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IMPLEMENTATIONS OF COLLABORATIVE KNOWLEDGE CREATION AND THE QUADRUPLE HELIX CONCEPT IN TEACHING FACTORY AND PRODUCTION BASED EDUCATION

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Abstract— The success of polytechnic education in winning the competition now depend on the power of the human factor, model of learning and graduates competencies. Human resources requested are those have the commitment, good quality in their work, given the current organization must be oriented to the learning organization / learning organization (Choo: 1998, Garvin: 2012, Du Chatenier: 2009). The concept of collaborative knowledge creation (CKC) conducted between polytechnics with industry, government and other institutions through on the job training (faculty and students), the preparation of competency-based curriculum and KKNI (Job Qualifications National Indonesia) as well as the experience of learning through teaching factory, teaching laboratory, production based education, assesment competency for students and lecturer. The purpose of this study was to determine how the concept quadruple helix as the implementation of the theory of CKC performed polytechnics with industry, firms through teaching factory and production models based education to produce graduates competent and ready to work. Places of the research is done through case studies at the Jakarta State Polytechnic (PNJ) and the Polytechnic Manufacturing Bandung (POLMAN).

Keywords— Politeknik, Collaborative Knowledge Creation, Triple Helix, Quadruple Helix, Teaching Factory, Ssm, Production Based Education.

I. INTRODUCTION

This study will examine the theories about learning organization, the concept of the triple helix (Etzkowitz 2008) to quadruple helix (Galbraith, 2015) and the implementation of collaborative knowledge creation (CKC) theory (CKC: Du Chateiner et.al.; 2009, Hermans & Castiaux, 2007) to analyze the problems has found relationship with the model in teaching factory in polytechnic. Learning organization (Choo, 1998; Senge, 2005; Nonaka & Takeuchi, 1995, Du Chatenier et.al., ; 2009). Petrides and Nodine (2003) in Sohail and Salina (2009) explains that the practice of information and learning strategy known as knowledge management, favorable and acceptable in education. The problem now that arises is of 262 polytechnic in Indonesia, there are six polytechnics that are considered has excellent academic achievement both at national and international level and also running teaching factory/teaching laboratory and production based education (PBE), namely: Bandung (POLMAN), Jakarta (PNJ), Jember State of Polytechnic, Surabaya (PENS), Malang (Polinema), and Batam (PNB).

II. REVIEW OF LITERATURE

2.1 Collaborative Knowledge Creation

Refer to Salisbury (2008) describes the framework for lifecycle management of knowledge organizations supporting the CKC. Du Chaternier et al., (2009) describes the four stages of implementation CKC, namely: (1) Externalizing and Sharing, (2) Interpreting and Analyzing, (3)

Negotiating and revising, and (4) Combining and Creating.

2.2 Triple Helix and Quadruple Helix

The Triple helix concept (UIG/university-industry-government) is a synergy between academia, business / industry and government adopted from Etzkowitz&Leydesdorff (2000: 2008). Quadruple helix (Galbraith:2015) is a synergy between the four elements that play a role in the collaboration of knowledge, namely: academic (academic), government (government), industry (industry) and users (users).

2.3 Teaching Factory

According to Rentzos L (2014) "The teaching factory to classroom concept of the teaching factory aims at transferring the real production / manufacturing environment to the classroom. The real life production site needs to be used for teaching purposes in order to enhance the teaching activity with of the knowledge, existing in the processes of everyday industrial practice".

III. METHODOLOGY

Checkland (1999) have attempted to transform reviews these ideas into practical form theory Soft Systems Methodology (SSM). The seven principles and stages of SSM are: (1) problem situation considered, (2) Expressed problem situation, (3) definition the relevant root systems of purposeful activity, (4) conceptual models of the systems (holons) named in the definitian root, (5) comparison of models and real world, (6) changes systematically

desirable, culturally feasible, and (7) action to improve the problem.

IV. METHOD OF DATA ANALYSIS

The techniques implemented a collection of the data is by: (1) in-depth interview with the person who is incharge Polytechnic in building relationship with the industry, government, and professional association, (2) partisipative observation, (3) study of literature / study documentation. The Data have been grouped to

associate with one another and interpreted by using the SSM and CATWOE approach (Clients, Actors, Transformation, Weltanschauung or World View, Owners and Environment).

