

Dynamics of Industrial Revolution in Improving the Quality of Human Resources of College Graduates

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Abstract: Indonesia is a large country with an area of 5,455,675 km², and a population approximately 265 million people, occupying some 17,504 islands, consisting of 1,340 parts and using 742 languages. The progress of a nation is determined by the quality of human resources of college graduates. At present, there are 4,498 higher education institutions, but the gross enrollment rate achieved is still very small, which is only 30%. This means that the number of human resources of college graduates must be a concern, because 60% of Indonesian workers are dominated by primary and secondary school graduates, so Indonesia is still relatively poor. But the world has entered the Industrial Revolution 4.0, marked by technological advances in cyber-physical systems where the industry began to enter human connectivity in the form of cyberspace, known as the internet. Therefore, universities must be able to interact in an integrated curriculum with instructional integrity. This means that educational institutions need to adjust to the advancement of science and technology and the dynamic behavior of the industrial revolution in order to improve the quality of human resources in the future.

1 INTRODUCTION

Indonesia is a large country with an area of 5,455,675 km² with a population of approximately 265 million people, occupying some 17,504 islands, consisting of 1,340 tribes and using 742 languages. These islands stretch from east to west as far as 6,400 km². Perimeter that surrounds the Indonesian territory is along the approximately 81,000 km², and about 80% of the area is the sea. With the above geographical span, Indonesia has a vast territory that is 1.937 million km² land and 3.1 million km² territorial sea, and the sea area EEZ (Exclusive Economic Zone) 2.7 million km².

This is why the Indonesian coastal and marine area is known as a country with wealth and biological diversity (biodiversity) in the world's largest ocean. The comparison of Indonesian sea area which is larger than the land area, of course, has an impact on the potential of natural resources. The sea area that is so great causes Indonesia to have a big enough potential of marine natural resources. Indonesia is also known as a maritime country with very wealthy maritime enormous potentials.

Besides the natural resources, Indonesia also has human resources that are not less greatness. Talking

about the issue of human resources is a problem that is easy as well as difficult at the same time. As far as it is concerned with theory, it seems that it is not difficult, but in reality, it is very difficult to hold. The problem of human resources is the concern of all countries. Concern for human resources is very important because humans are a very important element in a country, in addition to other elements because humans are the people who create innovation and develop a country so that the country becomes widely known by all countries.

The progress of a nation is determined by the quality of human resources of college graduates. Currently, there are 4,498 higher education institutions, but the gross enrollment rate achieved is very small, amounting to 31.5%. The Minister of Higher Education RI (<http://jateng.tribunnews.com/2018/06/27/>) states that the Gross Participation Ratio (GPR) Higher Education in Indonesia is still low, even losing to neighboring Malaysia. Currently, GPR Indonesia is only around 31.5 percent, while in Malaysia it is about 38 percent, even in Singapore, it reaches 78% (<https://geotimes.co.id/opini/2018/03/24>).

This means that the number of human resources from higher education graduates is a major concern, because 60% of Indonesian workers are dominated

by elementary and junior high school graduates so that Indonesia is still relatively poor. There are many factors that cause GPR universities in Indonesia to be low. Among the factors causing the low GPR of higher education in Indonesia is the uneven quality factor of higher education in Indonesia. Uneven quality of higher education can be seen from the data of private universities (PTS) that have been accredited with A. Recorded 27 PTS under the guidance of Ministry of Research and Technology of Higher Education have obtained accreditation scores, but PTS accredited A is still concentrated in Java (<http://jateng.tribunnews.com/2018/6/27/>).

The researchers are triggered by this apprehensive condition of the students in learning English to find a new breakthrough in teaching English. The short course program is also made referred to HESD (Higher Education Sustainability Development) program. Seatter, C.S & Ceulemans, K (Seatter, C.S and Ceulemans, K . 2017) inferred that HESD program has capacity in formal education to promote transpormative learning. This program allows the students to be active, creative, critical, and transformative in learning. In this research, the researchers tries to treat the Indonesian students related to translating English verbal sentences by giving short course to them. Therefore, the theory dopted in this research is constructivist theory. Constructivist theory is a mening-making theory (Richardson,V, 1997). The theory suggests that the students should be creative to get a new knowledge with their own understanding by using their prior knowledge and the new information of the new knowledge. The reseachers would like to see the effect of the short course to the students' ability in translating English verbal sentences. Therefore, the research questions in this research are:

1. How does the short course affect the students' ability in translating English verbal sentence?
2. Is the short course able to reduce the students' error in translating English verbal sentence?

