

Analysis of Fulfilling the Needs of the Business World, The Industrial World, and Entrepreneurship Through the Vocational Ecosystem

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ABSTRACT : *Technological developments affect the business, industrial and entrepreneurship worlds. The Industrial Revolution 5.0 features collaboration between humans and machines, enabling humans to change role, and become human capital that can adapt to advances in technology such as IoT, AI, big data, robotics, and automation. Human Capital is treated as "renewable" intellectual capital, with individuals able to increase their productivity through continuing education and training. Vocational Education plays a strategic role in meeting the needs of skilled, competent personnel for the working world. This research aims to identify the readiness of vocational education to support the fulfilment of the needs of the business world, the industrial world, and entrepreneurship. The research method used is a qualitative case study at the Indramayu State Polytechnic (Polindra). Linking and matching the curriculum to the required competencies, as well as close collaboration among all stakeholders in the vocational ecosystem through the Supply-Demand-Link innovation system model, are the main keys to producing vocational education graduates aligned with the demands of the job market.*

KEYWORDS – *Vocational Education, vocational ecosystem, supply-demand-linkage strategy*

I. INTRODUCTION

The rapid development of technology influenced the Industrial Revolution that occurred. The industrial revolution 4.0 is characterized by advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data, robotics and automation. Then it developed into the Industrial Revolution 5.0, which focused more on the harmonious interaction between advanced technology and human capabilities, as well as the collaboration between humans and machines. Technology is designed to improve the quality of life, create more meaningful jobs, and support social and environmental sustainability. These changes have a major impact on industry, business, and entrepreneurship. The industrial and business sectors must adapt to rapid technological change, while the entrepreneurial sector must foster creativity and innovation in products or services that are more efficient and relevant to market needs. Thus, the need for labor quality across sectors has also changed. The workforce must have skills and abilities that align with the demands of technology and increasingly complex industrial processes, to compete and develop.

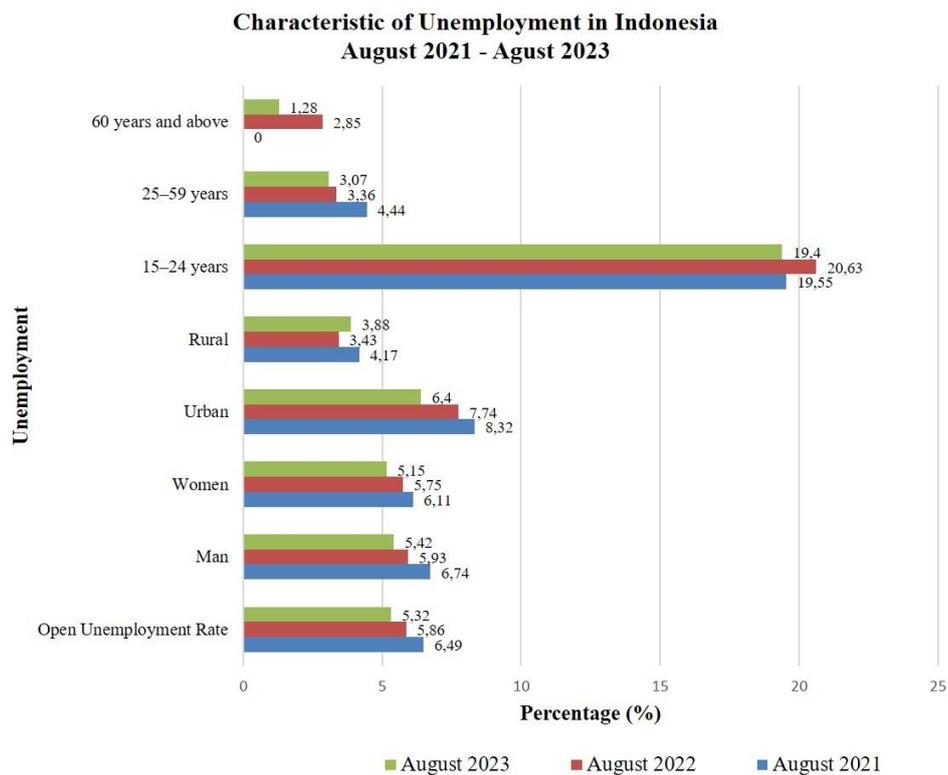
In addition to technological developments and the industrial revolution, Indonesia is entering the golden age of the 21st century (100 years) a Golden Indonesia Vision for 2045, Advanced Indonesia. With the hope that the Unitary State of the Republic of Indonesia will become a developed country on par with a superpower. For this reason, Indonesia must escape the middle-income traps. In an effort to get out of the middle-income traps, economic growth is the main key to achieving this goal. Economic growth is influenced by various factors, both internally and externally. An important factor that affects economic growth is the availability of a workforce of the right quality and quantity to meet the needs of industry, business, and entrepreneurship. The availability of labor goes hand in hand with infrastructure development. At any point in a country's infrastructure, Human Resources (HR) is the key to further development, enabling infrastructure progress to serve as the foundation for economic growth.

The discourse of Golden Indonesia for 2045 towards an Advanced Indonesia is a big challenge. However, it will happen in the next 20 years, the generation that will make it happen is the current young generation. The youth currently pursuing secondary and college education will be 40 years age or older in 2045. 40 years old is

the peak age for a career for professionals. For this reason, it is necessary to have the right strategic and action plans so that the current young generation can develop superior Human Resources (HR) and character that meet the needs of the future. The availability of a workforce that meets needs is one of the keys to unlocking the potential of the industrial sector and generating high-quality national economic growth. The development of superior human resources and skilled labor is closely intertwined with education and training. Superior, quality and characterful Indonesian human resources can be created by increasing and expanding investment in education and skills training.

