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Certificate

Dr. Bruri Triyono / YSU, Indonesia

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Contents of the RCP Research Pass

- M0 RCP research project results on the following topics
  - **P1.2** Models of and approaches to Public Private Partnership between government, university and industry on TVET in Indonesia and China
  - **P2** Lessons learned from the development and implementation of National Teacher Standards in ASEAN Member States and China as inputs for the development of Regional TVET Teacher Standard (linked to RECOTVET Working Group 1 Developing a Regional TVET Teacher Standard in ASEAN)
- M1+M2 Knowledge sharing beyond the network & follow-up funding
- M3 Matchmaking event 2017 and RCP network resource analysis

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RESEARCH REPORT

COOPERATION BETWEEN INDUSTRIES AND EDUCATIONAL INSTITUTIONS FOR TVET IN THE FIELD OF HEAVY EQUIPMENT

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ABSTRACT

This study aims to determine: (1) profile and competence of graduates that can meet the needs of the industry, (2) profile and competence of educators / trainers, (3) pattern of cooperation between industry and educational institutions on vocational education and training program in the field of heavy equipment (4) contribution by each parties in the implementation of cooperation.

This study used survey method with a qualitative approach. This study population is for the parties involved and interested in the implementation of vocational education and training program in the field of heavy equipment. The sample of the research consisted of three parties, namely: vocational education institutions as a producer of middle-level manpower, a company engaged in the field of heavy equipment distributor or a company engaged in mining, and the college as a producer for vocational educators. The data collection is conducted by: observation, interviews and document analysis. Data were analyzed using a model Creswell with stage steps: (1) data, (2) data reduction, (3) interpretation, (4) conclusions.

The results showed that: (1) Graduates of vocational education and training program in the field of heavy equipment according to the needs of the industry are: (a) Knowing and understanding how to use tools and equipment, master the concept of electricity, master the concept of the power train and hydraulic system, master the basic maintenance and troubleshooting of heavy equipment unit, (b) be able to apply the knowledge to repair and maintenance of heavy equipment unit, and (c) able to work independently with periodic monitoring. (2) Qualified educators in the field of heavy equipment must: (a) have academic qualifications S1 education in heavy equipment engineering, mechanical engineering or automotive engineering, (b) have experience internship or work in the field of heavy equipment, (c) have the pedagogical ability with a certificate of expertise on training and assessment, (d) have the ability and professional competence of the heavy equipment. (3) The pattern of relationship between vocational and industrial cooperation are: (a) fully collaborate (full partnership) in carrying out cooperation programs and (b) partial partnership that the school is in collaboration with some of the industry to carry out some activities of educational programs. Cooperative activities undertaken by the industry is only one aspect of the activities that is part of the overall educational program. (4) Each party has a positive contribution in accordance with the competence and scope of work of each institution.

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A. Title

Cooperation between Industries and Educational Institutions for TVET in the Field of Heavy Equipment

B. Background

Utilization of science and technology in the field of heavy equipment in the industrial sector, mining, construction, and others has shown significant improvement. This leads to the increase of Human Resources (HR) need that has the competence of heavy equipment maintenance and repair in terms of both quantity and quality. Attempts to support the fulfillment of HR needs are done in various ways, namely non-formal education undertaken by the industry, such as training center or formal education such as vocational school (SMK), Polytechnic, and University. The needs of HR especially in the fields of heavy equipment mechanics and operators, continues to increase every year, it is as presented by Assistant Director of Academic Affairs at UT School Bustamamsyah Djalal, that the needs of HR correlates with sales of heavy equipment that are also rising every year. However, workers absorbed in the business of heavy equipment is still very little compared to the existing needs. (tttp://www.medanbisnisdaily.com).

The obstacle in preparing the HR of heavy equipment field especially in the formal education sector is the availability of professional educators whose competence can be accepted by the industry as an employer and administratively recognized by the government in accordance with the applicable legislation. Meanwhile, one of the obstacles that are happening is teachers' expertise in vocational schools are mostly not in the areas of heavy equipment. The second obstacle is the lack of adequate equipment for the learning process in formal education. Another obstacle is the cur-riculum that can adjust to the development of heavy equipment technology and competency re-quirements in the industry.

Some heavy equipment distributor has committed to contribute in advancing the education and training programs for the preparation of professional manpower in the field of heavy equipment. PT Trakindo Utama (Trakindo) provides scholarships for graduates of vocational students who excel and also implement Trakindo Cooperative (Coop) programs which aims to raise the competence of teachers and students through a variety of approaches (http://www.kabarcsr.com). PT United Tractors also has a great commitment to contribute to the development of workforce education and training in the field of heavy equipment such as the implementation of the UT School and also cooperation with vocational schools in the form of Target School (http://www.utschool.sch.id/). In addition to the two companies, PT Thiess Contractors Indonesia, a mining company based in Balikpapan also has an educational program to produce a heavy equipment mechanic labor, which is usually called Apprenticeship Program. These companies are implementing education and training programs in accordance with the conditions of each company, so there is a need for collaboration and harmony in the preparation of human resources in heavy equipment between vocational school, industry and universities in order to obtain competent and professional human resources.

This research will analyze how the form and pattern of ideal cooperation between industries and educational institutions, especially in the implementation of educational programs and vocational training to prepare human resources professionals in the field of heavy equipment. The added value for the industry is the availability of more educated and skilled employees so it will be easier to develop their skills when later they already work in the industry. The advantage for society is opening up new employment opportunities, whereas for educational institutions, there will be opportunities for the science development as a form of moral responsibility to contribute to the development of professional human resources.

This research is a collaborative research conducted by YSU Indonesia and CDIBB China. There were several points of research problem that have been

studied together and/or studied by each institution, as shown in the table below.

No	Problems	YSU-Indonesia	CDIBB-China
1.	The form and pattern of cooperation between industries and educational institutions in the implementation of TVET	In the field of heavy equipment	In general and automobile
2.	Human resources requirements from industry	The competence of graduates of vocational education and training program in the field of heavy equipment	How they influence the industry involvement in TVET?
3.	How to improve the pedagogic competence of trainer in TVET programs?	V	
4.	The appropriate curriculum design that can produce qualified and skilled graduates (plan of curriculum development)	V	
5.	Which economic and institutional elements are crucial to the successful implementation of PPP in VET in reality?		V

C. Research Question

This research will analyze how the form and pattern of ideal cooperation between industries and educational institutions, especially in the implementation of educational programs and vocational training to prepare human resources professionals in the field of heavy equipment. Here is the formulation of the problem to be solved by this research project:

1. How is the competence of graduates of vocational education and training program in the field of heavy equipment?
2. How qualified educator / trainer in vocational education and training programs in the field of heavy equipment?
3. What is the form and pattern of cooperation between industries and educational institutions in the implementation of educational programs and vocational training in the field of heavy equipment?
4. How is the contribution of each party in support of the implementation of such cooperation?

D. Research Objective

The objectives of this research are:

1. To get a complete figure about the profile and competence of graduates of vocational education and training program in the field of heavy equipment that can meet the needs of the industry.
2. To get a complete figure about the profile and competence of teachers / trainers in vocational education and training program in the field of heavy equipment.
3. To obtain information and data on existing patterns of cooperation between industries and educational institutions in the implementation of vocational education and training program in the field of heavy equipment, so it can be used as development partnership program.
4. To obtain the identification of resources and the role or contribution by each of the parties in the implementation of cooperation.

E. Research Approach

The design of study is survey method with a qualitative approach. The survey method is a method of research that takes a sample from a population and using questionnaires as a data collection tool. Three important steps in the study refer to the suggestion of Babbie (1982), which outlines three important steps to determine the success of the study, namely: (1) developing questionnaires as research instruments, (2) selecting and establishing the study sample, and (3) collecting data by conducting interview or dis-tributing questionnaires.

F. Place and Time

The research location is in several provinces on the island of Kalimantan and Java, namely: East Java, Yogyakarta, East Kalimantan and South Kalimantan. The research was conducted in January through June 2016.

G. Sample and Population

This study population is the parties involved and interested in the implementation of educational programs and vocational training in the fields of heavy equipment. There are three groups of sample in this study, namely: vocational education institutions as producers of middle-level manpower, companies engaged in heavy equipment distributors or companies engaged in mining, and the higher education as a producer for vocational educators. In line with research sample provision from education institution / Vocational school which own Heavy Equipment Expertize Program from 5 schools in Java and Kalimantan as follows: (1) SMKN 1 Singosari Malang, East Java; (2) SMKN 1 Ngawen Bantul Yogyakarta; (3) SMKN 1 Balikpapan, East Kalimantan; (4) SMK PGRI Banjarbaru, South Kalimantan; (5) SMKN 5 Banjarmasin, South Kalimantan; (6) SMK Bhakti Bangsa Banjarbaru, South Kalimantan. Research sample for industry group which own business in the field of heavy equipment, namely: PT United Tractors branch Banjarmasin (Training Center), while for industry on mining business is PT Thiess Contractors Indonesia. The sample came from the higher eduction is Faculty of Engineering, Yogyakarta State University.

H. Data Collecting Method

The process of collecting data on the research carried out by several ways: direct observation, interviews and document analysis. Direct observation of the object is intended to obtain a full picture, especially related to facilities and equipment as well as the implementation of educational programs and training of research objects on-site. Interviews were conducted to obtain in-depth information related to the formulation of the problem. Analysis of documents executed as a complement and support to the data obtained by observation and interviews.

I. Research Instrument

Research instruments are observation and interview papers used by the field agent to obtain data for the research. Research instruments are divided into two types namely instrument for education institution and instrument for industry. Validasi instrumen dilakukan secara *judgement the expert*. Research instrument framework is shown in Table 1 as follows.

Table1. Research Instruments Framework

NO	INSTRUMENT	MAIN FACTOR	SUB-FACTOR
1.	Education Institution	1.1. Factor of Education	1.1.1. Curriculum and learning 1.1.2. Teacher and educator resource 1.1.3. Education facilities and requirement 1.1.4. Graduates tendency
		1.2. Prospect of heavy equipment expertize	1.2.1. Animo/intention on heavy equipment study program. 1.2.2. Quantity of heavy equipment study program graduates.
		1.3. Cooperation between school and industry	1.3.1. Model of cooperation program 1.3.2. Supporting Factor 1.3.3. Adverse Factor 1.3.4. Benefits
2.	Industry	2.1. Prospect of industry in the future	2.1.1. Quantity of Vocational School graduates demand. 2.1.2. Type of position/strata for vocational school graduates 2.1.3. Required competence of upcoming human resource 2.1.4. Heavy equipment industry progress trend
		2.2. Training Program	2.2.1. Training Program for employee 2.2.2. Instructor qualification 2.2.3. Training program evaluation 2.2.4. Availability of training facilities
		2.3. Cooperation with school	2.3.1. Conduct the cooperation program 2.3.2. Output of cooperation program 2.3.3. Benefit of cooperation program.