2 METHODOLOGY

2.1 Discussion

2.1.1 Resource Potential to Improve the Indonesian Public Welfare

The potential of Indonesia's natural wealth is from the sea, land, and other natural resources contained in Indonesia's earth. The wealth of natural resources has been partially utilized to meet the needs of the

Indonesian people, and some other potentials have not been exploited due to the various constraints such as technological and economic capabilities. Natural resource potential is so great that it can contribute not only to the development of the state but also to the welfare of the people, if it is well managed by the government. Natural resource wealth itself includes agriculture, forestry, marine, fisheries, livestock, crops, and mining also energy.

Article 33 Paragraph (3) of the Law of the Republic of Indonesia Year 1945 states that earth, water, and natural resources therein shall be controlled by the State and is in use for the greater welfare of the people. The definition of "controlled by the state" does not mean that the State itself become entrepreneur. More precisely is that the state has the authority to make regulations, and this is intended to facilitate the economy, therefore the law prohibits weak exploitation by those who have capital (Hatta, 1977, p. 28).

In the Basic Agrarian Law Article 2 Paragraph 1, it is explained that that "the earth, water and space, including the natural resources contained in it at the highest level controlled by the State, as the organization's entire power of the people". The meaning of "controlled" State here does not mean "owned" by the State, but it implies that the state has authority or power to:

- a. Arrange and conduct allocation, use, supplies and maintenance.
- b. Determine and regulate the rights to possess over (part of) the land, water and aerospace.
- c. Determine and regulate legal relations between the people and the legal acts concerning the earth, water and space.



Figure 1: Resource Potential to Improve the Indonesian Public Welfare.

According to Law No. 4 Year 2009 on Mineral and Coal Mining, it is an activity in the context of exploitation of mineral and coal covering the steps of the activity:

1. **General Survey (Prospecting)**
Prospecting is an investigation activity, search, or the discovery of valuable mineral deposits that aims to discover the existence or indications of minerals that would provide hope for further investigation.
2. **Exploration**
Exploration is an activity performed after a prospecting or after the deposition of minerals found and aims to gain certainty about the deposition of minerals that includes the shape, size, position location, quality (levels) deposition of excavated material as well as the physical characteristics of the excavated materials deposition.
3. **Feasibility Study**
The feasibility study is the final stage of a series of previously conducted a preliminary investigation as a determinant of whether mining sediment of excavation material is competent or not.
4. **Construction**
Preparation or construction are activities undertaken to prepare the facility site prior to mining operations.
5. **Mining**
Mining is part of mining business activities to produce minerals and / or coal and mineral descent.
6. **Processing and refining**
Processing and refining is a stage in which minerals are mined was treated beforehand with the aim to separate and then marketed.
7. **Marketing**
Minerals that have been through the treatment process and subsequent purification will be marketed to consumers.
8. **Post-Mining (Reclamation).**
Reclamation is an activity to rehabilitate the environment that has been damaged, whether as a result of mining or other activities.

The Mining is basically grouped into two (2) types, namely mineral and coal mining. With this mining industry, the country can work together to manage and exploit the wealth of natural resources that the results are used entirely for the welfare of the people.

In-Law No. 4 Year 2009 on Mineral and Coal Mining, in Article 1 paragraph 4, it is explained that mineral minings are mining collection in the form of ore or rock, outside geothermal, oil and gas, and

groundwater. Whereas in Article 1 paragraph 5, it is explained that the coal mining is mining deposition of carbon contained in the earth, including shale, peat and rock asphalt. Supramono (2012; 6) states simply mining can be given a sense as an activity carried out by digging into the ground (earth) to get something in the form of mining (minerals, oil, natural gas, and coal).