In the coming years, demand for skilled technology workers, especially in digital technology, is expected to increase, so Indonesia's human resource development must focus on skills education and mastery of technology. The problem is that there is still a gap between the need for a competent workforce and the quality of vocational education graduates available. Based on data from the National Central Statistics Agency (BPS) in 2023 (figure 1), Indonesia's Open Unemployment Rate (TPT) is 5.32%, meaning that out of 100 workers, approximately 5 are unemployed. The Open Unemployment Rate (TPT) is an indicator used to measure the labor force not absorbed by the labor market and reflects the underutilization of available labor.

By area, urban TPT is 6.40%, almost double the rural TPT of 3.88%. Higher unemployment in urban areas generally indicates that, although there are more job opportunities in urban areas, with the challenges of fiercer competition, the need for higher competencies and skills has led to many urban residents remaining unemployed even with higher levels of education. In rural areas, while employment is more limited, the types of jobs available are often more accessible to locals because they are informal in traditional sectors that do not require a high level of education, competence, and expertise. Non-formal types of work in traditional sectors are typically low-wage and tend to be less developed. The percentage of the number of unemployed is dominated by 15 - 24 years old as much as 19.55%, which is the productive age category. The productive age group is the population in the age range of 15 - 64 years. The productive age group is considered to be an age that demographically has great potential to work and generate income, as well as to be actively involved in economic and social activities.



**Figure 1. Characteristic of Unemployment in Indonesia
August 2021 - August 2023**

With awareness of the importance of the availability of superior, quality, and character human resources, the Indonesian government declares vocational education as one of the efforts to meet the needs of a skilled and competent workforce. Vocational education, both in vocational schools and vocational colleges, is prepared to produce graduates who are ready to work. In fact, TPT graduates of Vocational High Schools (SMK) occupy the

highest position in the number of unemployed, as many as 9.31% in 2023, compared to graduates of other levels of education (figure 2). In an effort to improve the quality of vocational education in Indonesia, the government stipulated Presidential Regulation number 68 of 2022 concerning the Revitalization of Vocational Education and Vocational Training.

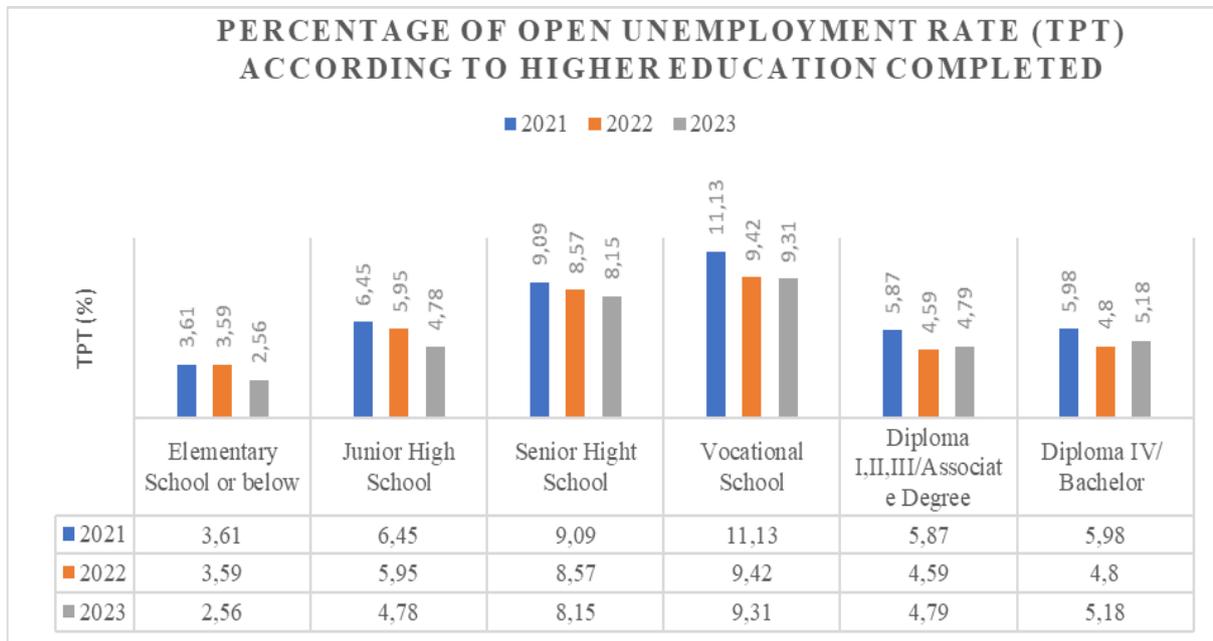


Figure 2. Percentage of Open Unemployment Rate (TPT) According to Higher Education Completed in Indonesia August 2021 - August 2023

This research was carried out in Indramayu Regency, considering that although it has diverse natural products and products, Indramayu Regency has ranked first in the highest percentage of poor people in West Java since 2022. Indramayu Regency is located on the coast of the Java Sea with a wide coastline and a fairly long coastline, so it has great potential in the fisheries and tourism sector, especially marine tourism. In the Balongan sub-district, it has the largest oil processing facility in Indonesia, namely the Balongan oil refinery owned by PT Pertamina. In the Sukra sub-district, there is the Patimban International Port, which was built to support export and import activities, especially in the automotive and logistics industry sectors. Indramayu Regency also has great potential in the agriculture and plantation sectors, so it is known as the largest rice barn in West Java. In fact, even though Indramayu Regency has abundant natural resources, it is known that since 2022, it has become the Regency with the highest percentage of poor people in West Java, as much as 12.13%. The Indramayu State Polytechnic (Polindra) is the only state university in Indramayu Regency.