J. Data Analysis Method

Data are analyzed using a model of Creswell (2012: 237) as described below. Creswell model is chosen because it is more comprehensive and the most advanced of various models of qualitative data analysis.

In general, steps implemented are as follows: (1) data presentation, is the results of data collection, (2) data reduction, is an attempt to classify, direct, organize, and remove unnecessary data or not relevant to the formulation of research problems, (3) the interpretation of the data that has been reduced, (4) interpretation and conclusion.

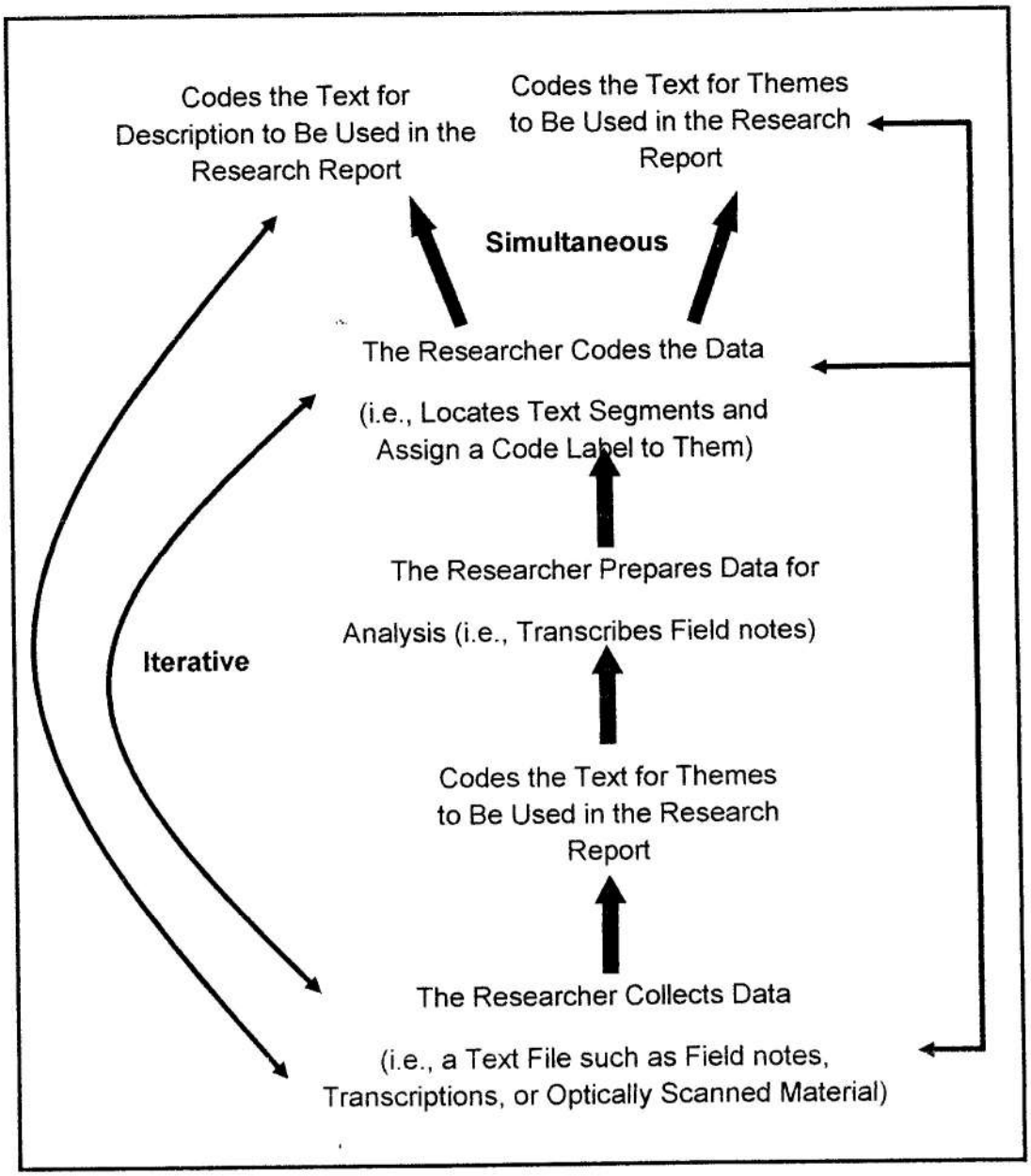


Figure 1. Creswell Data Analysis Method

K. Research Data

The survey data is presented in the form of exposure of both school and industry institution as a whole. The data can be seen in the tables below.

1. SMK N 1 Singosari Malang, East Java

SMK Negeri 1 Singosari is located at Jalan Raya Mondoroko No. 3 Singosari Malang, East Java. This school organizes 10 different training programs in

accordance with the employment needs. Heavy Equipment Mechanic Skills Program (in collaboration with PT. Trakindo Utama) particularly employs USA Caterpillar curriculum. Table 2 below presents the results of a survey in SMK N 1 Singosari held on March 12, 2016.

Table 2. Results of Survey in SMK N 1 Singosari Malang

NO	ITEM	DESCRIPTION
2.1.	Curriculum development	It is developed by the industry adjusted to the curriculum of the government for cooperative and non-cooperative / regular class. All the material and demands of the curriculum are based on the industry needs.
2.2.	Learning process	It is implemented by using a block system. Compulsory learning resources are in the form of modules from industry compared to learning resources from general text books. The evaluation is conducted by assessors from the school and industry. Inhibiting factors: (1) Lack of infrastructure for practices, (2) Lack of special tools
2.3.	Graduated competences	They are based on enforceable standards in the industry. Also, they follow enforceable standards of government as a condition of national test / UKK
2.4.	Internship / apprenticed	Carried out using different patterns.
2.5.	Trainer competences	Mechanical/automotive engineering teachers that have received heavy equipment training in PT Trakindo; S1 qualification
2.6.	Learning equipment	➢ 1 workshop for various areas of work ➢ 1 engine that is still running (genset) ➢ 1 unit of forklift
2.7.	Graduates' tendency	Not identified
2.8.	Students' interests and statistics	Not identified
2.9.	Cooperation Model with Industry	➢ Carry out cooperation for new students' recruitment, learning, evaluation, and job placement ➢ Procurement of equipment (leasing) ➢ Provision of learning materials (leasing) with the supervision of industry audit
2.10	Supporting factors	➢ Students who pass the selection ➢ Parents' support ➢ Mutual trust between stakeholders
2.11	Inhibiting factor	Normative and adaptive learning schedule, because the allocation of OJT is different from the regular classroom; Industry situation is not good
2.12	School advantages	➢ Support practice facilities ➢ Support learning material ➢ Support teachers' development ➢ Get The OJT ➢ Guaranteed graduate placement
2.13	Expected cooperation program	Not identified

2. SMK BAKTI BANGSA Banjarbaru, South Kalimantan

SMK BAKTI BANGSA is located at Jl. Karang Rejo RT.005 RW.001, Kel. Guntung Manggis, Banjarbaru, South Kalimantan. The school organizes four (4) different programs, namely: Heavy Mechanical Engineering, Lightweight Vehicle Engineering, Motorcycles Engineering and Multimedia Engineering. Table 3 below presents the results of a survey in SMK BAKTI BANGSA Banjarbaru held on March 16, 2016.

Table 3. Results of Survey in SMK BAKTI BANGSA Banjarbaru

NO	ITEM	DESCRIPTION
3.1.	Curriculum development	The curriculum is developed by the school (KTSP) with the proportion of 60% practice 40% theory and consulted to the industry (UT Training Center). Competences in the productive subjects are as follows: Basic Competency Study (140 hours): Understanding the basic machine, understanding the basic processes of metal forming, explaining the processes of machine energy conversion, interpreting engineering drawings, utilizing equipment and tools in the workplace, utilizing measuring tools and implementing safety, occupational health and workplace environment procedures. Competency Study (1044 hours): utilizing special tools, utilizing workshop equipment, utilizing seal bearing and coating materials, utilizing service literature, carrying out the work in electricity, utilizing a hydraulic system, carrying out the basic work of the engine, carrying out basic work under carriage, carrying out basic work of power train, repairing turbo charger, repairing cylinder head group, repairing fuel injection pump, repairing radiator assy, maintaining 10 operating hours (daily), maintaining unit / machine 50 operating hours (weekly), maintaining unit / machine 250 operating hours (moonthly) and maintaining unit / machine 2000 operating hours.
3.2.	Learning process	The learning process theory is implemented in schools. In addition, hands-on lessons are held at the Training Center UT Banjarmasin for first grader in second semester. There are 2 classes (@ 30 students) for each grade level. The material is developed based on the results of teacher training at TC UT Banjarmasin and the practice of the learning process in the UT where teachers shall be involved in the teaching activity as well. The equipment is relatively complete and there is 1 unit of wheel loader. Learning Obstacles include: ➢ Teachers originally do not have heavy equipment qualification (solved by joining the training included in UT and participating internship teaching in UT) ➢ Most teachers do not have S1 qualification
3.3.	Graduated competences	Being able to utilize special tools, utilize workshop equipment, utilize seal bearing and coating materials, utilize service literature, carry out the work in electricity, utilize a hydraulic system, carry out the basic work of the engine, carry out basic work under carriage, carry out basic work of power train, repair turbo charger, repair cylinder head group, repair fuel injection pump, repair radiator assy, maintain 10 operating hours (daily), maintain unit / machine 50 operating hours (weekly), maintain unit / machine 250 operating hours (moonthly) and maintain unit / machine 2000 operating hours.

NO	ITEM	DESCRIPTION
3.4.	Internship / apprenticed	Industry work practices are implemented in groups for 3 months in the ninth graders in 4th semester. Industry work practices placement is determined by the school. Extra hours/replacement is provided for the students who carry out industry work practices. In addition to the regular Industry work practices, sometimes there is internship demand from companies outside the schedule and still served with participants/students that are carefully selected based on the mastery of competencies. The company requires students to join Industry work practices charged to the school. Implementation of Industry work practices: students training -> implement Industry work practices (monitored by school/advisors to the industry, when the industrial location are too far, the monitoring is done via telephon -> write final report -> exam (students' presentation in the company and also in schools.)
3.5.	Trainer competences	Formal education of D3 or S1; A certificate of competency skills of the heavy equipment industry The number of teachers are 5 people and all had been trained from the industry.
3.6.	Learning equipment	One workshop/garage room which is used to carry out the competency practice (bench work, diesel motors, heavy equipment components). One versatile space that is utilized for public lectures from the company or its recruiting activities. Constraints that are associated with facilities: support from the government department is not in accordance with the curriculum, expensive price of equipment, (solved by buying second components that are still suitable to be used with a much cheaper price.)
3.7.	Graduates' tendency	Percentage graduation in the last three years amounted to 100%, only a fraction (less than 10%) who go to college and more than 50% work in the field of heavy equipment, with a waiting period of 1-2 months. How to get a job: distributed or facilitated by the school, seeking or through kinship.
3.8.	Students' interests and statistics	The number of new admissions decreased by 132 students in 2013, 70 students in 2014 and 70 students in 2015. Registrants' interest decreased because the condition of the mine is slack. An average of 2-3 students resigned because of their parents or moving to a state school.
3.9.	Cooperation Model with Industry	Cooperation with industry in the form of: guest teachers from industry for students, teachers are sent to industry for heavy equipment training, as Industry work practices student placements, recruitment and industrial grade in TC United Tractors. MoU with the first major company and then with another company as a supporter.
3.10	Supporting factors	➢ The number of mining companies in South Kalimantan are quite a lot. ➢ The requirements for companies to implement CSR, one of which is in the field of education
3.11	Inhibiting factor	Mining company situation is not good; students who join Industry work practices are withdrawn and transferred to another company.
3.12	School advantages	➢ There is a training facility for teachers ➢ Industry work practices place for students -> get certification from the company ➢ Aid equipment / components ➢ Partner in developing the curriculum.
3.13	Expected cooperation program	➢ Target SMK BISA -> SMK helps reducing unemployment and graduates can get a job quickly ➢ More and more companies are recruiting heavy equipment graduates so that they can all get a job in the company.