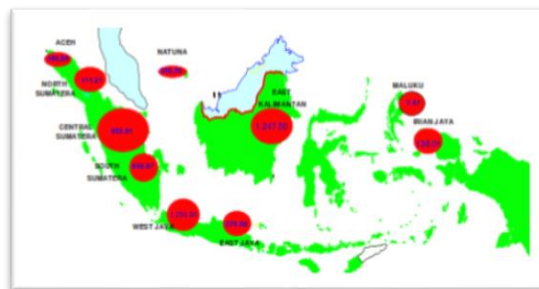


Figure 2:Oil Mining in Indonesia.

Mining activity is currently known as mining for metallic mineral commodities, such as gold, copper, nickel, bauxite and coal commodities. In addition to the main mineral commodities and coal, rock commodities also have an equally important role, particularly in providing material support to infrastructure development, such as the establishment of road infrastructure, construction of residential and office buildings.

Based on the Provincial Regulation on Spatial Planning, there are several area allocated for mining activities. Region Mining allotment is an area intended for mining activities to the region that is being, or will soon be carried out mining activities, including the class of minerals A, B and C mining materials (rocks). This area is expected to be a source of income/ revenue funding for local governments (revenue-sharing) as stipulated in Law No. 33 of 2004 On Financial Balance between the Central Government and Local Government. It also functions as Appropriation Mining Region which is expected to generally be the welfare of Indonesian society through the management and utilization of natural resources as minerals

2.2 Sample

To detail the regulations of Law Number 4 of 2009 concerning Minerals and Coal which were later reissued in the form of Government Regulations (PP), one of which is Regulation Number 23 of 2010 concerning Implementation of Mineral and Coal

Mining, mining commodities are grouped into five groups, namely:

1. Mineral, i.e. radioactive radium, thorium uranium,
2. Mineral metals, i.e. gold, copper,
3. Mineral not metals, i.e. diamonds, bentonite,
4. Rock, i.e. andesite, clay, landfill, gravel excavation of the hill, river gravel, sand landfill,
5. Coal, i.e. rock asphalt, coal, peat

Empirical experience around the world has proved, that progress, independence and prosperity of a nation is determined by the mastery of science and technology (Science and Technology) of the nation. The countries that today are known as the developed countries, such as the G7 (US, Japan, Germany, France, Canada, the UK and Italy); Scandinavian countries, Australia, South Korea and Singapore are superior in mastery and application of science and technology in almost all areas of life. The empirical evidence of this kind is also true in the ability of exploration and exploitation of marine resources, eg, fisheries resources, as experienced by the people of Japan, Taiwan, South Korea, Thailand, the Scandinavian countries, Canada and Spain.

2.3 Instrument

The term industry 4.0 is derived from the idea of the fourth industrial revolution. European Parliamentary Research Service in Davies (European Parliamentary Research Service, 2015) stated that the industrial revolution happened four times. The first industrial revolution occurred in England in 1784 in which the invention of the steam engine and mechanization began to replace human work. The second revolution occurred in the late 19th century in which the production machines are powered by electricity used for mass production. The use of computer technology for the automation of manufacturing started in 1970 to mark the third industrial revolution. Today, the rapid development of sensor technology, interconnect, and data analysis gave rise to the idea to integrate these technologies into various industrial fields. This idea was predicted to be the next industrial revolution. The number four in terms Industry 4.0 refers to the fourth revolution. Industry 4.0 is a phenomenon that is unique if compared to the three that preceded the industrial revolution. 4.0. Industry announced a priori because the event has not happened and in fact still in the form of ideas (Drath and Horch, 2014).