V. RESULTS AND DATA ANALYSIS

Doing some interviews, observation paticipative, with leaders, faculty, administrative staff and students at Polytechnic as owner issues in PNJ and POLMAN.:

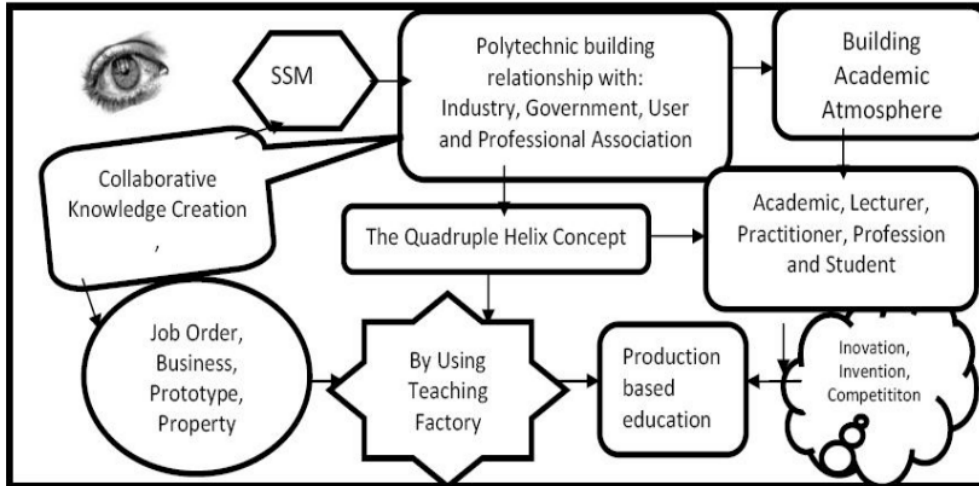


Figure 1 Rich Picture Implementation of CKC and Quadruple Helix concept for teaching factory in Polytechnics

Learning process using teaching factory is a process for students can be done with the involvement of practitioner and transfer of knowledge from the companies /industries to students and the lecturer. It's feel directly how the actual work environment.

The proces of classroom learning with workplace atmosphere at the company/industry should be followed by the standard operation procedures, learning patterns, teaching materials, lay out a place of learning and facilities used in learning.

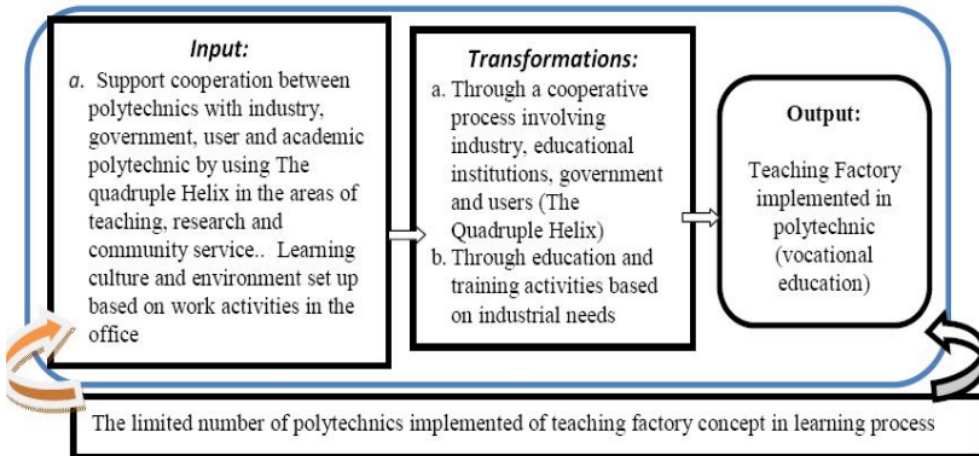


Figure 2. Transformation of Teaching Factory Process

Tabel 1. Root Definition (RD) for Teaching Factory through The CKC and Quadruple Helix Concept In Polytechnic