3. SMK PGRI Banjarbaru, South Kalimantan.

SMK PGRI Banjarbaru located at Jalan Kebon Karet No. 1 Loktabat Banjarbaru South Kalimantan. The school is held four (4) expertise extracurricular program, namely: Mechanical Equipment, Industrial Chemical Engineering, Accounting Graphic Techniques. Table 4 below presents the results of a survey on SMK BAKTI BANGSA held on March 17, 2016.

Table 4. Results of Survey on SMK PGRI Banjarbaru

NO	BUTIR	DESKRIPSI
4.1.	Curriculum development	The curriculum was developed by the school and consulted to the industry partner. Basic Competency Study (140 hours): Understand the basic machine, understand the basic processes of metal forming, explaining the processes of energy conversion machine, interpret engineering drawings, use of equipment and fixtures in the workplace, using measuring tools and implement safety procedures, occupational health and workplace environment. Vocational Competency (1044 hours): using special tools, use of workshop equipment, use a seal bearing and coating materials, using the service literature, carrying out the work in electricity, using a hydraulic system, carry out the basic work of the engine, carrying out basic work undercarriage, carrying out the basic work of power train, improve the turbocharger, improved cylinder head group, fix the fuel injection pump,repairing radiator assy, maintain for 10 hours of operation (daily), treat the unit / machine 50 hours of operation (weekly), treat/take care unit / machine 250 operating hours (monthly) and take care of unit / engine 2000 hours of operation.
4.2.	Learning process	Learning the theory is implemented in schools, sometimes also to invite guest teachers from the industry. Practical learning workshop held at the school for the means that available, while for the means which are not available, the instructional practices implemented in industrial workshops. learning Barriers: deficient facilities and supporting infrastructure, the number of teachers is still less productive, low quality of students inputs factor, deficient participation / involvement of parents in school activities.
4.3.	Graduated competences	Basic Engine, basic electrical, basic hydraulic, maintenance, assembling & disassembling, troubleshooting.
4.4.	Internship / apprenticed	Implementation of prakerin/OJT block basis for 3 months, the time is adjusted to the industrial needs. Since in the class of X students is monitored based on their merit to take precedence of implementing the Pakerin. Conduct the prakerin/OJT special briefing on the ethic code of work in the industry and how to fill prakerin/OJT journal. Monitoring prakerin/OJT communication with the industry and also of charging journal. Given learning module as a substitute for face to face class. Prakerin/OJT exam is not implemented by the school, however as a pure assessment of the industry and received certificates.
4.5.	Trainer competences	Qualifications: Minimum D3 Engineering, has a training certificate of the company, has the industry experience and integrity. The number of productive teachers as much as 3 people and all of them had been trained from the industry.

NO	BUTIR	DESKRIPSI
4.6.	Learning equipment	Complete facilities owned are for: work bench, diesel engine, hydraulic system, basic electricity. Constraints faced by is related means is on funding issue in the procurement of the equipment because the price is expensive.
4.7.	Graduates' tendency	Never has passed before
4.8.	Students' interests and statistics	The number of new admissions and the interest of new applicants likely to be increased. However, the numbers dropout / resign quite high 10-15 people every year due to family problems as well as economically.
4.9.	Cooperation Model with Industry	Cooperation with industry in the form of: prakerin/OJT student placement, support equipment / component, students practice learning, recruitment of student achievement and collaboration curriculum (school curriculum adjustments to the necessary competence industry).
4.10.	Supporting factors	Supporting factors: • Integrity students who carry prakerin/OJT • Intensive communication between the school and industry • A taste of good family • Handling students' problems quickly when monitoring prakerin/OJT
4.11.	Inhibiting factor	The Mine conditions which being slowdown resulted in reduced corporate activity.
4.12.	School advantages	• Compliance of curriculum with industrial use • Graduates competent for industrial use • Increased competence of students, especially the practice of • Alumni absorbed
4.13.	Expected cooperation program	• The number of prakerin/OJT admissions can be further improved • There is assistance for facilities for the practice learning

4. SMK N 5 Banjarmasin, South Kalimantan.

SMK Negeri 5 Banjarmasin is located at Jl. Maj Sutoyo No. 330 Pelambuan, West Banjarmasin, South Kalimantan, Banjarmasin. This school organizes 14 (fourteen) membership program, one of which is a Heavy Equipment Engineering. Table 5 below presents the results of a survey on SMK Negeri 5 Banjarmasin which was held on March 18, 2016.

Table 5. Results of Survey on SMK Negeri 5 Banjarmasin

NO	BUTIR	DESKRIPSI
5.1.	Curriculum development	The curriculum is developed Based on the guidelines of Dikmenjur (government) and also refers to the needs of industry (Trakindo and United Tractors). The school made a draft curriculum then be verified by the appropriate industrial partner in accordance with MoU. The subjects of specialization divided into 3 categories: Primary areas of expertise are given in grades 1 and 2 (Physics, Chemistry, Image Technique), Basic programming skills are only given in class 1 (Simulation Digital, Basic Technology Automotive, Employment Basic Automotive Engineering, Electrical Engineering Basics automotive) and the Skills Package is given in grades 2 and 3 (Electrical Equipment, Power Train and Hydraulic Equipment, Maintenance Engine and Heavy Equipment Unit)

NO	BUTIR	DESKRIPSI
5.2.	Learning process	The learning process is implemented in schools for both to theory and practice. Total classes are 3 classes. Teaching materials related to the competence of the heavy equipment used have no official version of the government, the reference still refers to material from the industry which is the material obtained while the teacher accompanying the student training / training in industry or at PKL /internship of the student in the industry. Obstacle in the learning process is as follows: a. Equipment is still in a minimal stage (availability units of heavy equipment but the unit is not working) b. The room facilities are limited and still join with the TKR expertise package c. Some teachers still fail to fully understand the material / components of heavy equipment machines. d. The draft curriculum of collaboration between the school and the industry is still not final. e. Has not provided specific modules / textbooks for teaching materials
5.3.	Graduated competences	Competence graduate membership of heavy equipment packages is as follows: a. Mastering the basics of automotive b. Mastering the electrical machine c. Mastering the power train and hydraulic machine d. Mastering the engine maintenance and heavy equipment units.
5.4.	Internship/ apprenticed	Industrial working practices (Prakerin/OJT) conducted over six months, namely: 3 months in Grade 11 and 3 months in class 12. Time schedule for execution and placement of students assigned by the school and the industry agreed under the appropriate clause in the MoU. Every industry is occupied by a minimum of 2 students. Before the implementation of prakerin/OJT will be held briefing the students about preparation for work in the industry, filling journals and prakerin/OJT assessment. the Monitoring is done during the early departure and late / withdrawal of prakerin/OJT. Students are required to fill out a journal and make a final report later presented to a team of testers. Assessment consists of: the attitude 30%, skills 30% and 40% presentation. The certificate Facilitated by the school with a note by the industry, while the original score is from the industry. Learning material that being skipped during the implementation of prakerin/OJT will be given additional extra hours. Some of the obstacles in the implementation of prakerin/OJT are: a. Students are placed outside of the regional area (another province) (site project) that is off the beaten track or which is in the remote area. b. Students in grade 11 corresponding with the initial concept should apprentice in the workshop instead of placement in site
5.5.	Trainer competences	Qualifications to become a teacher is a plot S1 education or at the same level, or who are already having competencies through training of heavy equipment industry. Educators still join another package of automotive expertise (TKR & TSM) today totaled 18 peoples and 4 personnel among them are S2 / post graduate degree. Almost all teachers have completed the training material on heavy equipment (1 person have attended full 4 months of training, 1 person have never been involved in the training and other random per-topic material)
5.6.	Learning equipment	Building / lab space for facilities still fused with TKR membership packages. The Practice Media / equipment owned: work bench, diesel motors, basic electricity, the wheel brakes suspension, hydraulic system and testing fuel. Obstacles associated with the practice equipment:

NO	BUTIR	DESKRIPSI
		a. Purchasing units of heavy equipment is very expensive b. Equipment / component that being used for practice is the secondhand item
5.7.	Graduates' tendency	Until 2015 has graduated three generation and graduation percentage of 100%. All graduates get a job and no one has continued the study to university.
5.8.	Students' interests and statistics	The number of new students of the last 3 years as much as 2 rombel @ 30 new students while in 2015 only 1 rombel 30 students. the interest of applicants for membership package of heavy equipment remained stable ≥ 600 prospective students. The number of students who dropped out about 1-2 people per year with a graduation rate is 100%.
5.9.	Cooperation Model with Industry	The Cooperation with industry which has been signed the MoU related to the development of materials and the educator / teacher training. The industry as a partner in the development of curriculum and teaching materials, curriculum draft prepared by the school then verified by the industry. Teachers are given the opportunity to attend training on existing industry MoU. There are four companies that have MoU with SMK N 5 related to the heavy equipment.
5.10.	Supporting factors	• The big number of mining companies in South Kalimantan . • The requirement for companies to implement CSR, one of which is in the field of education
5.11.	Inhibiting factor	• Internal administrative problems in the company, the existing MoU must be approved and signed by the head office (Jakarta) so that the process will take a long period of time and take a long time, even some have canceled the MoU. • In the event of a change of leadership of the company (PIC in MoU) there will be policy changes also that can impact on the school.
5.12.	School advantages	• MoU as the fulfillment of the administrative requirements of the terms of accreditation • Assist in curriculum development • Assist the development of teachers or educator • The Placement of prakerin/OJT students • Recruitment
5.13.	Expected cooperation program	The running program can be also improved, facilitated in order that will be able to visit industrial training center in headquarters There is a priority in recruitment / recruitment.

5. SMK N 1 Balikpapan, East Kalimantan

SMK N 1 Balikpapan is located at Jln. Marsma R Iswahyudi Sepinggan, Balikpapan East Kalimantan. This school organizes 17 (seventeen) expertise membership program, one of which is a Heavy Equipment Engineering technique. Table 6 below presents the results of a survey in SMK N 1 Balikpapan that was held on March 18, 2016.

