Framework of Vocational Education Quality Based on Dynamic System

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Abstract. The problem of meeting the needs of business and industry towards vocational higher education graduates is a discrepancy between the desired skills and the availability of labor. To meet the needs of competent Human Resources (HR) in business and industry, the implementation of Vocational Education (VE) must be quality or smart. This study formulates the factors that influence the implementation of quality VE, the entities contained in the VE system, building framework of VE system base on dynamic system.

1. Introduction

The situation in the world of work tends to change rapidly, in line with growth and technological progress. The business and industry has been dominated by robotic technology, both in production industry and the industrial design. Automatic tools integrated depicting the era of the industrial revolution 4.0. The benefits of workers who have knowledge and skills also experience change. In addition to being competent in their fields, they must also be able to maintain and improve their working conditions. Vocational Education (VE) is an educational institution tasked with building a whole person and developing the Indonesian people as a whole [1]. Full human development, including physical ability, ability to think, manage the heart, and master science, technology, sports and art. In addition, human development can also produce people who can play an active role in building all Indonesian people. The success of vocational education can be measured from the balance of these two goals, namely the development of a whole person and the development of the people as a whole [1]. In this case VE plays a role in producing competent human resources for the Business World and Industry.

To Improve economic development and advanced society, human resources competency is one determinant of the level of competitiveness of the country with other countries in the world. To produce competent human resources depend on the quality of VE. But now the human resource found the weakness in their division [2]. Concern about VE and its relationship to work remains very relevant. In the social and economic context, policymakers and researchers question the extent to which vocational education pathways must prepare young people for broadly specific jobs that tend to be dynamic, and global labor markets [3]. VE experts are expected to be able to occupy jobs in
accordance with the field of competence they have and get a balanced salary or become a new entrepreneur. In reality, it doesn't match expectations. Many VE graduates who do not get a job, even those who have got a job also experience problems in adjusting to the rapid technological developments that occur in business and industry. They have not been able to hold (sustain) with knowledge and skills they possess. This situation is suspected to have caused many factors, among others from the side of VE organizers, Business and industry and also from the side of the graduates themselves. A number of factors identified as problems for VE graduates include:

a. Information to get a job is less supportive
b. Business and Industry wants a workforce that already has experience;
c. Business and Industry complain, most graduates do not have the knowledge and skills that are in line with their needs.

Thus, it can be said that the obstacle in fulfilling Business and Industry demands for vocational high school graduates is that there is a discrepancy between the desired skills and the availability of labor. To meet the needs of competent human resources in Business and Industry, the implementation of VE must be quality or smart. This study formulates the factors that influence the implementation of quality VE and the implementation of ICT in the implementation of VE.

To be able to win the competition in business and industry, there is a need for an industry-based education management model. Management of this model emphasizes the efforts of the management of educational institutions to improve the quality or quality of education [4].

The concept of Vocational Education is able to produce graduates who have skills in the fields of:

a. Digital Literacy. Consists of: Basic Literacy, Economics, Technology, Science & Technology, Visual, Information, Various Cultures, Responsibilities and Global Understanding.
b. Effective Communication. Communication skills of teamwork, interpersonal skills, individual responsibility, social and interactive communication [5].

Implementation of dynamic system to simulate the effect of changes in the education policy system on time to the development and demand trends of employees in the technology industry. The simulation results from policy scenarios show the ability in the technology industry to expand by improving education policies [6].

E-Learning is a new learning technique and approach that contributes to the formation of new education trends, known as "intelligent education". This trend provides extraordinary opportunities to acquire skills, competencies and professional knowledge through various uses active information and communication technology. Therefore, ICT has very large influence in the field of education including vocational education [7].

Other research groups mem focus their research on the issue of educational outcomes in the contemporary education system. Results-based concept VE. The aproach can be regarded as an intelligent part in the educational paradigm. The main part of the results includes the study of their cognitive abilities, needs, skills and training through E-Learning.

