Revitalization Road Map of Vocational Higher Education in Industry 4.0 (a study in Politeknik Negeri Balikpapan)

Gozali, Elisabeth Milaningrum, Bambang Jati Kusuma, Lilik Damayanti
Politeknik Negeri Balikpapan

gozali@poltekba.ac.id

Abstract. The industrial revolution 4.0 has shifted some human activities, technology automation in almost of all work fields that has impacts with the skills which are needed by industry. Polytechnic as higher vocational education needs to prepare strategic steps in creating creditable graduates in order to face the challenges in that era. The aims of this study are to examine the revitalization of Balikpapan State Polytechnic in industrial era 4.0. The collecting data were done through observation, interviews, and focus group discussions (FGD). The data obtained were analysed with descriptively qualitative. Based on the analysis, it can be concluded that there are seven aspect of Poltekba revitalization to answer the challenges of the industrial revolution 4.0, such as: (1) Workshop Development, (2) Industrial Involvement, (3) Curriculum Development, (4) Dual system 3-2-1 Implementation, (5) Teaching Factory, (6) Strengthening of Lecturer Competence, (7) TUK, LSP, and Graduate Certification.

1. Introduction
The era of revolution industry 4.0 is predicted to shift some human activity. Technology and a new approach that combines the physical world, digital and biological on the fundamental basis will change regulation of life and human interaction [1]. Therefore, human must have the ability to predict the future that changes very quickly [2]. The industrial revolution era 4.0 is a formidable challenge for higher education. Quoting from Jack Ma in annual World Economic Forum meeting, education is a big challenge this century. If we don't change the way of educate and teaching learning process, therefore we will face great difficulties 30 years later. Education and learning process that are loaded with knowledge which push away with attitudes and skills as currently has been implemented, it will create students who are unable to compete with machines. The mission of education is to prepare students to enter certain professions in the types of social roles that are already structured in society will soon be obsolete. The task of education will turn to be more primary to meet the needs of students' self-development in creating their profession [3].

Nawacita has placed higher vocational education as the priority in the development of education. The President has also issued Presidential Instruction Number 9 year of 2016 in the context of Improving the Quality and Competitiveness of Indonesian Human Resources which direct the vocational education development going forward. Through the president instruction at Kemenristekdikti that make policy about revitalization of polytechnic who have begun in 2017. By using the new policy of revitalization of Polytechnic will encourage Balikpapan State Polytechnic to revitalise in order to create the graduate which are autonomous, adaptive, and sensitive with change of industry and
This research is different from the previous research. For the previous study has discussed about revitalization of higher education in general, however in this study focused on seven aspects revitalization of polytechnic.

2. Research Methods
The research methodology used descriptive qualitative method. The researcher intends to describe the process of polytechnic revitalization in the industrial revolution era 4.0. The collecting of data used observation, interviews and focus group discussions (FGD). Observations and interviews were conducted on two revitalized polytechnics in the Kalimantan region, namely: Samarinda State Polytechnic and Banjarmasin State Polytechnic. The FGD was conducted to obtain data related to the revitalization of the Balikpapan State Polytechnic in the industrial revolution era 4.0. The data obtained was verified and analyzed. The data analysis in this research was conducted through three activities that was happened simultaneously such as: the reduction data, presentation of data and the withdrawal of conclusion or verification.

3. Results and Discussion

3.1. Workshop Development
Based on the results of the Focus Group Discussion (FGD), The existence of facilities and infrastructure or workshop facilities owned by Poltekba is an important factor for improving the quality of graduates. According to the Head of Mechanical Engineering Workshop of Poltekba, the existing equipment in their workshop is partly not functioning properly and is classified as old equipment. So that the efforts to improve the quality of graduates are hampered. In addition, the limited allocation of Poltekba budget, the fulfillment of facilities and infrastructure has not been fully realized based on plan. Therefore, several alternative strategies for fulfilling infrastructure facilities are needed, namely: (1) Industrial involvement as a forum to influence student learning experiences, and (2) Empowerment of facilities and infrastructure is intended to work independently from deficiencies or needs of facilities, including efforts to prevent damage facilities and infrastructure through production based training programs, production and service units, and Teaching Factory.