Table 1. Population of Indramayu Regency (2023)

Age (Years)	Indramayu Regency Population 2023	
	Number	(%)
0 – 14 (Non-Productive Agee)	423.199	22%
≥ 65 (Non-Productive Age)	126.017	7%
Non-Productive Age	549.216	29%
15 – 64 (Productive Age)	1.345.109	71%

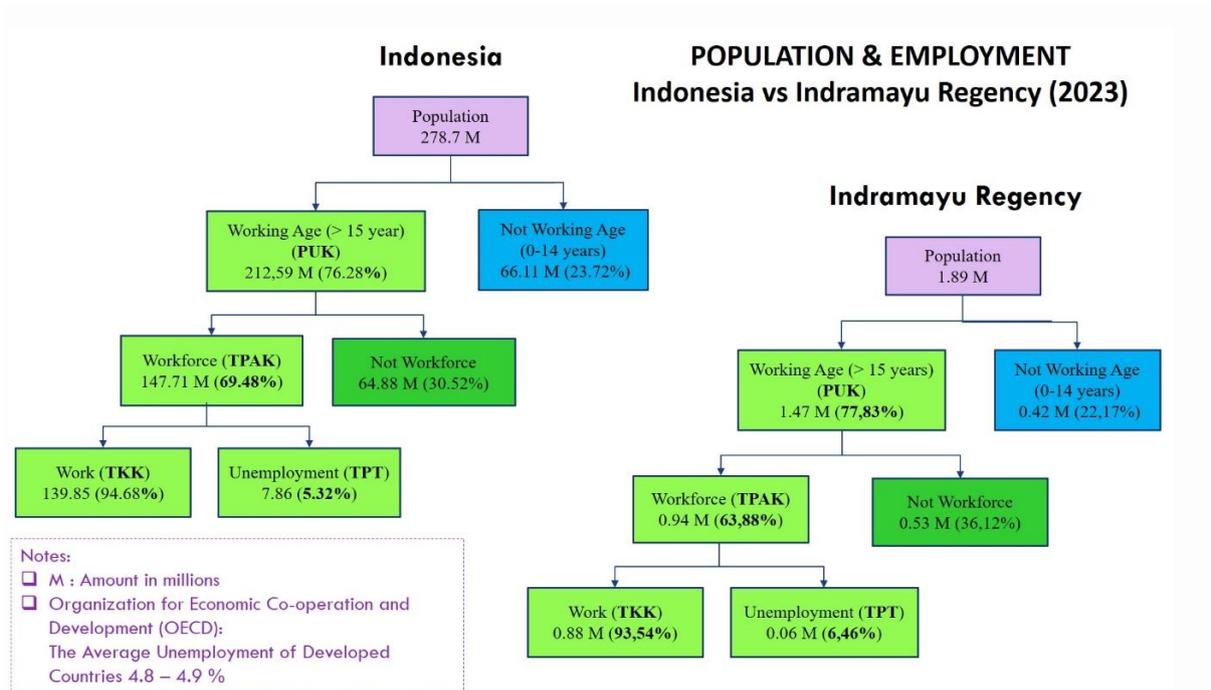


Figure 3. Population & Employment Indonesia vs Indramayu Regency (2023)

Based on a comparison of National BPS data with Indramayu Regency in 2023, it is known that in 2023 Indramayu Regency will have population and employment patterns that are almost similar to the national situation in Indonesia (Figures 3 and 4). Indramayu Regency experienced a demographic bonus, with the number of people of productive age (15-64 years) reaching 71% while the number of non-productive age population was only 29% (Table 1). This means that the number of productive populations is more than 2 (two) times the number of people of unproductive age. The Open Unemployment Rate (TPT) of Indramayu Regency is 6.46%, higher than the national TPT of 5.32% (Figure 3). The labor force and unemployment in Indramayu Regency are dominated by residents with the highest education who have completed junior high school and below (Figure 4). This means that in 2023, Indramayu Regency is in a demographic bonus period, but the quality of the available workforce is still in the low category. Workers with the highest level of education from junior high school and below do not have good competence and do not have competitiveness.

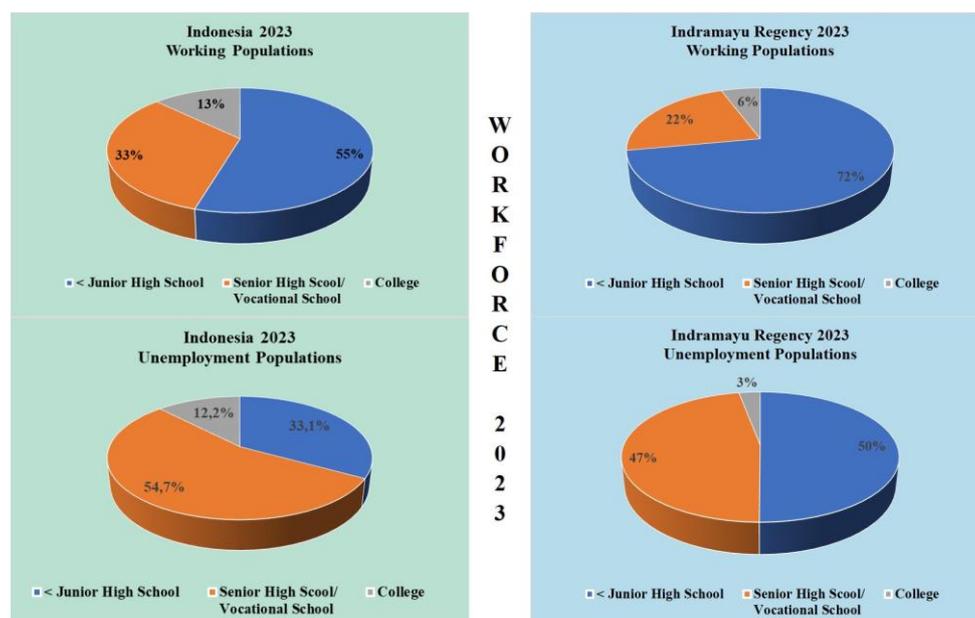


Figure 4. Working Populations – Unemployment Populations Indonesia vs Indramayu Regency (2023)