Table 6. Results of Survey in SMK N 1 Balikpapan

NO	BUTIR	DESKRIPSI
6.1.	Curriculum development	Using curriculum in cooperation with industry of heavy equipment dealers, the main framework of the government, a charge material that is taught according to the composition of industrial competence; Competence according to the guide book of PTTU Skill proficiency; maple theory and practice @ 24 hours
6.2.	Learning process	Are integrated theory and practice, later validated by teachers as a requirement to follow prakerin/OJT. Constraints of learning practice facilities are very limited (although there is one unit bulldozer)
6.3.	Graduated competences	Based on industry requirements that are integrated with the graduation requirements of the government. There are several key competencies required as a condition of graduation, especially for basic mechanics. Not all were tested during final exams, but conduct only the sampling process.
6.4.	Internship / apprenticed	For the class of cooperative implemented in PT Trakindo, 3 months in the 4th semester and 3 months in the semester 5. For regular classes for 4 months in the company of other heavy equipment depending on the business school, namely UTI, Volvo, etc. Once students have finished the OJT they will get a certificate of OJT. Several obstacles prakerin/OJT are: (a) Students are not obtained approval / validation of the teacher for the class of cooperative, (b) Mental of students have not been strong.
6.5.	Trainer competences	Koop grade teacher educators must have received training by Trakindo on basic technical for 3 months, while the regular classes by teachers automotive / machine that does not have to be trained. No certified teacher educators on heavy equipment engineering.
6.6.	Learning equipment	There are several means of support practices , namely the workshop, bench, diesel motor workshop, workshop of the hydraulic system with 1 unit bulldozers, basic electrical workshop, the workshop steering system, brakes, and suspension, with the support of the space theory and the library department.
6.7.	Graduates' tendency	Not identified
6.8.	Students' interests and statistics	Not identified
6.9.	Cooperation Model with Industry	Formed a Koop classes and regular classes. For the Koop class, more intensively in the field of education, from recruitment, learning, assessment and certification to graduates. While for regular classes in cooperation with PT Komatsu remanufacturing Asia for OJT activities, equipment, and their guest teachers.
6.10.	Supporting factors	• Support from the education office • Support from Industry • Parents
6.11.	Inhibiting factor	• Schedule of training and teachers OJT often disrupt the learning process • School budgets are limited to follow the activities of cooperation
6.12.	School advantages	• HR Development teachers and students • Getting OJT facilities • The presence of industry representatives in schools to support the implementation of activities • Ease of borrowing facilities of the company • The existence of scholarships and graduate recruitment
6.13.	Expected cooperation program	• Successful Cooperation Program • The existence of Program of Improvement Tools • Upgrades Tools and Media Education • The existence of recruitment every year

6. Training Center PT United Tractors, Banjarmasin Branch.

Banjarmasin Training Center branch is located at Jl. A. Yani Km 13.5 Peat South Kalimantan, is one of the training center owned by PT United Tractors. Table 7 below presents the results of a survey on TC PT United Tractors Banjarmasin Branch which was held on March 16, 2016.

Table 7. Results of Survey on TC PT United Tractors Branch Banjarmasin

NO	BUTIR	DESKRIPSI
7.1.	Prospects for the heavy equipment industry	The trend fluctuates with the price of crude oil, as it will affect mining. Labor needs for heavy equipment were relatively stable despite mining slowdown conditions, on the other hand construction will rise, although not as big as mining. Job opportunities for Bachelor of Engineering heavy equipment: Vocational school/SMK Teachers heavy equipment; trainers / instructors in the industry as well as a field supervisor. So although it was a slowdown of mining conditions of employment is still wide open and remain competitive in the industry.
7.2.	Types of positions for graduates of vocational schools and industry capabilities required	Vocational school graduates placed for the position of Mechanic and operator after getting a series of internal training UT. For the new mechanics will be trained in 4 months theory and 8 months internship OTJ. Level of competency expected to vocational school human resource is Capable (able to work under the guidance of superiors, namely: applying knowledge in employment, working under supervision, with regular supervision)
7.3.	Employee training program	The materials / modules for education and training program of mechanics as the table below. The material is intended for the whole new mechanic to the implementation for 1 year (4 months of theory and practice at the UT School, 8 months OJT / internship in the project site). After graduating from the education and training program is then mechanics deployed to the field as well as other mechanics. The next stage is the development of quantum mechanics advanced training given per-competencies according to the interests and talents of mechanics. Furthermore, a senior mechanic / advanced directed to master all competencies in a particular unit. Model evaluation of the education and training program are: the participants are given learning module, provided the material of theory and practice, and then will be a test for each module topics both theoretical and practical exams. For those who pass on a topic specific modules then continue on the next topic, for those who do not pass must repeat it until the graduation, or if not able to repeat it so that they declared failed / DO
7.4.	Instructor qualification and evaluation system	To become an instructor then the educator / trainer must master the material and basic competence to mechanics as the table below, but it should have followed the Training for Trainers and other supporting training to improve teaching abilities. Model evaluation and certification / assessment see picture below, both for instructors and mechanics are almost at the same groove, the difference is on its content, namely: the type of their training, implementation on his work, his assessment component and the type of certification)
7.5.	Employee	Model of evaluation and certification / assessment see picture below, both

NO	BUTIR	DESKRIPSI
	evaluation system / Mechanics	for instructors and mechanics are almost at the same groove, the difference is on its content, namely: the type of their training, implementation on his work, his assessment component and the type of certification)
7.6.	Availability of training facility	Availability of training equipment/means: adequate theory room facility and there is a workshop which is equipped with a variety of props training for all modules taught. When required of participants can be invited to the maintenance of existing workshop.
7.7.	The program of cooperation with SMK	Cooperation with SMK with the program name "SOBAT" is divided into two categories: School Patronage (UT involved in curriculum development, learning, human resource development of teachers etc.) and school partner (merely for the sake of recruiting candidates for employment either mechanics or operator, prakerin/OJT and industrial visits) Forms of activities including: a. UT School every Saturday for students from partner schools are alternately scheduled b. Teacher development programs to target schools (mentoring school curriculum and teaching materials) c. Customer training of -> teachers / lecturers included d. Grant used components to SMK e. Guest lecturers to the school / college f. Competency test of students to target schools g. Monthly mentoring for PKL students h. Industrial visits from school / college i. Review of the implementation of cooperation programs targets schools
7.8.	The program of cooperation with universities	Pioneering collaboration with polytechnic Hasnur to the opening of new study programs and curriculum development. As for the implementation of Placement/OJTs for students ideally 6 months. Suggestions for FT UNIVERSITY if demanded MoU with the UT: Contact the UT headquarter in Jakarta, preceded by activities of industry visits to UT HQ, then ask the cooperation, especially in such matters, the implementation of the PI student and curriculum development. Cooperation with UT HQ reason is in order that the coverage of PI student placement can be done throughout the entire site branches in Indonesia owned by UT.
7.9.	Benefits for Companies	• As a contribution to society in the form of CSR • As a business promotion efforts • As early recruitment efforts

7. Traning Center PT Thiess Contractors Indonesia

Training Center PT Thiess Contractors Indonesia is located at Jl. Mulawarman No. 1 Small Batakan, Kel. Manggar Balikpapan in East Kalimantan, a training center owned by PT Thiess Contractors Indonesia will prepare the heavy equipment mechanic. Table 8 below presents the results of a survey on TC PT Thiess Contractors Indonesia which was held on March 17, 2016.

Table 8. Results of Survey on TC PT Thiess Contractors Indonesia

NO	ITEM	DESCRIPTION
8.1.	Prospects for the heavy equipment industry	There is a reduction of employees in the last three years as the impact of a decrease in the price of coal and oil; The construction work is possible to rise; Mining jobs were less stable.
8.2.	Types of positions for graduates of vocational schools and industry capabilities required	• Heavy equipment mechanic • Auto electrical heavy equipment • Welder • Storeman • Tool keeper • Ability: Good technician fundamental, good attitudes and behaviors, conscientious
8.3.	Employee training program	Employees recruited from graduates of the apprentice program and Work Experience. Apprentice held for 8 blocks @ 6 months. Material: Basic mechanic awareness, the mandatory material of Thiess, trade stream, as well as specialist units. System evaluation: carried out by the training center, but the material test has been validated by CQ university, in accordance with the needs of industry.
8.4.	Instructor qualification and evaluation system	Customized with qualifications set by CQ university, Cert IV for training & assessment, Cert III for Engineers (mechanical, electrical, and fabrication). The evaluation system is done by CQ University through an audit of all devices which are modules, test material and its action plan.
8.5.	Employee evaluation system / Mechanics	Employee evaluation system implemented by the supervisor. For mandatory material and safety, do refresh and reassessment on an ongoing basis. Implemented using e-learning.
8.6.	Availability of training facility	Having a theory room as much as 7 rooms with a capacity of 10-15 people and 1 computer room, workshop / electric auto repair shop, fabrication, mechanical disassembly and assembly. Training dept has a training kit: syllabus, modules, materials, evaluation tools.
8.7.	The program of cooperation with SMK	• To cooperate in terms of recruitment of participants of an apprentice with several schools in Yogyakarta to get a mechanic level I. • Cooperation is also done by providing training to teachers and students in vocational school cooperated with PT Thiess. • Talent scouting for prospective employees.
8.8.	The program of cooperation with universities	In cooperation with two universities, namely University and PoltekBa. Cooperation with the University concerning training, OJT, and collaboration tools to achieve technical education courses of heavy equipment. Cooperation with poltekba conduct for work experience programs for poltekBa graduate. Graduates who obtained is the technician level II who is projected to level III.
8.9.	Benefits for Companies	• Obtain prospective employees who already have a good basic technique. • Facilitate training activities and cost saving of the training Input and hope: the organizers of the training other than PT Thiess can implement CBT learning properly, so they can be accepted in their work.

8. Result of Data Reduction

Furthermore, implement the data reduction to obtain a "key point" that represents all sample data in accordance with the lattice existing instruments. then the results of the data reduction are used to answer the research question which requested. Table 9 shows the results of the data reduction of educational institutions that are key points of each item based on information from each school respondents.

Table 9. Key Points Data on Educational Institutions.