3.2. Industrial Involvements
Based on the results of the Focus Group Discussion (FGD), the industry involvement in the development of Poltekba was still very limited, this could be seen from the number of industry lecturers/instructors involved in the learning process in each study program of approximately 1-2 people. According to the Director and Senate of Poltekba, many industries in Balikpapan City have good opportunities to develop Poltekba. In order to answer the challenges of the industrial revolution 4.0, industry involvement will be expanded and increased to 30-50 percent.

Figure 1. The Concept of Industrial Involvement

Figure 1 shows that in developing Poltekba, academic lecturers collaborated with industry lecturers with each percentage of 50 percent. The involvement of industry lecturers were started in the process
of curriculum arranging and learning process until the evaluation of learning. In order to answer the challenges of industry 4.0, the involvement of industry lecturers through planning and learning processes which is suitable with the agreed curriculum that is curriculum 4.0 will be able to create quality graduates that are suitable with the characteristics of stakeholders’ need.

3.3. Curriculum Development

3.3.1. Relevance Curriculum

Based on the results of the Focus Group Discussion (FGD), curriculum implementation in Poltekba experienced degradation that out of the context and has not oriented to achieve student abilities and stakeholders’ needs. According to the Chairman of the Senate and P3M Poltekba, this condition occurred because the industry has not been maximally involved in the arranging the curriculum, and so far the industry only has been acknowledge with the curriculum, therefore it needed to adjustment. Then, the model of curriculum has developed in principle used collaboration competency based curriculum and curriculum of work based learning [4]. Therefore, we must redesign the curriculum, especially higher education to adjust with industrial era 4.0 [5], and have to optimally cooperate with industry that graduates resulting in accordance with the demand and needs of the workforce.

Figure 2. Curriculum Concepts of Poltekba in Industry 4.0

Figure 2 shows the concept of Poltekba curriculum development referring to the qualifications of KKNI and SNPT that are adapted to the various challenges of the industrial revolution era 4.0 that have new literacy ability such as: digital literacy, technology literacy, and human literacy which having good character in religious beliefs. The development of Poltekba curriculum is based on good foundation in philosophical, sociological, psychological, historical, and legally therefore hopefully one day it will produce quality graduates, and able to adapt to their environment, and have the opportunity to win the challenges of life, especially in the industrial 4.0 era.

3.3.2. Integration of Digital Literacy, Technology and Humans into Curriculum

Based on the results of observations on the learning process in Poltekba, it still tends to be oriented to technical skills without paying attention to other important aspects. Digital literacy skills that should be an important part of 21st century skills that students really need, actually do not get the proper portion. For this reason, Poltekba, according to the Director General of Student Affairs of the Kemenristekdikti, needs to revise the curriculum, hybrid / blended learning, and life-long learning. The ability to process the data, apply it to technology and understand how to use the technology.

Human literacy is important to survive in the industrial era 4.0, the goal is that humans can function well within the human environment and can understand interactions with fellow humans. Therefore, Poltekba needs to use methods to develop student cognitive capacity (higher order mental skills, critical and systemic thinking). From this description the integration of new literacy into the curriculum becomes an important thing to do, so that Poltekba graduates are able to adapt in using and utilizing technology properly in the industrial era 4.0.
3.4. Dual System 3-2-1 Implementation

Based on the results of the Focus Group Discussion (FGD), the implementation of the concept of dual systems 3-2-1 needs to be done in order to answer industry doubts about the quality of Poltekba graduates. According to the representative of PHRI, the communication between the industry and the education institution often did not out synchronous especially with the problem of dual system because the education institution did not explain comprehensively when assigned the students to do training in industry. Therefore the industry did not understand the desires of education institution. With the new concept 3-2-1, it is hoped that education can establish better communication with the industry, and explain in detail what industry needs for students who do training in industry. In general, industry in Balikpapan City is greatly helped by the presence of students who practice in industry, especially with the new concept of 1 year of training in industry. The industry will welcome this concept. So that the students have enough time to form competencies that are in accordance with industry standards. In addition, students also learn about management and industrial organizations to learn about the business world and ways of managing businesses so that they have insight and knowledge about the business world. Through learning management and organization, students can also add capabilities to the world of entrepreneurship.

