced notable quantitative and qualitative results over the last 10 years. For instance, students who participated in industry-based learning secured employment 2.4 months sooner and earned an average wage that is 1.4 times greater than that earned by those who did not engage with the program. This demonstrates how focused endeavors can minimize the talent gap. Given the numerous benefits of vocational higher education reform, policymakers and/or practitioners should step up their efforts to raise the standard of vocational education because it contributes positively to national productivity.

As with any other research, the current study is encumbered by certain limitations. Its scope, for example, is limited to vocational higher education in Indonesia, which may preclude a comparison with the circumstances of other nations. More research is needed on the development of comprehensive vocational education programs. Such explorations can involve the establishment of living laboratories as platforms for collaboration with industry stakeholders and practitioners in specific sectors or fields.

## DECLARATIONS

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Pranita D: Methodology and Validation. Musthofa BM: Conceptualization and Writing. Kusumastuti H: Visualization. Haidlir BM: Review and editing. All authors have read and approved the final version of the manuscript.

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