NO	ITEM	Key points
9.1.	Curriculum development	• The curriculum was developed by school together with the industry partner, adapted to the demands of the government. Materially, the target competence. • Content: basic vocational competencies, vocational competencies of heavy equipment engineering technique (basic mechanic, engine, electrical, undercarriage, hydraulic systems, powertrain, and maintenance unit and engine) • Assessment of student competency through validation by the teacher, as well as a current industry while the OJT assessment and final exam. Recognized by their logbook and or a certificate of competence from industry. • There are two models of OJT placement , cooperation with industry on the site or another industrial partner for the regular classroom.
9.2.	Learning process	Educational facilities in accordance with national standards. The industry provides assistance and / or practice of lending facilities. Learning resources in the form of an industrial module coupled with common textbooks.
9.3.	Graduated competences	Competence of graduates: As per the demands of the government's requirement of passing/graduation. The main capabilities based on industry needs: good technician fundamentals, good attitude and behaviors, meticulous. Basic Ability mechanic: hand tools, special tools, workshop equipment, seal bearing and coating materials, service literature, the basic work of electrical, hydraulic system, the basic work of the engine, the basis of the undercarriage, the basic work of the power train, turbocharger, cylinder head group, fuel injection pump, radiator assy, caring for 10 hours of operation (daily), maintenance of unit / machine 50 hours of operation (weekly), maintenance of unit / machine 250 operating hours (monthly) and maintenance of unit / engine 2000 hours of operation. job desk including remove and install, disassembly and assembly, as well as troubleshooting.
9.4.	Internship / apprenticed	Prakerin/OJT utilized to provide experience to students, which is carried out with a duration of 3 to 6 months. The Length/period is adjustable with schools and industry agreements. Distinguished between special classes and regular classes. Schools: get a prakerin/OJT placement, certification for students and the development of teaching materials. Industry: Getting additional manpower to assist the work, ensuring the readiness of prospective employment of graduates.
9.5.	Trainer competences	Heavy equipment engineering teacher qualifications: met government regulations basis of academic qualifications, of automotive or machinery. Requirements of industries: Special Class: Experience in technical training

NO	ITEM	Key points
		in heavy equipment industry partner, or have work experience in the industry. Does not require a regular classroom. Ability: basic technical training / basic mechanic, intermediate engine system, intermediate hydraulic system, intermediate powertrain, electrical and electronic systems, engine rebuild.
9.6.	Learning equipment	Requires Infrastructure of the heavy equipment repair shop for disassembly, assembly of the engine, electrical workshop, hydraulic workshop, garage and undercarriage chassis, tool storage space. Accompanied gear K3.
9.7.	Cooperation Model with Industry	The role of industrial partner: Recruitment of students, grant / loan means practices, materials / teaching module theory, delivery of expert / guest teachers, provision of OJT, Provision of teacher training, certification for teachers, the recruitment of prospective students, scholarships, guarantee the absorption of graduates. The role of school: Supplies the candidate's worker, who elected and qualified workers, Teachers at the training center, as a provider of mechanics helper during OJT.
9.8.	Supporting factors	Supporters: Parents, local government (department of education), mutual trust of stakeholders, student quality, industrial-school communication, the extent of employment, corporate responsibility (CSR)
9.9.	Inhibiting factor	Obstacles: Dynamism companies, technological developments, the provision of high profile enterprise, high standard, limited school budgets, bureaucratic companies
9.10.	School advantages	Advantages of the school: curriculum match with the workplace, advanced human resources, school accreditation, student recruitment, guest teachers, training experience, the facility is complete, graduates are absorbed by the job field, placement of PI is assured, full of teaching materials, scholarships for graduates,
9.11.	Expected cooperation program	Expectations: appliance preparation program, sustainability recruitment, adequate work placement location, industrial visits, recruitment priorities.

Table 10 shows the results of data reduction from industries that act as key points of each item based on information from every industry respondents.

Table 10. Key Data Points on Industry

NO	ITEM	KEY POINTS
10.1.	Prospects for the heavy equipment industry	The decline of the coal price so Minning activity also declined, however, the employment opportunities of heavy equipment sector is still open due to construction work on is the rise
10.2.	Types of positions for graduates of vocational schools and industry capabilities required	Position as a heavy equipment mechanic; auto electrical heavy equipment; welder; storeman; Tool keeper, with the level of competence is Capable.
10.3.	Employee training program	Each industry implement training programs to prepare the heavy equipment mechanic, PT United tractors formed the UT School program with a training period of one year, while the PT Thiess form Apprentice program for 3 years.
10.4.	Instructor	The instructors must master both the technical competence related to

NO	ITEM	KEY POINTS
	qualification and evaluation system	heavy equipment mechanic and should have the qualifications / capabilities of implementing the learning process
10.5.	Employee evaluation system / Mechanics	Employees are given a training / training to improve competence, then the implementation on the field, in a certain period subsequent boss (supervisor) conduct the evaluation and assessment on an ongoing basis and, if it deemed worthy enough to be included then will be involved in the competency certification program
10.6.	Availability of training facility	Each industry has room and other training facilities that are adequate to carry heavy equipment mechanic training programs and learning tools in the form of modules, media and the assessment / evaluation
10.7.	The program of cooperation with SMK	Each industry has a good program of cooperation with SMK for the recruitment of trainees, prospective employees and contributes to the development of SMK (HR curriculum and teacher)
10.8.	The program of cooperation with universities	Each industry has a program of cooperation with universities in the form of: apprentice / internship industry both for lecturers and students, the development of new courses related heavy equipment (curriculum and grant media practices)
10.9.	Benefits for Companies	Each of these industries benefited from the cooperation program carried out either with a vocational or higher education, namely: early recruitment, obtaining more competent candidates, saving training costs, contribution to society in the form of CSR and as a business promotion

L. Discussion

1. The Competency of Graduates on Educational Program and Training Sector of Heavy Equipment

Vocational school as an institution that produces graduates prospective workers who will work in the industry, establish the criteria or qualifications of competence of graduates who pursued consistent with the needs of industry. The heavy equipment industry as users also expects competence of graduates of vocational school/SMK graduates are in accordance with the qualifications and competence of the work that will be encountered. Vocational school/SMK and industrial relations are not just limited to supply and demand relationship but it is as a 'give and take' relationship that is mutually beneficial. SMK graduates as a producer and industry as a user of the graduate student but on the other hand the industry as a provider of input and support for the improvement of the learning process in SMK.

The regulation of Minister of Education and Culture No. 54 of 2013 on Graduates Competency Standards (SKL) SKL is clear that the criteria regarding the qualifications of graduates capabilities that include attitudes, knowledge, and skills. SKL consists of the qualification criteria ability learners are expected to be reached after completing his studies in the education unit. Table 11 shows the SKL for vocational school/SMK levels according to Permendikbud the No. 54 in 2013. The discussion in this study is limited to the aspects of knowledge and skills.

Table 11. SKL for vocational school/SMK level

Dimension	**Qualification of Capabilities**
Behaviour	Having Behaviour that reflects the attitude of the faithful, noble, knowledgeable, confident, and responsible to interact effectively with the social and natural environment as well as in placing itself as a reflection of the nation in the association world.
Knowledge	Having knowledge of factual, conceptual, procedural, and metacognitive in science, technology, art, and culture with human insight, national, state, and civilization-related with causes and effects of phenomena and events.
Skill / Ability	Having the ability to think and the act of effective and creative in the realm of the abstract and concrete as the development of the material learned at school independently.

Head of SMK Bakti Bangsa Banjarbaru South Kalimantan explained that the competency standards of graduates are qualifications that must be met by students and used as a basis for curriculum development and learning. This explanation is supported by the existing documents of curriculum in vocational school/SMK Bakti bangsa which shows that the competence of graduates is expected is that students are able to: (1) use of special tools, (2) use of workshop equipment, (3) use a seal bearing and coating material, (4) using service literature, (5) carry out the basic electrical work, (6) using a hydraulic system, (7) carry out the basic work of the engine, (8) carrying out basic work undercarriage, (9) carry out the basic work of the power train, improve turbocharger, (10)

fix the cylinder head group, (11) fix the fuel injection pump, (12) repair radiator assy, (12) maintain for 10 hours of operation (daily), (13) maintain of unit / machine 50 hours of operation (weekly), (14) taking care unit / machine 250 operating hours (monthly) and (15) took care unit / engine 2000 hours of operation. The explanation is also consistent with data obtained from other CMS as respondents in this study who said that the competence of graduates sought to meet government requirements and tailored to the needs of industry to obtain the human resources of a competent heavy equipment mechanics , among others: (a) master the basic of automotive , (b) master the basic concepts of electrical machines, (c) master the concept of the power train and hydraulic systems of heavy equipment, and (d) master the engine maintenance and heavy equipment units.

In terms of the needs of the industry indicates that in general the vocational school/SMK school graduates are expected to work well as a heavy equipment operator and mechanic. Department Head Training Center of PT United Tractors explained that graduates of vocational school/SMK placed for the position of Mechanic and operator after getting a series of internal training by United Tractors. The level of competency expected from SMK manpower is Capable namely is able to apply knowledge in work, working under a supervision and under the regular supervision conduct the work by superiors. In the outlines document of Education and Training Program conducted by PT United Tractors in mind that the purpose of the training is to provide knowledge and skills about: (1) regular maintenance on heavy equipment, (2) the basic ability to the disassembly and installation of components in the appliance of heavy tool, (3) the basic ability of the troubleshooting on heavy equipment, and (4) the ability to analyze problems that happen to occur in the heavy equipment through the monitor panel located on the operator cabin. For mechanics who are eligible and qualified to be

included for the certification program competencies held by the Indonesian Professional Certification Heavy Equipment (LSP-ABI).

In harmony with the explanation above of PT United Tractors, PT THIESS Contractor Indonesia also put vocational school/SMK graduates as a mechanical labor with a prior training. The training program is conducted by PT Thiess in the form of apprenticeship program that generates senior mechanic of heavy equipment to comply with the standards issued by the Industry Skills Councils of the Australian Government that AUR12 (Automotive Industry Retail, Service and Repair Training Package), and MEM05 (Metal and Engineering training Package). The training program consists of three vocational fields, namely: mechanical, auto electrical and fabrication. Qualifications and competence of each of these fields, more specifically a reference to the standard as described above, namely: the field of mechanical refers to the qualifications specified in AUR31212 - Certificate III in Mobile Plant Technology, while the field of auto electrical reference to the qualifications specified in AUR30312 Certificate III Automotive Electrical Technology and fabrication refers to the qualifications specified in the Certificate III in MEM30305 Engineering- Fabrication Trade. MEM05.v11. In the implementation of the program, PT Thiess cooperate with Central Queensland University (CQU) as a party having the license to issue a Certificate III for heavy equipment mechanics.

Based on the above exposure both graduates of vocational school competence and qualification in industrial mechanics, it can be presented in a table with the aspect of competence as stipulated in Permendikbud No 54 of 2013 as shown in Table 12.