3.5. Teaching Factory

Based on the results of the Focus Group Discussion (FGD), teaching factory is very necessary because it provides real experience for students to innovate according to their expertise competencies. According to the Head of the Senate and Head of Mechanical Engineering Workshop of Poltekba, the application of the teaching factory concept will enhance entrepreneur spirit, create independence and train students to work professionally. Teaching factory allows participants to learn how to produce things based on their scientific discipline. It can provide students with knowledge and direct experience of the industrial atmosphere, and also can shape the spirit and abilities of students as workers based on the industry requirements, increase discipline and build professional attitudes in carry out various jobs, and enhance creativity, competence and entrepreneur spirit of students, produce the products from the students that have realistic value [6-9]. The implementation of teaching factory will give positive impact for students. While the objectives program, curriculum well designed and implemented with staff support and properly evaluated, the program will have a positive impact [10-12].

![Figure 3. Concept of Poltekba Teaching Factory](image)

Figure 3. Concept of Poltekba Teaching Factory

Figure 3 shows the concept of Poltekba teaching factory designed according to industry and communities’ needs, and operated in collaboration with industry in order with harmonize with stakeholder need. The teaching factory has functions as a research and development centre to improve the competence of students who are able to compete in the industrial era 4.0.

3.6. Strengthening of Lecturer Competence

The innovation of education depend on the implementation of educators ability. Future educator is very prosecuted has competence standars in accordance with the development of educations [13].
Based on the results of the Focus Group Discussion (FGD), the competence of Poltekba lecturers need to be updated and improved. According to the Head of research and community service of Poltekba, to answer the challenges of the industrial revolution 4.0, it is necessary to build lecturer capabilities through certification and training. Vocational lecturers must have certificate of competence as mandatory requirement. The competence of Polytechnic lecturer certification can also push the quality of the campus. According to Nasir, to produce graduates who have high competitiveness and also ready to compete in the Industrial 4.0 era, it is needed lecturers who have creditable competencies, having good soft skills, critical thinking, creative, communicative and also collaborate well with students. Therefore, lecturer in era 4.0 have competence that prevent the change, as well as implement the innovation in each job. [14].

![Figure 4. Lecturer Preparation of Poltekba 4.0](image)

Figure 4 shows that the concept of the lecturers preparation of Poltekba starting with mapping the core competencies of lecturers, training / retraining and competencies certification. Mapping is conducted to determine the expertise of Poltekba lecturers, while training / retraining is conducted to improve the ability of lecturers' expertise. Through competency certification, competitiveness and knowledge of lecturers are increasingly based on the industry needs. Therefore, the knowledge and skills that are taught is real according to those in industry.

3.7. Competency Test Place, Professional Certification Institute, and Poltekba Graduates Certification Based on the result of Forum Group Discussion (FGD), TUK and LSP is very important to improve the quality of Poltekba. According to the secretary of LSP Poltekba, so far the process of formation LSP Polteka still in the process of filling, on progress of submission license in BNSP, it need to facilitate students obtain certificates of competency. Meanwhile, TUK fo certification in Poltekba there is only hotel and restaurant in hospitality. Furthermore, according to the Chairman of the Poltekba Senate, as an effort to improve the quality of graduates to meet with the Industry standards and competitiveness, graduate certification is an absolute must. The benefits of competency certificates for graduates as a form of individual qualifications as well as creating recognition of individual competencies in the mastered field. According to the secretary of LSP Poltekba, so far Poltekha has collaborated with LSPs in the East Kalimantan region to equip graduates with expertise certificates. Efforts to expertise certify for graduates have been going done well, but it was just involves LSP from outside and certainly need a lot of cost. Therefore, it is needed synergy in accelerating the establishment of LSP Poltekba and TUK in other fields (Construction, Heavy Equipment Engineering, Electronics).

4. Conclusion

Based on the analysis above, it can be concluded that there are seven aspects that are done by Poltekba concerning with the revitalization, such as: (1) Workshop Development, (2) Industrial Involvement, (3) Curriculum Development, (4) Dual system 3-2-1 Implementation, (5) Teaching Factory, (6) Strengthening of Lecturer Competence, (7) TUK, LSP, and Graduate Certification.
5. Suggestion
Based on the description of the results of this research that has been presented, there are some suggestions such as: (1) for policy makers of Poltekba must do overall revitalization (2) for further research, it is necessary to do furthur research about the concept of dual systems 3.2.1.

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