II. LITERATURE REVIEW

THEORETICAL STUDIES

In qualitative research, theory is used not as a basis for formulating hypotheses, but to strengthen the author as a human instrument, in order to be able to make research questions, collect data and analyze qualitative data in a natural setting based on the phenomena that occur (Sugiyono, 2018)

INNOVATION SYSTEM THEORY

It was first introduced by Freeman in the late 1980s, then elaborated further by Nelson (1993) and Edquist (1997). Edquist stated that "Innovation Systems are a series of tools covered in the political, economic, social, institutional, organizational, and other aspects related nationally involving government and private elements based on the learning process, dissemination, and application of science and technology to implement current and future innovation goals." The Supply-Demand-Linkage Innovation System is an innovation system model that refers to the fulfillment of the supply side to meet the demand side and the linkage between the supply and demand sides.

Christopher Freeman developed the concept of Innovation Systems in 1982, through his work entitled *The Economics of Innovation*. The innovation theory developed by Freeman emphasizes the importance of the interaction between technology, economics, and institutions in understanding the innovation process. The concept of innovation systems describes how innovation occurs in the context of a larger economic system, encompassing the role of the state, industry, and education sector in facilitating innovation. The elements related to the innovation system are:

- 1) Main Actors, consisting of:
 - a. Companies (industries) play a role in the development and application of new technologies.
 - b. Research and Education Institutes, which play a role in generating new knowledge and technologies that drive innovation.
 - c. The government plays a role in creating policies to support innovation. The government is also the one that finances research, makes regulations, and provides technological infrastructure.
 - d. Investors and Financiers are financial institutions and investors that fund research and development of new technologies. In addition to financing research and development of new technologies, investors also finance the commercialization of inventions or starting new technology-based ventures.
- 2) Innovation System Model: there are several approaches, including:
 - a. National Innovation System: a country's innovation ability depends on the interaction between actors within the country, such as companies, universities, government agencies, and markets.
 - b. Regional Innovation System: emphasizes the importance of local and regional interaction in supporting innovation, so that certain regions with a growing innovation ecosystem can produce more appropriate innovations.
 - c. Sectoral Innovation System: focuses on specific industries or sectors, such as information technology, automotive, healthcare, and others

HUMAN CAPITAL THEORY

Developed by Theodore W. Schultz and Gary S. Becker. Intellectual and human capital are treated as sources of renewable productivity. The ability of human capital to develop and increase productivity over time, through the process of education, training, experience, and continuous learning. Human capital is the most important intangible asset that does not appear on the balance sheet, but helps companies produce and sell goods or services. Human capital is considered renewable because it develops through the improvement of individual knowledge, skills, and competencies. Becker, in his book *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education* (1964), explained that education and training have a long-term impact on individual income and overall economic productivity. Becker saw labor not only as a static factor of production but also a resource that could be developed and improved through education and training.

Issues related to Human Resources (HR) in the economy, not only human capital, but also supply and demand. Furthermore, Becker connects the concept of human capital to labor demand. The more skills and knowledge the workforce has, the greater the demand for them in the market. An overall increase in human capital can boost productivity thereby improving economic well-being more broadly. This will also affect economic growth, as a more skilled workforce can use more efficient technology and equipment to get more results.

Gary Backer provides the basis for a theory of labor market equilibrium that accounts for the interaction between supply and demand, as well as factors such as human capital, wages, and economic policy. Based on the theory of supply and demand, the balance between market needs and production capabilities greatly determines business continuity. The theory of supply and demand is a basic concept in economics that explains how the price and quantity of goods or services are determined in the market through the interaction between sellers (producers) and buyers (consumers). In the world of labor, an imbalance between labor demand and supply occurs when the amount of labor available is not proportional to the amount needed by the business and industrial worlds, in both quantity and quality. The phenomenon of labor supply and demand theory is explained as follows:

- 1) Labor demand is the amount of labor required by a company or organization to run its operations, usually determined by economic, technological, and industrial conditions.
- 2) The labor supply is the number of individuals willing and able to work at a given wage level.

The balance between supply and demand for Human Resources (HR) is an ideal condition when the amount and quality of labor available in the job market are proportional to the quantity and quality of labor needed by the business and industrial worlds. The balance between labor demand and supply is influenced by external factors including technological developments, government policies, education systems, and global market dynamics. When balance is reached, then:

- 1) Structural unemployment can be minimized, as the available workforce has relevant skills.
- 2) The company's recruitment and training costs have become more efficient, as the workforce is ready to use.

VOCATIONAL EDUCATION

Rupert Evans (1978) defines vocational education as part of the education system that prepares a person to work more effectively than others. Pavlova (2009) states that vocational education is education and training designed to produce graduates who are ready to work, with the skills and competencies needed in a particular field of work, aligned with the needs of business and industry. The Law on the National Education System, number 20 of 2003, explains that vocational education is secondary education that prepares students to work in certain fields and to continue to a higher level of education. Meanwhile, a vocational college education prepares students to work with applied skills at a level equivalent to a bachelor's program. Vocational education and training are carried out in stages, starting from the secondary education level, namely vocational and extraordinary vocational schools, as well as higher education levels, namely polytechnics and diploma programs at universities. Educational services can be through formal channels (education) or non-formal channels (skills training or courses). Currently, graduates of vocational higher education are not only required to work competently but must also possess entrepreneurial skills.