Table 12 The Competence of graduates of vocational school training programs of heavy equipment

Dimension	**Competency of Vocational School**	**Industry Qualifications**
Attitude	*Not identified*	*Not identified*

Dimension	Competency of Vocational School	Industry Qualifications
Knowledge	▪ Mastering the basics of automotive ▪ Mastering basic concepts of electrical machines ▪ Mastering the concept of the power train and hydraulic systems of heavy equipment ▪ Mastering concepts of engines and heavy equipment units maintenance method. ▪ Know and understand how to use tools and equipment ▪ Knowing seal bearing and coating materials, ▪ Knowing how to use the service literature,	▪ Knowledge of regular maintenance on heavy equipment ▪ basic knowledge of dismantling and assembly or removal and installation of components on heavy equipment ▪ Basic knowledge of troubleshooting on heavy equipment ▪ Tools and equipment knowledge ▪ Basic Machine Element ▪ Basic safety heavy equipment ▪ Product Knowledge ▪ Part Book Reading
Ketrampilan	▪ Carry out basic electrical work, ▪ Using workshop equipment, using special tools, ▪ Carry out basic engine work, undercarriage and power train ▪ Fix the cylinder head group, ▪ Fix the fuel injection pump, ▪ Fix the radiator assy, ▪ Maintain the unit / machine 10 hours of operation (daily), 50 hours of operation (weekly), and 250 hours of operation (monthly) ▪ Maintain the unit / machine 2000 hours of operation.	▪ Basic Driving ▪ Diesel Engine ▪ Hydraulic System ▪ Electrical System ▪ Direct Drive System ▪ Torqflow Drive System ▪ Steering & Brake System ▪ Final Drive & Undercarriage ▪ Axle, Wheel & Suspension ▪ Basic Remove & Install ▪ Basic Maintenance ▪ Basic Trouble Shooting ▪ AUR31212 Certificate III in Mobile Plant Technology ▪ AUR30312 Certificate III Automotive Electrical ▪ MEM30305 Certificate III in Engineering-Fabrication Trade

Table 12 above shows that there are overlap competencies taught in vocational schools and industry nevertheless is still a gap between the two, which is a necessary qualification in the industry but it is not taught in the vocational school. Education programs and vocational training fields of engineering machine tools is expected to produce graduates with the competencies according to user needs graduates. It is necessary to set the qualifying standard of competence of graduates as heavy equipment mechanics with Competent skill level as shown in Figure 2. Mechanic with Competent skill level must: (1) have the basic knowledge to do the job, (2) able to apply that knowledge in the work, and (3) able to work independently with periodic monitoring. Standard of competence and qualifications must be agreed by both parties both vocational and industries as users of graduates.

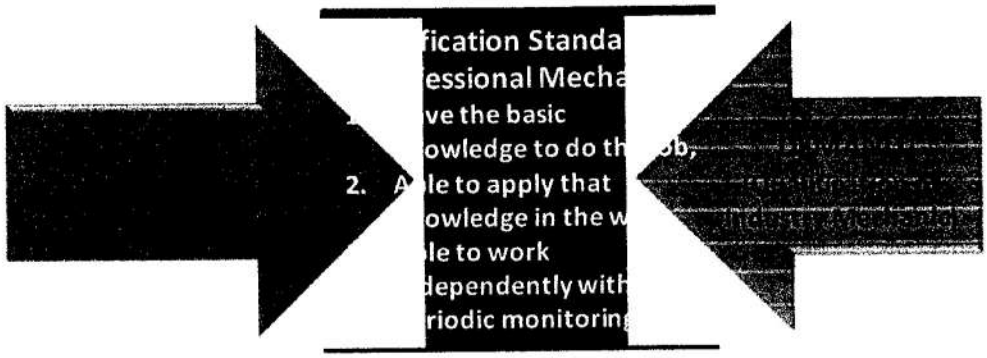


Figure 2. Fulfillment of qualification standards of Heavy Equipment Mechanic

The education program implemented by CMS and hosted by the training center for the industry to be managed simultaneously in order to achieve the qualifying standard of competence that has been agreed upon it. The necessary coordination and cooperation relations between the two so the attainable standard of competence and qualifications of the mechanical work effectively and efficiently.

Figure 3 below shows one of the efforts to be made in the framework of the division of tasks between vocational schools and

industry in achieving the qualifying standard of the mechanics. The effort is to divide the competence and qualifications under 3 (three) clusters and determine their respective roles in the phases of achieving the existing qualifications.

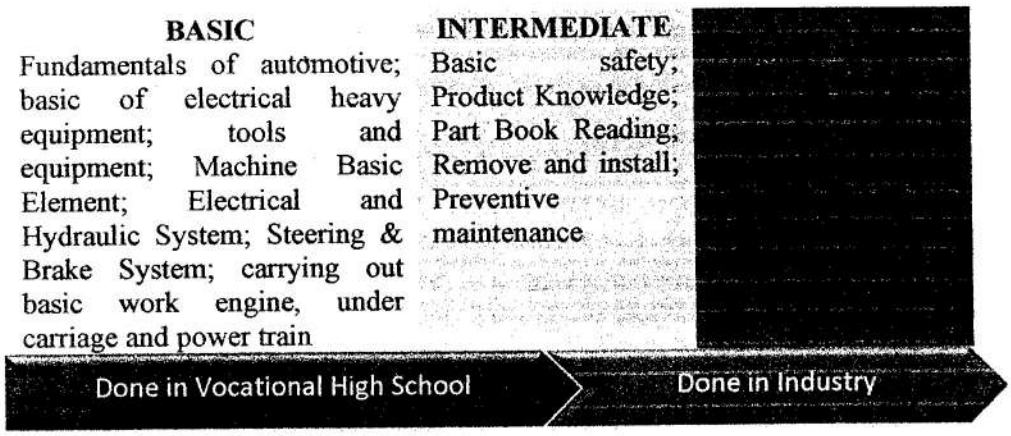


Figure 3. Distribution of roles in the stage of qualification achievement

2. Qualification Educator / Trainer in Vocational Education and Training Program Field Equipment

Based on the observation of the data as presented above, indicates that the school (SMK) conduct the heavy equipment engineering education program, while the other hand, the industry also conduct a training, especially in the field of heavy equipment mechanics and operators personnel preparation. Head of Heavy Equipment Engineering Program of SMK Negeri 1 Singosari Malang said that the process of learning the technical field of heavy equipment was carried out with the system block system. Learning resources shall be used in the form of an industrial module and equipped with learning resources from general text books. Evaluation of the students carried out by assessors from the schools and from the industry. While in some vocational respondents / object of other observation there is little difference in the learning process, which is carried out in an integrated theory and practice in schools by teachers, and during the education program students are

required to carry out the practice of industrial work for varying periods of about 2 to 6 months.

The data also showed that the observation of the training program carried out in an industrial area is more intensive and specific . Paimin (Training Center United Tractors) said that to become a new mechanic in PT UT, then vocational graduates should follow an intensive training for 1 year ,which is 4 months of theory and practice in the UT School workshop, 8 months OJT / internship in the field of the project site. While Alusiyansyah explained that the training program for the candidate of the mechanic in PT Thiess Indonesia through the Apprentice program implemented for 8 blocks @ 6 months in workshops and training center project site PT Thiess.

One important component which supports the learning process of heavy equipment engineering program is a good resource lecturer and teacher at the vocational and the training center instructors in the industry. Qualifications of educators and instructors must be appropriate and aligned with the competencies of graduates defined. Regulation of the Minister of National Education of the Republic of Indonesia No. 16 of 2007 on standard academic qualifications and competence of the teacher explains that any teachers or educators must have academic qualifications and competency standards that apply nationally. Teacher competency standards developed in their entirety from the four core competencies, namely pedagogical, personality, social, and professional. This study discusses only in terms of academic qualifications, pedagogical competence and professional competence. Academic qualification in question is minimal education that must be met by an educator as evidenced by diplomas and / or certificates of relevant expertise.

Pedagogic competence in question is the ability of teachers / educators in managing the learning process, recognize the characteristics of learners, mastering learning theory and principles of learning, and be able to develop curriculum and instructional media. While professional

competence in question is the ability of teachers or educators in participating in the development of science in accordance with the areas of expertise that is always dynamic, the educators or teachers developed with learning and reflective action in mastering the learning material extensively and profound .

Paimin of Training Center United Tractors explained that to be an instructor must master the material and the basic mechanical competence, on the other hand it also should have followed the Training for Trainers and other supporting training to improve teaching abilities. Meanwhile, Darmawan, an instructor at the training center coordinator PT Thiess explained that the instructor must have the technical ability to match the heavy equipment mechanic with a certificate III for mechanical engineers, electrical and fabrication, and qualify for a certificate IV training and assessment issued by CQ University Australia. Second only to explain the requirements of the pedagogic and professional competence, but does not explain the other academic qualifications required to become an instructor. Other data revealed that the majority of industrial instructors have academic qualifications undergraduate (S1) but many of them also have the educational background of high school / vocational school with a long period of work experience .

Generally, qualified vocational teachers to thc technical field of heavy equipment are meet government requirements in the minimum academic qualification S1, in the field subject of automotive engineering or mechanical engineering. It is an appropriate explanation given by the head of Heavy equipment engineering program of SMK Negeri 1 Singosari and in harmony with the explanation from yyy the head of Heavy equipment engineering program of SMK Negeri Banjarmasin. Teachers also must have the ability in heavy equipment engineering including basic of technical training / basic mechanic, intermediate engine, hydraulic system and powertrain, electrical training, and have the experience of industrial training or work experience is become a plus

point. For teachers who teach classes of industrial cooperation are required to have a certificate of training techniques from the heavy equipment industry partner, as described by The Head of SMK Negeri 1 Balikpapan.

Table 13 below shows the qualifications and competence of teachers in vocational school and the trainer in the industry site based on data on the points table 2.5, 3.5, 4.5, 5.5, 6.5, 7.5 and 8.5.

Table 13. Qualification of teachers / trainers based on academic qualifications, competence and professional pedagogic

No	Qualifications / Competencies	Vocational school Teachers	Instructor in the Industry
1.	Academic	Minimal S1 Automotive Engineering or Mechanical Engineering	There is no absolute requirement. (S1 or vocational school with considerable field experience)
2.	Pedagogic	Not identified	• Training Program for Trainers • Certificate IV (training & assessment)
3.	Profesional	• basic technical training / basic mechanic • an intermediate engine system, • intermediate hydraulic system, • intermediate powertrain, • electrical & electronic system, • engine rebuild.	• Safety • Product Knowledge • Tools • Basic Machine Element • Basic Driving • Diesel Engine • Hydraulic System • Electrical System • Direct Drive System • Torqflow Drive System • Steering & Brake System • Final Drive & Undercarriage • Axle, Wheel & Suspension • Basic Remove & Install • Basic Maintenance • Basic Trouble Shooting • Part Book Reading

Table 13 shows that heavy equipment engineering educator qualifications both vocational teachers and instructors industries accordingly have in common but also there are differences in quality standards both in terms of academic, pedagogical and professional. Pedagogical competence of teachers of SMK technique / engineering of heavy equipment is not identified definitively from the observation, it can be assumed that the pedagogical competence of a teacher attached to the qualification requirements of their S1 educational. This is because the provision of qualifications and competence of vocational teachers should be based entirely on the rules and regulations set by the government, while the instructor qualification in the industry prefers the achievement of competencies of graduates that required. The relationship between the two, where there are similarities and differences, in order to facilitate further understanding, can be described as in Figure 4 below.