2. Methodology
This research is divided into several stages

a. Literature Study
   Studying theories and concepts about ICT components, Vocational Education, Dynamic Modeling (DM), Dynamic systems
b. Data Collection
   1. Document. Data derived from documents, examples of documentation in the form of reports from the Medan State Polytechnic, and literature
   2. Numeric Data. Specific and accurate data that supports the quantitative of the process model and provide clarity of the system functions mathematically.
   3. Mental Data. The data has the information content and the main source in modeling.
c. Indicator
   This stage formulates the VE indicator of quality based on a study already conducted by Researchers on Vocational Education.
d. Developing and simulation model

The system developed and simulation using software dynamic system Powersim. The stages of research are carried out as in Figure 1.

![Figure 1. Step of Research](image)

3. Result and Discussion

This research was conducted to examine the factors that influence the implementation of VE quality in the teaching and learning process.

3.1. Entity VE system

The learning system is usually influenced by two groups of components, namely the components that come from the students themselves (PD) and components that come from outside the PD. Components originating from outside PD individuals can be grouped into environmental, government, socio-economic factors, educators and education personnel, learning methods, curriculum, learning content incorporated in infrastructure, ICT and industry simulations. Figure 2 shows the VE system.
The VE system has a structure that describes the entities contained in the system. In this study the entity is divided into two groups, namely the internal system and the external system.

1. Internal entity: College student, Educators (Lecturers), Non-educators (administration, technicians and laboratory assistants), Infrastructure (PBM facilities, ICT devices)
2. External Entity: Parents, Government, Industry, Environment, ICT, Outcome, Economy
3. Relationship (link). The relationship between entities contained in the system structure.

Each entity has attributes like the following:
Entity 1. Student: Education background, Experience of using ICT
Entity 2: Educator Power: Field of study, Ability to use ICT, Quality of Teaching
Entity 3: parents: Education, Income, Hope
Entity 4: Education personnel: Service, Ability to use ICT
Entity 5: Infrastructure: Curriculum, Content, Learning Process, infrastructure facilities
Entity 6: Industry: internship, Discussion / Collaboration / sharing, Teaching factory, Information
Entity 7: Government: Policy, Regulation
Entity 8: ICT: Hardware, Software, Internet
Entity 9: Environment: Comfort, Security/safety
Entity 10: Outcome: Training, Competency Test

3.2. VE System Framework
The Causal Loop Diagram (CLD) describes the VE implementation system consisting of many components as shown in Figure 3. The implementation of VE is carried out based on government policy to carry out the learning process to increase student participation rates. This must be supported by infrastructure such as infrastructure, curriculum, learning content and learning processes that are adapted to the development of Business and industry. And supported by professional educators and the ability of students in a comfortable and safe atmosphere. The components of educators, government, environment and infrastructure are the main components in the implementation of education in general, so it is assumed that the percentage of availability for each component is 75%. The government component can be a positive factor if the rules or policies issued support the implementation of VE such as the implementation of Learning Process. And it can also be a constraint if the rules that are issued often change for example in the application of curriculum and competency
standards and the absence of policies that require DUDI to collaborate with vocational education to build competent human resources.

Figure 3 show the framework of VE quality based on a study of the literature general education and vocational education. VE quality supported by ten components: student, parents, lecture, staff personel, infrastructure, ICT, government, Environment, industry. Learning method can do combine between face to face learning and E-Learning, ditambah dengan membawa industri kekampus melalui program simulasi industri dengan ICT utilization and industrial simulation.

Metode pembelajaran dilakukan The face-to-face component is one of the principles of learning in vocational education that requires a minimum of 75% face-to-face of the entire meeting for one semester. The E-Learning supports the implementation of learning activities in a face-to-face way to optimize learning through discussion or collaboration, material uploads, tasks and others between educators and learners or among fellow educators. One of industry component present industry in vocational education environment through colaboration or information sharing by teleconference/video conference, group discussion through social media, teaching factory directly from industry. This technique is to understand the needs of process and work culture that occur in the industry, and get information about the implementation of the latest technology in the industry. All that can be realized by applying ICT components through web, cloud and IoT technologies to the delivery of vocational education. By utilizing ICT able to connect with other components, both inside and outside the VE system.

4. Conclusion
Based on the results and discussion, can be concluded:

a. There are 10 components that must be considered in the implementation of quality VE.
b. The VE system consists of entities that are mutually integrated in realizing a quality VE

c. The framework of VE system can be used as a reference in implementing quality VE

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