III. RESEARCH METHODOLOGY

RESEARCH METHOD

This research uses qualitative-interpretive research methods, with a descriptive approach. The qualitative research was grounded in the phenomenological paradigm of Edmund Husserl (1859-1926). According to Sugiyono (2018), the qualitative research method is based on the philosophy of positivism or interpretivism, which is used in the condition of natural objects, where the author is the key instrument. The main goal of qualitative research is to understand, gain deep insight, and discover something unique. The qualitative paradigm is also called a constructivist, naturalistic (interpretive), or postmodern perspective, which emphasizes understanding problems in social life in terms of the conditions of reality. The Interpretive approach emphasizes on a deep understanding of the subjective meaning individuals give to their experiences in social contexts. In the interpretive paradigm, social reality is understood through personal experience and individual perspectives. Reality is not considered objective but a social construct shaped by the meanings given by an individual or group (Creswell, 2013). Interpretive is an approach that focuses on a deep understanding of the experiences, views, and meanings that individuals or groups attribute to a particular phenomenon or their social context.

The social situation in this study is an Indonesian vocational ecosystem with a case study at the Indramayu State Polytechnic (Polindra). The researcher is the primary instrument directly involved in data collection with participants. through the multiple source method (triangulation). collecting data from several sources, namely interviews, observations, and document analysis. The sources of information or participants in this study are those related to the readiness of vocational education graduates to meet the needs of business, industrial worlds, as well as entrepreneurship, within the Supply – Demand – Linkage innovation system.

TYPE OF DATA

The study used 2 (two) types of informants, namely key informants and supporting informants. Key informants are informants who know the problems being researched in depth, while supporting informants are selected based on their knowledge and often have formal and informal contact with key informants. The author mentioned the key informants in this study as participants. The participants in this study are (1) The Deputy Chief Executive of the National Vocational Coordination Team, (2) Former Chairman of National Professional Certification Agency (BNSP) and former Chamber of Commerce and Industry (KADIN) administrator, (3) The Deputy Director of Academic Affairs of Polindra, and (4) Head of the Academic Support Unit (UPA) of Polindra Career and Entrepreneurship Development. The supporting informants are the Director of Polindra, the Head of the Indramayu Regency Marine and Fisheries Service, the Chairman of the Indramayu Cracker Entrepreneurs Association (APKI), the Head of the Indramayu Regency Marine and Fisheries Service, and the Secretary of the Indramayu Regency Regional Research and Development Planning Agency.

The researcher used data sources in this study from two categories primary and secondary data. Primary data were obtained directly from participants without intermediaries through interviews and direct observation at the research location. Secondary data were obtained through discussions, literature reviews, and documentation, using social and electronic media, in the form of books, journals, reports, information, and other additional sources related to this research.

DATA ANALYSIS TECHNIQUE

The data analysis in this study follows the concept expressed by Miles and Huberman. According to Miles and Huberman (in Morissan, 2019), the qualitative data analysis process consists of 3 stages, namely:

- 1) Data Reduction includes selecting, namely determining important and unimportant data, focusing attention on certain data, simplifying data, formulating a general idea, or abstracting the phenomenon being studied, transforming general ideas into the form of data displays (transforming) so that they can be understood in relation to the issues being discussed. In reducing the data, the author is guided by the research objectives.
- 2) Data Display, can take the form of a matrix, graphic, network pattern, chart, or a temporary conclusion sentence. The data display is intended to reveal meaningful patterns and support the drawing of conclusions.
- 3) Conclusion Drawing and Verification is a stage to give meaning to the data, confirm whether the meaning is correct, and verify whether the meaning is appropriate (must be tested for validity). The conclusion of qualitative research is a new finding that did not exist before. The findings can be in the form of a description of an object that was previously unclear, so that after research, it becomes clear; or in the form of causal or interactive relationships, hypotheses, or theories.

IV. RESULT AND DISCUSSION

The description of the findings of this research was obtained by the author from interviews with participants and from observations, both during the interviews and of the surrounding conditions. Based on the interview results, the author prepared a transcript of the interview, converting the conversation word-for-word into writing. Then a reduction is carried out by selecting which data are important and which are not. Furthermore, focusing attention on specific data, simplifying data, formulating a general idea, or abstracting the phenomenon being studied into a theme. Then a thematic synthesis is carried out by providing coding and structural descriptions, to change general ideas into the form of data displays (transforming) so that they can be understood in relation to the issues being discussed.

Based on the results of the horizontal coding analysis, 9 (nine) themes were identified, and the author then conducted Theme Synthesis to narrate each theme for each participant. The themes are:

- 1). Chamber of Commerce and Industry (KADIN)

The Chamber of Commerce and Industry (KADIN) is one of the most important stakeholders in the Vocational Ecosystem. KADIN is a forum that bridges the needs of the business world, the industrial world, and the world of work with vocational education (Vocational Ecosystem Linkages). The Chamber of Commerce has two functions: as a forum for communication and coordination between the business and industrial worlds and the government. KADIN provides input on the development of competency standards needed by the industrial world. KADIN recognized that vocational education graduates are unprepared for the needs of ready-to-use personnel in the industrial world, because the education system lacks 3-5 years to adjust to technological developments in industry. In fact, in the industrial world,

technological development over the past 3 years has changed. The gap between the very fast pace of technological development in the industrial world and limited time in the education system prevents vocational education and training from keeping pace, so it is graduates cannot meet the needs of the workforce in the business and industrial worlds.