Figure 4. Intesection of qualifications and competence of SMK teachers and industry instructors

Optimal alignment between the qualification of teachers for vocational teachers and instructors heavy equipment of industry engineering field can be achieved by enlarging or expanding sections intersecting in the picture above. SMK party and industry facilitated by the government and supported by the college on the basis of mutually beneficial cooperation can make a mutual agreement related to the expanding wedge that competency. If the region is increasingly

widespread, the qualifications and competence of vocational teachers with industry instructor relatively the same so that graduates produced both SMK and industrial training center has the competency standards are almost the same.

Thus vocational graduates who will work in the industry will only require a shorter training to become a heavy equipment mechanic conditioning as required by the industry. The industry will be more efficient in setting up a new mechanical power derived from vocational / SMK graduates fresh graduated. Universities and colleges are expected to participate actively in making a positive contribution to generating prospective vocational teachers in the professional field of heavy equipment. Universities should be proactive to improve and restructure the curriculum of learning, so it will be able to produce more candidates who are ready to become a vocational teacher or an instructor at the training center industry. Development model for improvement program of qualification and competence of heavy equipment engineering educators is shown in Figure 5 below.

Figure 5 illustrates that to gain the qualification of heavy equipment engineering educators as vocational teachers and instructors in the industry will require a proactive cooperation and contributive of each stakeholder. Universities should open in accepting input related to the improvement of the curriculum and the learning process in order to adjust vocational school and industrial needs. Material input for curriculum improvement as shown in the second phase of development is focus on areas of expertise and professional competence related to technological developments of heavy equipment. Universities should provide sufficient time in the curriculum for internships or industry practice for students of heavy equipment engineering education program. The development model can be implemented if there is already an understanding and cooperation between the government, vocational school, higher education and industry. Efforts to apply the development model needs to be preceded by a more in-depth and comprehensive research.

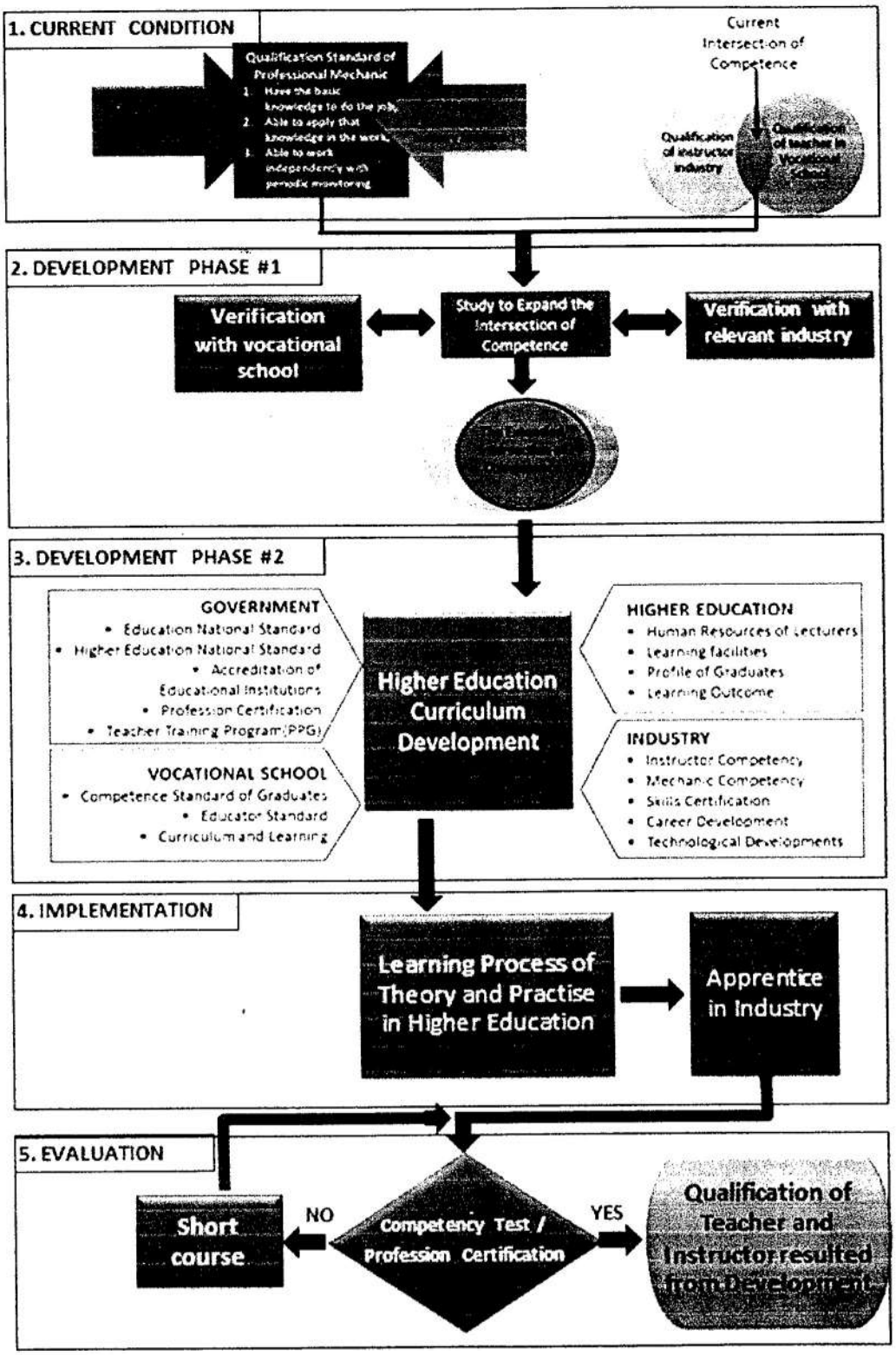


Figure 5. The pattern of development of qualifications and competence of engineering educators heavy equipment

Qualification of teachers of vocational of heavy equipment based on the description and discussion of the above can be expressed as follows:

a. Have an 'S1' education academic qualifications in engineering of heavy equipment, mechanical engineering or automotive engineering.
b. Having internship experience or work placement or even already have work experience in the field of heavy equipment.
c. Having the more honed pedagogical ability to have a certificate of training and assessment.
d. Mastering the ability and professional competence of the heavy equipment, as listed in Table 11 above.

3. Patterns of Cooperation Program Implementation of Heavy Equipment Vocational Education and Training Sector Heavy Equipment

As the data presented above that the respective institutions both schools and industry to implement education programs and vocational training in particular areas of heavy equipment. Schools that organizes membership packages Mechanical Equipment has a target that graduates produced will be absorbed and worked in industry as a heavy equipment mechanic power. While the industry is also implementing a training program in order to prepare a reliable mechanic.

Rahmat Triyono as Department Head Training Center of PT United Tractors Banjarmasin Branch stated that the job position for the vocational school graduates, in general was stationed as a mechanic and heavy equipment operator, after receiving a series of training beforehand (see Table 7 in point 7.2). While Alusiyansyah as Assistant Manager of Training Center PT Thiess Balikpapan explained that the job position in PT Thiess for vocational graduates are as: mechanical, auto electric, welder, storeman and tool keeper on job maintenance and reparation of

heavy equipment (see Table 8 points 8.2). Further explained that the employee should have a good technician fundamentals, good attitudes, and behaviors, and has a precision work. According to the table on points 7.2 and 8.2 it was known that vocational school graduates to be able to occupy a position of employment in the field of heavy equipment still needs to be done prior training by the company concerned.

There is a significant relationship between vocational. and heavy equipment industries. SMK as producing graduates who will work in the field and heavy equipment industry as a user on the graduates. However, there is still a considerable competence gap between the existing vocational graduates to industrial need, it is seen that the industry must conduct a training course before hiring the graduates of the vocational school. Both parties need to harmonize and agree on education and training programs were implemented in order to minimize the existing gap of competence. The school needs to improve the competence of graduates to be able to approach to the needs of the industry, but the industry also needs to support the efforts of the school to improve the competence of its graduates.

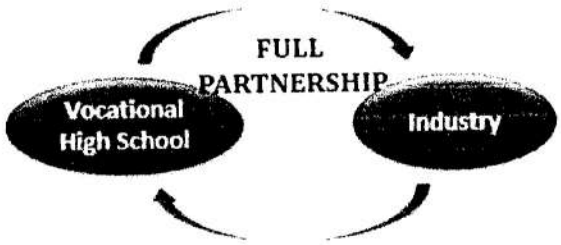
One of the obstacles faced by nearly all SMK who were respondents in this study to improve the competence of graduates are the the availability of a productive subject teacher quantitatively still need to increase the number and qualitatively still needs to increase the competency (see Table 9 points 9.2). This was revealed from the results of surveys and interviews conducted by the research team. Kartikawati, S. Pd, MM as Head of SMK Bhakti Nations Banjarbaru South Kalimantan most productive states that teachers are still not educated to degree level and not of the fields of expertise of heavy equipment. Efforts to overcome this, the school has a policy for the teachers included in the training program and apprenticeship Training Center PT United Tractors Branch Banjarmasin (see Table 3 point 3.2). Setiawan, S.E as Principal of SMK PGRI Banjarbaru also stated that the school is still a shortage of teachers

productive sectors, so sometimes invite guest teachers from the industry to help the learning process (see Table 4 point 4.2).

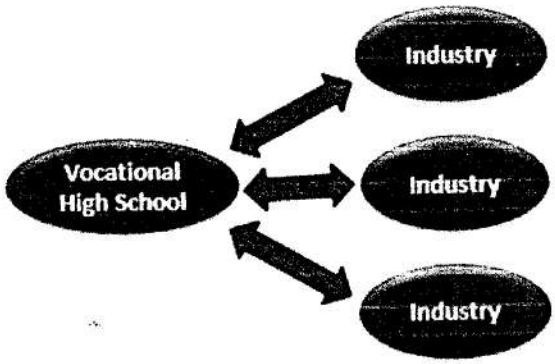
Meanwhile, Head of Engineering Program of Heavy Equipment SMK Negeri 5 Banjarmasin states that some of the productive teachers still have not yet fully understand the material / components of heavy equipment machines (see Table 5 points 5.2). While the Head of SMK Negeri 1 Balikpapan stated that teachers who teach in the field of expertise of heavy equipment have not possessed the teaching certificate in engineering of heavy equipment (see Table 6 points 6.5)

Seeing these conditions, it is importance to initiated and encouraged in order to create a pattern of relationships and mutual synergies between vocational schools and industry. The cooperation is expected to help the completion of some of the problems and constraints faced by both parties in developing the competence of human resources in the field of heavy equipment.