No	Name	Root Definition Activity
RD	Process teaching factory and production based education based on industrial needs with the quadruple helix concept	Building teaching factory and production based education (P) through quadruple helix and collaborative knowledge creation (Q) to produce qualified graduated based on industrial needs (R)

Table 2. CATWOE and 3E in the Root Definition

Customer	Director of polytechnic, government, industry and company
Actors	Director, Head of Department, government, industry and company
Transformation	Development of learning proces in polytechnic based on teaching factory or production based education to produce qualified graduated based on industrial/government needs
Weltanschauung	Teaching and learning collaboration with in polytechnic, industry and professional associaiton is important to improve the quality of graduates
Owner (s)	Vice Director for Academic, Vice Director for Industrial Relations, Head of Department, Head of Study Programme in Polytechnic
Environment	Constraints within the limitations of time and budget available, polytechnic organizational culture, changes in the regulation of higher education and change of industry and company needs
E-Efficacy	Implementation of competency-based curriculum based on KKNI (national framework in Indonesia) in facing the needs of industry and company
E-Efficiency	Using financial resources for teaching factory and teaching industry and the implementation of time and chance is limited
E-Effective	Learning by using teaching factory, production based education with the quadruple helix concept into curriculum development in each study programme

According to the data of implementation teaching laboratory in State Polytechnic of Jakarta (PNJ) with industry in establishing cooperation with the industry-based, teaching industry has implemented and produce graduates. Model teaching programs that have been held involving industry companies, for example: PT PLN, PT Holcim, PT Badak LNG, PT Jasa Marga, PT Trakindo, and INCAA. Government support for IKDU Center (waste management), support for development curriculum and on the job training. In Bandung State Polytechnic Manufacturing (POLMAN) with companies and industries used the Production-Based Education (PBE). Ilyas (2016) as Vice Director for Academic Affairs POLMAN said

that PBE has an objective and outcome to development of: (a) problem solving, (b) professional attitude, (c) autonomous, planning, execution and control of the work, (d) attitude: sense of quality, (e) efficiency: sense of economy, (f), management: sense of planning and strategy, (g) empowerment: sense of utilization, (h) critical thinking and creativity, (i) measurable knowledge base, (j) performance ability, (k) interpersonal skill, (l) self and sufficient and self motivation, (m) communication skills, (n) leadership and managerial skills, (o) facility eith current technology, (p) ability to work on team, (q) practice think, (r) congruence and relevant with workplace skills.

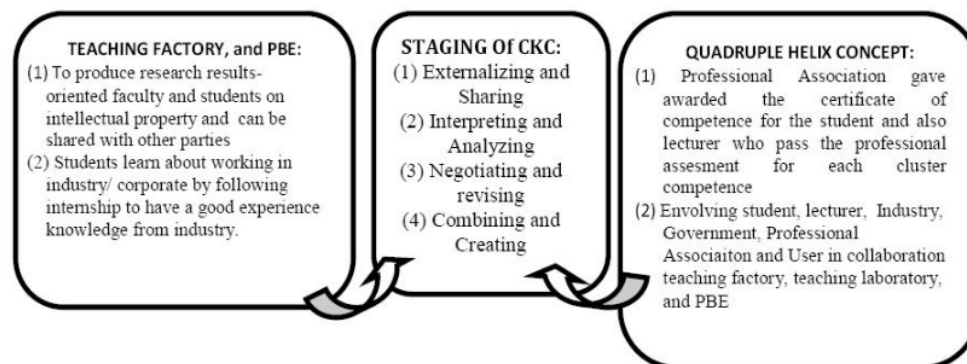


Figure 3. Impelmentations of Teaching Factory and Production Based Education With Quadruple Helix Concept and CKC

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CONCLUSIONS

- a) Student learning at Polytechnics means have a good knowledge and experience by following on the job training or partnership program with industry. Teaching factory and PBE are one of collaborative learning with in polytechnics and industry.
- b) Impelementation of all four stages of the CKC to the model of development process polytechnic education, culturally acceptable, because the process of teaching factory/teaching laboratory used updated curriculum collaboratton with industry.

SUGGESIONS

Quadruple helix concept can be a suitable model for polytechnic education at the current time facing globalization era.

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