4.0 Industry term itself was officially born in Germany precisely the time of the Hannover Fair in

2011 (Kagermann et al, 2011). Reich has a great interest in this regard for Industry 4.0 becomes part of the policy development plans called High-Tech Strategy 2020. The policy aims to retain Germany in order to always be in the forefront in the world of manufacturing (Heng, 2014). Several other countries also participated in the realization of the concept of Industry 4.0, but using different terms such as *Smart Factories*, *Industrial Internet of Things*, *Smart Industry*, or *the Advanced Manufacturing*. Despite having the mention different terms, all of them have the same goal, that is to improve the competitiveness of the industry of each country in the face of a highly dynamic global market

2.4 Data Collection and Analysis

Fraunhofer, a research organization and technology in Europe recommends another model called Fraunhofer Industrie 4.0 layer models (Neugebauer et al, 2016). This model is claimed more comprehensive because it puts more tangible elements. The model is composed of the extracted document researches and interview resultsto the experts. As shown in Figure 2.9, this model is composed of three main layers. The core layer related to production is divided into ten sections of core technologies, namely:

- a. Engineering
- b. Manufacturing technologies and organization
- c. Machines
- d. Smart capabilities
- e. Robotics and human-robot collaboration
- f. Production planning control
- g. Logistics
- h. Work organization
- i. Workplace design and assistance
- j. Resource and energy efficiency,

The next layer is the aspect of information and communication technology which enables the realization of the concept of Industry 4.0. The outermost layer is related to the company's transformation as a result of the implementation of Industry 4.0 which includes business, management and human resources.

This flow is certainly supported by the qualified Indonesian human resources to implement the industrial revolution. Qualified human resources provides excellent effect when used with the best. The good benefits are useful to society and the country itself. Human resources is essential for developed and developing countries. Human resources are also the authorized capital of the wealth of a nation, because humans as the factors of production are actively raising

capital, exploit natural resources, build social organizations, economic, political and implement national development.

To produce qualified human resources, the education plays an important thing, and improving the quality of human resources absolutely must be done due to the qualified human resources can provide a multiplier-effect on a country's development, especially the development of the economic sector. In general, education and health levels can represent the quality of labor due to education increases their skills.

With regard to supply-side issues, the quality of labor and the population of workers in Indonesia is still limited. Various efforts have been made by the government or the private sector to produce quality human resources through the establishment of universities (PT), but the opening of the new PT Indonesia on a large scale without being followed by the provision of adequate infrastructure, even tend to only seek profits, only will result in an increase in the number of less qualified graduates.

In fact, the demand for skilled and educated labor as one of the key global labor markets will be more complex, due to the tendency of multinationalization of efforts and production and strategic alliances. The use of labor is also increasingly exposed from all over the world in a single business unit. This means that there will be increasing labor migration between countries. This is reinforced by various regional and international agreements, including the industrial revolution and the imposition of economic integration in the ASEAN Economic Community which has been in effect since the end of December 2015. In the agreement, there are five core elements underlying the AEC, including the free movement of skilled workers. This means that skilled labor is increasingly easy to fill the labor market in Indonesia, whereas Indonesian skilled labor is also relatively easier to fill the labor market in other countries.

To achieve a quality standard of education, quality improvement is focused not only on elements of education staff or lecturers, but also on higher education management, competency standards, processes, graduate competencies, infrastructure, management, financing and education evaluation; which can be applied by standardization bodies, guarantees and quality control of education (Article 35 paragraph 3 of Law No. 20 Year 2003).

Standardization group, assurance and quality control of education must be prepared by the government so that the quality of education always has

the minimum criteria that must be met by the manager of education, local government and central government. This strategy is usually associated with the change so that a change of strategy regarding the quality of education strategy must be changed into the right strategy. Regarding the change of strategy intended to allow organizations to become more effective in achieving its objectives, it is necessary to attempt to change the organization by taking into account various relevant factors. Indrawijaya (1989: 28) points out, "The efforts of managers to improve or change the organization during the past focused more on the changes of: (1) subsystem technology; (2) managerial subsystem; or (3) the human subsystem". To change is not easy because it is necessary to develop careful planning until the produced plans, programs and policies are appropriate for further consistent application. Elements that can be changed is not always wholly to change; the only thing that can be done means having to make changes; as explained by Robbins (in Udaya, 1994 428) that strategies tend to fall into one of the four categories, namely human, structural, technological and organizational processes. When there is a force that makes a change, there is someone who accepts the role as an agent of change, and has determined what must be discarded, we need to consider how to implement the change. We begin to see the steps in the change process. Successful change requires disbursering (not free) the status quo, moving (moving) to a new state, and freezing (refreezing); this change will become permanent. The process of change requires steps through: (1) disbursement (unfreezing) the status quo, i.e. domination must be merged by applying rules; (2) transfer (move) to a new state, i.e. the existence of the appropriate power has been planned; and (3) refreezing of changes into permanent ones, namely decision making.