2). The dual system of vocational education

The dual system of vocational education in Indonesia is based on the German model, particularly the concept of internships with campus-based learning and direct workplace or industry practice. Internships are designed to provide students with practical skills needed in a real work environment.

3). Internship program and collaboration with vocational education stakeholders

Cooperation with stakeholders, especially through internship programs in the business and industrial worlds, is one way to reduce the gap between vocational education skills and the technology used in the business and industrial worlds. An Internship is a planned activity in the learning curriculum, carried out to help students gain a more comprehensive picture of the Business World, the Industrial World, and the World of Work, as well as providing opportunities and media to apply theory and direct practice in the world of work.

4). Competency Certification

Competency certification is proof that someone is competent in a field of work. The main purpose of certification is to ensure that a person has mastered the competencies required by their workplace or industry. A certificate of competency in vocational education is official proof that an individual has mastered competency standards in a field of work or profession. The competency certificate is given by the certified institution or the Professional Certification Institute after the individual undergoes a competency test process in accordance with SKKNI.

5). SKKNI (Indonesian National Work Competency Standards)

SKKNI is a guideline that establishes competency standards for workers in Indonesia across various fields of work. In the context of human resource development and employment policy, the Indonesian government established SKKNI (Indonesian National Work Competency Standards) and KKNI (Indonesian National Qualifications Framework). SKKNI is determined by the Ministry of Manpower, which is responsible for compiling, developing, and setting national work competency standards for Indonesia's business and industrial sectors. Meanwhile, the KKNI was determined by the President, supported by the Ministry of Education and Culture, the Ministry of Manpower, and education providers, to ensure harmony between the qualifications required by the world of work and the world of education. The main goal of SKKNI is to align human resources qualifications with the needs of the job market, and to improve the quality and competitiveness of the Indonesian workforce, both domestically and in the international market. SKKNI also serves as a basis for preparing education, training, and competency certification programs needed to develop workers' skills. Meanwhile, KKNI is a system that compiles the qualifications of Indonesian human resources in 7 (seven) levels. The goal of the KKNI is to align formal education, vocational training, and work experience with the needs of the labor market, and to ensure that the qualifications individuals possess are recognized across sectors of employment. KKNI connects educational levels with appropriate career levels or positions, helping map career paths and workforce mobility in Indonesia.

6). Link and match the Vocational Education curriculum with Industry and stakeholders

Link and match in the context of vocational higher education is a close relationship that supports each other between vocational education institutions and the business world, the industrial world, and the world of work, including entrepreneurship. Link refers to the relationship between the curriculum applied in educational institutions and the needs of the business world, the industrial world, and the world of work. Meanwhile, the match is the alignment between the competencies possessed by students or graduates of vocational higher education and the skills and expertise needed by the business, the industrial, and work worlds. In general, linking and matching is the process of matching and aligning between two main things: (1) educational curriculum at vocational colleges or training programs with industrial or work needs, and (2) skills and competencies possessed by graduates with labor needs needed by companies or industrial sectors.

7). Tax Deduction Incentive System

The tax deduction incentive system for vocational higher education is a tax deduction for companies that participate in the vocational education student internship program. In an effort to encourage the involvement of the business world and the industrial world in the development of quality human resources, the government issued Minister of Finance Regulation no. 128 of 2019 (PMK 128/2019)

concerning the Provision of Gross Income Reduction for the Implementation of Work Practice, Apprenticeship, and/or Learning Activities in the Context of Fostering and Development of Human Resources Based on Certain Competencies.

- 8). Presidential Regulation Number 68 of 2022 concerning the Revitalization of Vocational Education and Vocational Training (RPVPV)

The implementation of the Revitalization of Vocational Education and Vocational Training (RPVPV) involves several ministries as an implementation team and a supervisory team. For this reason, the government issues several regulations related to the strategy, implementation, and supervision of the RPVPV. The RPVPV strategy is regulated in the Regulation of the Coordinating Minister for Human Development Number 6 of 2022 (Permenko PMK 6/2022) concerning the National Strategy for Vocational Education and Vocational Training. Permenko PMK 6/2022 regulates strategy, implementation, quality assurance, the role of stakeholders and funding, institutions and regulations, action plans, as well as monitoring and evaluation related to vocational education and vocational training. The RPVPV implementation team is regulated in the Decree of the Coordinating Minister for Human Development (Kepmenko PMK) number 35 of 2023, which was later changed to Kepmenko PMK number 14 of 2025.

- 9). Indramayu State Polytechnic (POLINDRA)

Indramayu State Polytechnic (Polindra) is a state university based on vocational education. Polindra is the only state university in Indramayu. Currently, Polindra has 3 (three) departments, namely Engineering, Informatics Engineering, and Health. The three majors are divided into 11 study programs, namely (1) Engineering there are 4 study programs: D3 Mechanical Engineering, D3 Refrigeration and Air Conditioning Engineering, D4 Manufacturing Design and D4 Instrumentation and Control Engineering Technology, (2) Informatics Engineering there are 4 study programs: D3 Informatics Engineering, D4 Software Engineering, D4 Smart City Information Systems and D4 Computer Engineering Technology, and (3) Nursing there are 3 study programs: D3 Nursing, D4 Electro-Medical Engineering Technology, and D4 Medical Laboratory Technology. The formation of the study program is based on: (1) need assessment, and (2) according to the level of saturation. When the saturation level is low, the study program is made. There are social obstacles that Polindra faces at the beginning of its operations as a vocational higher education institution. The traditional view of the people of the Indramayu regency is that formal education, especially higher education, is less important. Many high school or vocational school graduates, especially women, prefer to work abroad to become Indonesian Workers (TKI) and Female Workers (TKW). This view is still not fully resolved. BPS data for Indramayu regency, indicate that the average school length in 2023 was 6.94 years. This means that the average resident of Indramayu regency only has access to an elementary school (SD) or a junior high school (SMP). Meanwhile, with a long-term expectation of 12.29 years in 2023, it means that the residents of Indramayu regency have school expectations only up to junior high or high school/vocational school.