In relation to the quality of education, in fact those who receive attention are not only qualified and qualified lecturers, but also other aspects, such as standard content, processes, graduate competencies, infrastructure, management, financing, and educational needs assessment. Those aspects must also be constructed in such a way so that they are relevant with the organizational context to be more effective and efficient.

The majority of Higher Educations (PT) are located in Java and Sumatra Island. Carrying more than 70 percent of the total PT on both densely populated region. This condition shows that the distribution of PT in Indonesia has not been evenly distributed. Going forward, the government has a commitment to support the development of higher

education in order to create equitable access to higher education, particularly in some areas outermost, and left of Nusantara in the context of the dynamics of the industrial revolution

3 RESULT

The first aspect is horizontal integration, which means integrating CPS technology into business strategies and corporate collaboration networks including partners, vendors, customers and other parties. Cps vertical integration is the matters relating to how to apply technology to the manufacturing/ production systems that exist in the company so that it can be flexible and modular. The third aspect involves the application of cps technology in the end-to-end engineering value chain. Value chain engineering involves the process of adding product value from the design process, production planning, manufacturing to product use services. Integration of these aspects requires eight actions, namely: (1) standardization, (2) complex system modeling, (3) provision of communication network infrastructure, (4) guarantee of safety and security, (5) organizational design and work, (6) training of human resources, (7) certainty of the legal framework and (8) resource efficiency. Bitkom, vdma and zvei (vdi/ vde-gesellschaft mess- und automatisierungstechnik, 2015) has developed another model called rami4.0.

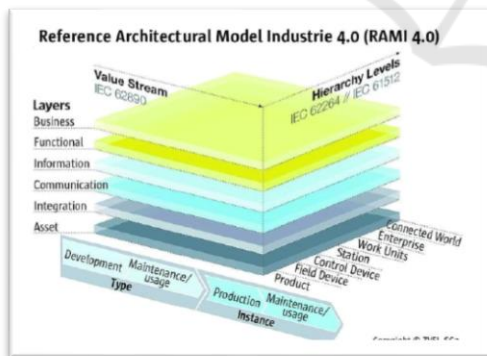


Figure 3: Rami 4.0.

The vertical axis RAMI 4.0 consists of six layers showing various aspects of the industry viewpoint of the Industry 4.0. These include the viewpoint of the market/business, function, information, communication and perceptions regarding the integration capabilities of the components (assets of the company). The horizontal axis to the left shows the flow of the product life cycle or the current value

added in the production process in the industry coupled with the implementation of digitization. The horizontal axis to the right explains the hierarchy of control systems ranging from product production, equipment on the production floor to the enterprise level and the outside world. According to Zezulka et al (2016), these models do not support the technical solutions necessary to realize the hardware and software implementation of Industry 4.0

4 ANALYSIS

Most opinions regarding the potential benefits of Industry 4.0 are about increasing production speed flexibility, improving customer service, and increasing revenue. Realization of potential benefits will have a positive effect on the economy of a country.

Industry 4.0 offers not only benefits but also challenges to face. Drath and Horch (2014) argue that the challenges faced by a country when implementing Industry 4.0 is the emergence of resistance to changes in demographics and social aspects, instability of the political situation, lack of resources, natural disaster risks and demands from the application of environmentally friendly technologies. According to Qin Jian et al (2016), there is a wide gap between the current technological conditions of the industrial world and the expected conditions of Industry 4.0. The research conducted by Balasingham (2016) also shows an unwillingness to apply Industry 4.0 due to concerns about the uncertainty of its benefits.