V. CONCLUSION AND RECOMMENDATION

The business, industrial, and entrepreneurial worlds play an important role in economic development and job creation. The business world plays a role as an economic driving agent by introducing products and services needed by the community. The industrial world is part of a more specific business world that focuses on the production of goods, especially on a large scale. The industry processes raw materials into finished or semi-finished goods, which are then sold to the market. No less important than the business and industrial worlds, entrepreneurship also plays a role as a driver of change by creating new products or services, and opening new jobs.

The rapid development of technology in the era of the industrial revolution 5.0 is changing the needs of the business and industrial worlds. Technology is accelerating the innovation process and transforming traditional business models into modern, more flexible, adaptive, and globally connected ones. The Industrial Revolution 5.0 features human collaboration with machines and the use of advanced technologies such as robotics and AI that work more closely with humans but do not replace human work. This collaboration allows for increased efficiency while still paying attention to human touches in the production process and service. With technology, many new business models have emerged that have never been imagined before. Creativity and innovation are the keys for entrepreneurs to develop products and services that are more efficient and better aligned with market needs. Innovations such as e-commerce and online businesses allow entrepreneurs to sell products and services to global markets without a physical store. Platform-based applications, leveraging technology to connect business people with consumers. Fintech, or financial technology, enables entrepreneurs to create more inclusive financial services through digital payments, cryptocurrencies, and more.

With technological development, humans have changed their role in economic development. Currently, humans do not only function as Human Resources (HR) but even more so as human capital. Human capital has a significant influence on economic growth and the growth of technology use (Haryono, Lanadimulya, and Farhan, 2021). Human capital not only emphasizes the individual but also the qualities and capacities individuals possess. Human Capital theory holds that intellectual and human capital are "renewable" sources of productivity. The concept of "renewable" refers to the ability of individuals to develop and increase sustainable productivity through the continuous educational process, training, experience, and learning. In contrast to natural or physical resources, which are limited and cannot be replenished in the short term, human resources are considered renewable because they develop through the improvement of individual knowledge, skills, and competencies. Education and skills are forms of investment with great economic value. Human capital is the most important intangible asset that does not appear on the balance sheet, but helps companies produce and sell goods or services.

Human capital is closely related to the innovation system. The skills, knowledge, experience, and abilities of individuals are greatly influenced by the innovations and technologies used in human life activities. As technological innovation continues to evolve, "renewable" HR refers to individuals' ability to adapt to such changes and to develop the capacity to innovate. As individuals acquire new skills and experiences, they can begin to create new solutions to existing challenges, ultimately contributing to the creation of new economic value. This shows that human capital not only increases productivity in existing jobs but also creates new innovations and opportunities. Human capital is not only about technical skills, expertise, and knowledge (hard skills), but also includes soft skills, such as attitude, social and emotional skills, and the ability to work in a team, communicate effectively, and lead.

Technological developments, robotics, and automation systems ultimately affect the workforce structure across various business sectors and industries. Automation and robotics will replace simple, repetitive, and routine work, which is usually done by low-skilled workers and thus earn low wages. To keep up with technological developments and changes in the workforce's skills and competencies vocational education is one effort to meet these needs.