Based on some of these explanations in accordance with the submitted by Zhou et al (2015), in general, there are five major challenges to be faced is the aspect of knowledge, technological, economic, social, and political. To answer these challenges, it takes a great effort, planned and well positioned on the side of the regulator (government), academics and practitioners. Kagermann et al (2013) convey the necessary involvement of academics in the form of research and development to realize the Industry 4.0. According to Qin Jian et al (2016), the realization of the technology development roadmap Industry 4.0 is still not focused. This happens because the Industry 4.0 which is still a concrete manifestation of this idea has not been clear in terms of all its aspects in order to bring the various possible directions of development. Kagermann et al (2013) in the final report of the working group 4.0 industry sponsored by the German ministry of education and research provide recommendations skeleton model industry 4.0

5 CONCLUSION

1. Empirical experience around the world has proved that progress, independence and prosperity of a nation is determined by the mastery of science and technology (Science and Technology) of the nation. The Countries that today are known as the developed countries, such as the G7 (US, Japan, Germany, France, Canada, the UK and Italy); Scandinavian countries, Australia, South Korea and Singapore are superior in mastery and application of science and technology in almost all areas of life. The empirical evidence of this kind is also true in the ability of exploration and exploitation of marine resources, e.g. fisheries resources, as experienced by the people of Japan, Taiwan, South Korea, Thailand, the Scandinavian countries, Canada and Spain. Instead, even though a country has abundant marine resources, if it ignores the nation's science and technology in harnessing and managing these resources development, it will be relatively considered a small nation. Marine and fisheries sector development in Indonesia still face many constraints and problems. Performance marine construction has not contributed much to GDP (*Gros Domestic Product*) and still leaves the poorest communities in the country that has a great maritime potential. One cause of this problem is the inability of the people and nation of Indonesia to utilize available resources, and if it is pursued further, it is because of the mastery of science and technology and marine information is still very weak. Therefore, it will be very precise and strategic if governments from now on start strengthening research and technological development strategies of marine resources. This is very reasonable since Indonesia is an archipelagic country and Maritime (*Archipelagic State*) in the world. Indonesia is one of the maritime worlds, the geographical characteristics of Indonesia as well as the structure and typology of ocean ecosystems dominated have made Indonesia as Mega-Biodiversity spread across the world. Marine resources are natural resources that have the potential lucrative opportunities utilized as an effective resource in Indonesia is the nation building.
2. The low gross enrollment rate (GER) of higher education in Indonesia is only 31 percent when compared with other Asean countries such as Malaysia, which reached 38 percent and Singapore at 78 percent due to many factors.

Among the factors causing the low of GER higher education in Indonesia is the factor of uneven quality of higher education in Indonesia. The uneven quality of higher education can be seen from the data of private universities (PTS), which have been accredited with an A. Recorded 27 Private Higher Educations under the guidance of Ministry of Research and Technology Directorate of Higher Education already obtain the value of accreditation, but Private Higher Educations with A accreditation are still concentrated in Java. Another factor that causes the lack of skills of higher education graduates in Indonesia is that vocational or skills-based higher education is still lower than academic education. The Industrial Revolution 4.0 requires people to have skills at work. However, this is a dilemma, especially if the university is providing more academic-based education services than the education sector that gives birth to skilled human beings in the field of work they will do in the industrial field. In general, there are five main challenges that must be faced in the revolutionary industry 4.0, namely aspects of knowledge, technology, economics, social and politics.

6 RECOMMENDATION

The next layer is the aspect of information and communication technology which enables the realization of the concept of Industry 4.0. The outermost layer is related to the company's transformation as a result of the implementation of Industry 4.0, including business, management and human resources.

This of course flows and is supported by the quality of Indonesia's qualified human resources to implement the industrial revolution. Qualified human resources have amazing effects when used with the best. The benefits are beneficial not only to the community but also to the country itself. Human resources are very important for developed and developing countries since they are also the official capital of a nation's wealth. Human resources are the important factors of production that actively collect capital, exploit natural resources, build social, economic, political organizations and carry out national development.

To produce qualified human resources, the education plays important role, and improving the quality of human resources absolutely must be done due to the quality of qualified human resources can provide a multiplier-effect on a country's

development, especially the development of the economic sector. In general, education and health levels can become the indicators of the quality of labor. Besides, it is undeniable that one's education will affect his skills.

Related to the issue from the supply side, the quality of labor and the population of workers in Indonesia is still limited. Various efforts have been made by the government or the private sector to produce qualified human resources through the establishment of universities (PT).

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