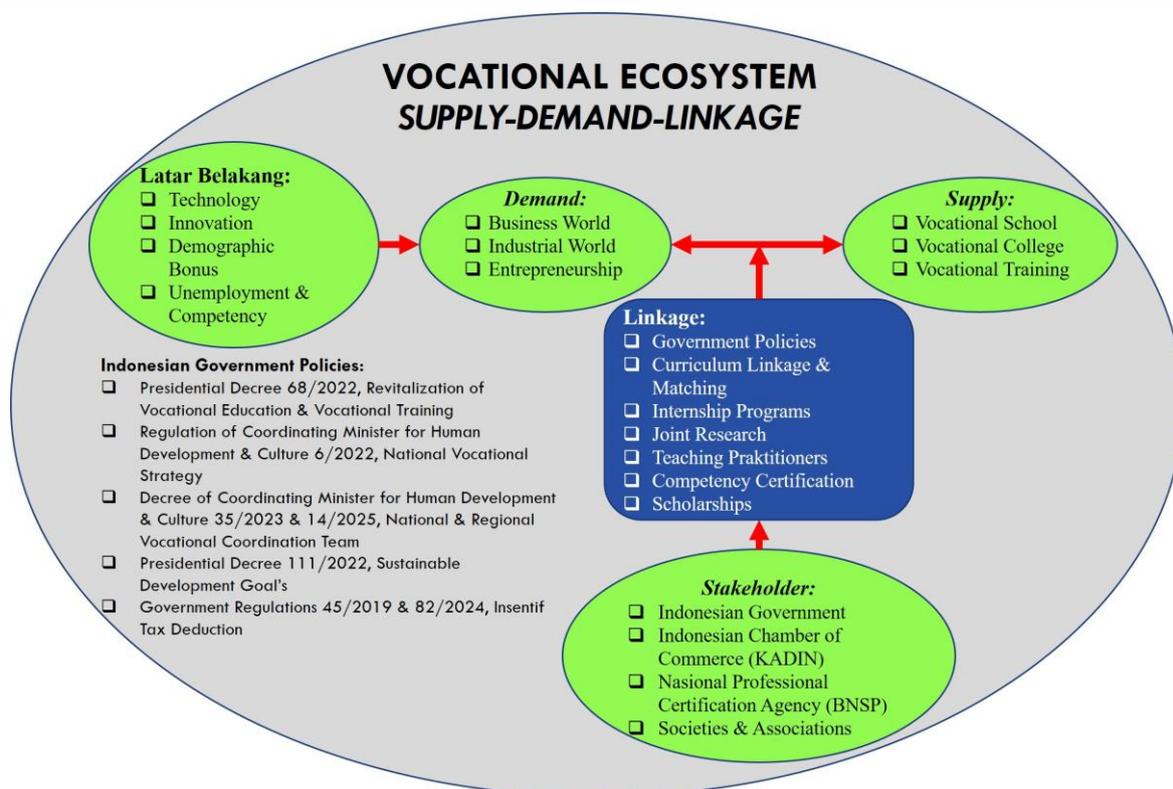


Figure 5. Vocational Ecosystem Supply-Demand-Linkage

The results of the research (Figure 5) indicated that an integrated vocational education ecosystem between the industrial world, the business world, and entrepreneurship, as well as related stakeholders, must focus on supply-demand-linkage. Supply-demand-linkage is the key to the success of relevant, high-quality vocational

education, enabling the preparation of human resources as human capital ready to face future competition and challenges. Ideally, the vocational education ecosystem has 4 (four) subsystems, consisting of (1) educational institutions, (2) the business world, the industrial and entrepreneurial world, (3) the government, and (4) the community. The four have their own duties and responsibilities, forming an interrelated ecosystem that needs, adjusts, supports, and fills each other. Each stakeholder in the Vocational Ecosystem has their own but interrelated duties and responsibilities.

- (1) The business world plays an agent role, driving the economy by introducing products and services needed by the community.
- (2) The industrial world is part of a broader business world that focuses on the production of goods, especially on a large scale.
- (3) Entrepreneurship plays a role as a driver of change by creating new products or services and opening new jobs.
- (4) The government, as a policymaker, has issued several regulations related to strategy, implementation, supervision, monitoring, and evaluation.
- (5) KADIN, as a strategic partner of the government, serves as a bridge between the business/industry world and vocational education institutions, helping ensure that the curriculum taught in vocational education institutions is relevant to the needs of the job market. KADIN can also be involved in the preparation of work competency standards in accordance with industry developments. In addition, the Chamber of Commerce plays a coordinating role with the government in implementing vocational education policies.
- (6) BNSP is in charge of developing a competency certificate system that consists of test materials that must align with competency standards and procedures for testing.
- (7) The community has a role in disseminating information about the importance of vocational education to young people, parents, and the general public. In general, the role of the community is crucial to creating dynamic and sustainable vocational education ecosystem, which requires the active participation of all sectors of society, including the business world, parents, and individuals at the community level.

STRENGTHENING VOCATIONAL ECOSYSTEM SUPPLY – DEMAND - LINKAGE

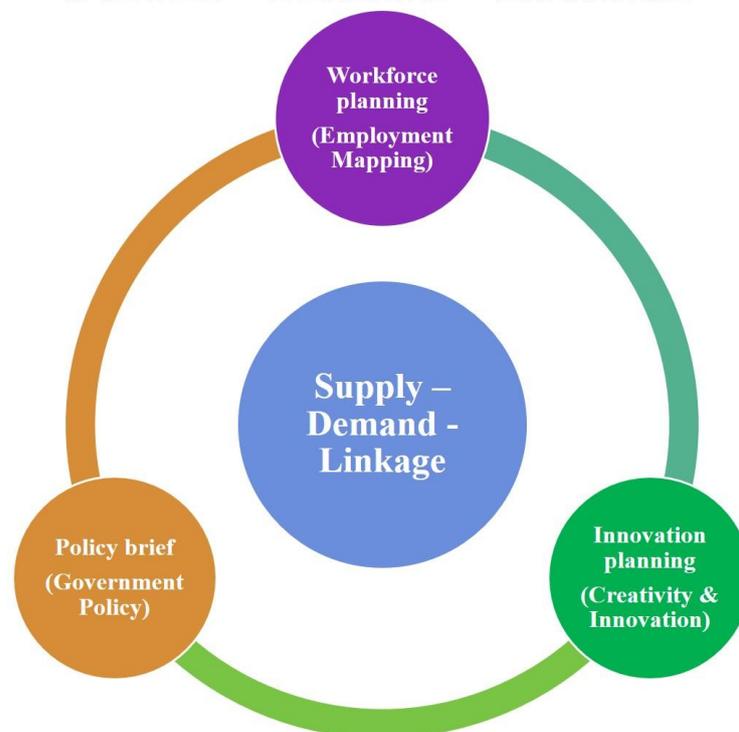


Figure 6. Strengthening Vocational Ecosystem Supply-Demand-Linkage

The three important things that can be produced through strengthening the vocational ecosystem with partnerships (Figure 6) are:

- (1) Workforce planning and job mapping are carried out for the current year and the following year. With this mapping, it is possible to identify the education and labor fields required by the industry. Then an analysis is carried out on the suitable field of education and the ratio of the number of vocational schools, vocational higher education (polytechnics, institutes, academies, and so on), course institutions, and guarantee institutions (certification), so that graduates produced by vocational education can be directly absorbed by industry. Job Market Information is one way to monitor the needs of the business and industrial worlds for the competencies and quality of the workforce.
- (2) Innovation planning: this program is carried out by encouraging vocational education to develop innovations tailored to industry needs in their respective regions, or by improving entrepreneurial skills, so that vocational education graduates are not completely dependent on industry.
- (3) **Policy brief: a regional regulation issued to support the use of vocational education, especially the absorption of vocational education graduates by industries in their respective regions.**

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