Based on observation and description of the data in the table above, the relationship between vocational and industrial cooperation when seen from the side of SMK as stated in point 2.9, 3.9, 4.9, 5.9, 6.9, it can be described as follows:



(a) Full partnership



(b) Partial partnership

Figure 6. The relationship of cooperation in terms of SMK

Figure 6 (a) shows that the schools and industry collaborate in full (full partnership) in running the cooperation program. Forms of cooperation are conducting a special program of cooperation in vocational school. Activities carried out is start from the selection admissions, curriculum development, learning, evaluation, procurement of equipment (grants or leasing), the provision of learning materials (leasing) with an audit of the industry to a job placement and follow-up of graduates (see table of data points 2.1 , 2.9, 6.1 and 6.9) that have an impact on the whole process and components of the education program. This kind of cooperation has been implemented by SMK Negeri 1 Singosari Malang and SMK Negeri 1 Balikpapan PT Trakindo Utama. Advantages of the school with this kind of cooperation is (see table of data points 2:12, and 6:12) to get prospective students' potential, obtain a grant / loan facilities, teacher development, facilitation of learning, a place prakerind (OJT) as appropriate, obtain recognition of the quality of graduates of industries, graduates can be absorbed in the industry.

Figure 2 (b) shows that the school in collaboration with some of the industry to carry out some activities of educational programs. Cooperative activities undertaken with the industry is the only one aspect of the activities that are part of the overall educational program. In general, the industry involvement only on teacher training activities, curriculum draft

verification, the place of prakerin (OJT) and recruitment of prospective employees (see the table of data points 3.9, 4.9, and 5.9), while the learning activities conducted by the school without involving the industry. This kind of cooperation has been implemented by SMK BAKTI BANGSA Banjarbaru SMK, SMK PGRI Banjarbaru, and SMK Negeri 5 Banjarmasin with each their industries partner.

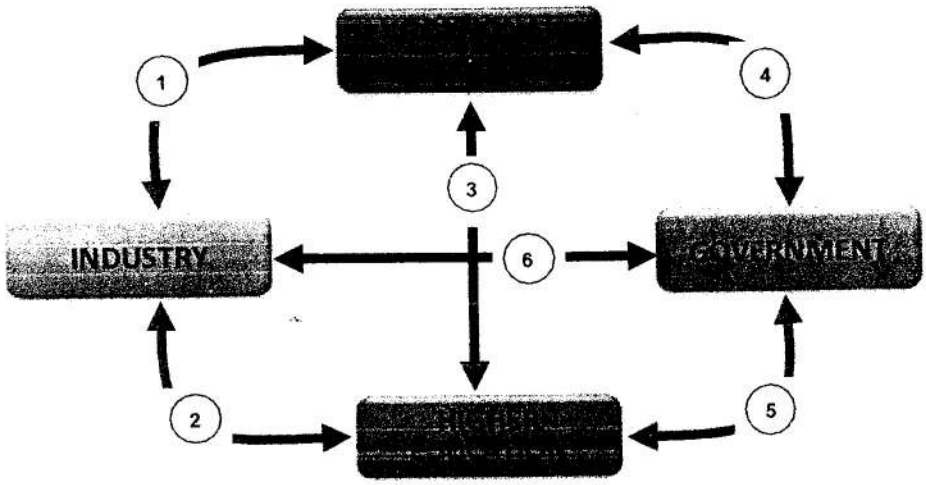
Meanwhile, when it is seen from the side of the industry, partnerships between industry and education can be categorized into 2 groups (see the table of data points 7.7, 7.8, 8.7 and 8.8), which is a program of cooperation with vocational schools and cooperation with universities. Activities that are supported by the industry is the general recruitment of candidates from vocational or college graduates, work placement / OJT, training or internships for teachers / lecturers and curriculum development. Paimin from the Training Center of PT United Tractors Banjarmasin Branch said that in the corporate United Tractors strongly supports the development of educational and training programs of the heavy machine with conducting a program of cooperation in the form of Assisted Schools and Partner Schools. Besides United Tractors is also very supportive and encouraging universities to be able to open new courses of engineering machine technique.

See opportunities and potential support for cooperation from the side of the industry, and in order for the program to increase human resources in the field of engineering heavy equipment, it is necessary to set up a comprehensive concept of a pattern of intensive cooperation involving all interested parties, namely: SMK, universities, industry and government , SMK graduates as the provider for the mechanical level 1 for the industry, however, requires professional teachers, curriculum and other supporting facilities. College as a party to produce teachers for schools or mechanical level 2 and 3 for the industry, however, requires a means of Placement/OJT and training / internships for faculty and industry need feedback from the vocational school as curriculum development and

instructional materials. The industry as a strategic partner that requires a professional workforce produced by vocational and higher education, need to be involved in the development of education and technical training of heavy equipment to get the job candidates with competencies in accordance with the needs and requirements in the field. The government as the parties provide and regulate which regulation and licensing.

The education system is generally regulated by the government in an Education National Standards set forth in Government Regulation No. 32 Year 2013. Graduate Competency Standards for education and technical training of heavy equipment, as already discussed in point A above, is prepared based on the standard format set by the government. The regulation also explains that Graduate Competency Standards is used as the main reference for the development of Content Standards, Process Standard, Education Assessment Standards, Teachers and Educators Standards, Infrastructure Standards, Management Standards, and Financing Standards. Vocational school in implementing these existing standards can not stand on its own and should establish cooperation particularly with relevant industry and universities.

The relationship between all interested parties, especially in the development of Graduate Competency Standards, Process Standard, Educators Standards, Infrastructure Standards and Appraisal Standard in education and technical training of heavy equipment is shown in Figure 6.



1
- SKL development (mechanic level 1)
- Training / apprentice of teachers
- Curriculum development (aspect productive competence)
- Prakerin/OJT
- Competency test
- Grant / loan use practice facilities
- Recruitment of prospective mechanic level 1
- Industrial Visit
- Guest teachers

2
- SKL development (mechanic level 2 and 3, instructors)
- Training / internship of lecturer
- Curriculum development (aspect productive competence)
- Internship / OJT
- Grant / loan use practice facilities
- Recruitment of prospective mechanic level 2/3
- Competency test
- Industrial Visit
- Guest lecturers

3
- SKL alignmet (mechanic level 2 and 3, instructors)
- Teacher development
- Curriculum development (pedagogical aspect)
- Practice of learning
- Implementation of research result
- Implementation of community service

4
- Regulation and licensing
- Monitoring and Evaluation the implementation of the National Standards of Education (especially vocational school)
- Founding of teachers
- Cooperation mediation to industry school and higher education

5
- Regulation and licensing
- Monitoring and Evaluation the implementation of the National Standards for Higher Education
- Preparation programs for teachers
- Cooperation mediation to industry or vocational school

6
- Fulfillment of obligations of CSR
- Tax incentive program for industries that care for education
- Cooperation mediation to vocational school and higher education

Figure 7. The pattern of relations of cooperation between vocational school, higher education, industry and government

Figure 7 above describes the relationship patterns of cooperation also simultaneously shows the contribution of each party to pursue cooperation. Strengthening cooperation pattern could be upgraded in the field of heavy equipment engineering by implementing the development model to improve the qualification and competence improvement program for heavy equipment engineering educators. The results of the development model can provide optimal benefits to all stakeholders.

4. Contributions of the Parties to the Implementation of Vocational Education and Vocational Training in the Heavy Equipment Sector

Efforts to harmonize qualification standards of competent mechanics is shown in Figure 2, while attempts to acquire heavy equipment engineering educators (vocational teachers and instructors industry) is shown in Figure 5. Patterns of cooperation in vocational school in order to prepare graduates to be qualified heavy equipment mechanics as expected and also to prepare educators for vocational school and industrial needs positive contribution from government, universities, vocational schools and industry. The contribution of each such parties is shown in Figure 8 below.

Figure 8 shows the contribution already made by each of the parties when this research was conducted. There is a need of specific sharpening in order to obtain a more optimal result.

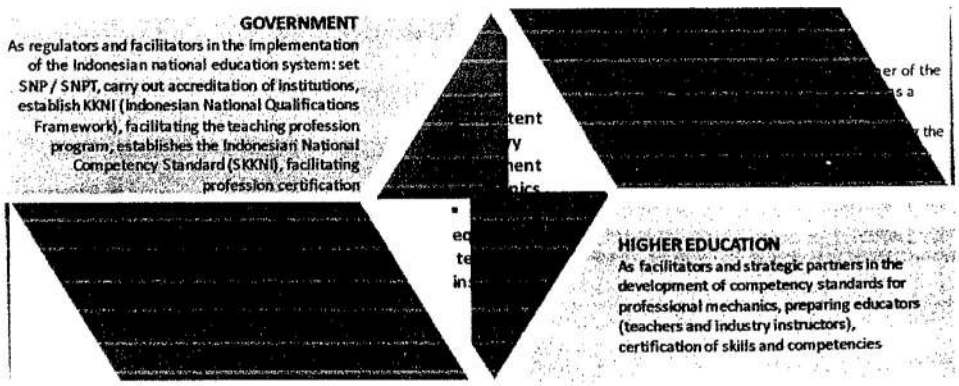


Figure 8. Contributions of the parties in the field of heavy equipment

5. Collaboration Research Conducted by CDIBB China

CDIBB China has also conducted research studies related to the problem described in the table in the introduction. Title of the research that has been done by CDIBB China is: "Key institutional factors in firm's involvement in initial vocational education and training-Analysis of evidence from China". The full research report of China CDIBB is attached at the end of this report, and this is one unit report with the report conducted by YSU-Indonesia.

M. Conclusion

Based on data presentation and discussion above it can be concluded as follows:

1. Graduates of vocational education and training program in the field of heavy equipment according to the needs of the industry are: (a) Knowing and understanding how to use tools and equipment, master the concept of electricity, master the concept of the power train and hydraulic system, master the basic maintenance and troubleshooting of heavy equipment unit, (b) be able to apply the knowledge to repair and maintenance of heavy equipment unit, and (c) able to work independently with periodic monitoring.
2. Qualified educators in the field of heavy equipment must: (a) have academic qualifications S1 education in heavy equipment engineering, mechanical engineering or automotive engineering, (b) have experience internship or work in the field of heavy equipment, (c) have the pedagogical ability with a certificate of expertise on training and assessment, (d) have the ability and professional competence of the heavy equipment.
3. The pattern of relationship between vocational and industrial cooperation are: (a) fully collaborate (full partnership) in carrying out cooperation programs and (b) partial partnership that the school is in collaboration with some of the industry to carry out some activities of educational programs.

Cooperative activities undertaken by the industry is only one aspect of the activities that is part of the overall educational program.

4. Each party has a positive contribution in accordance with the competence and scope of work of each institution.

N. Suggestion

As an effort to deepen the results of this study in order to be used more practical and operational in supporting the cooperation between the parties: the government, higher education, vocational schools and industry, then here are some suggestions that can be followed up.

1. Perform harmonization for more specific perception between the vocational schools and industries relating the qualification standard of heavy equipment mechanic. This can be facilitated by universities to conduct research and deeper study related to the mechanical qualification standards.
2. Conducting further studies to obtain the development model of qualifications and competence of heavy equipment engineering educators (vocational teachers and instructors industry).

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APPENDIX

Key institutional factors in firm's involvement in initial vocational education and training

--- Analysis of evidence from China

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Abstract: Using the institutional economic theory of OE Williamson, this paper endeavors to analyze some cases of firms' involvement in VET in China and to investigate the key institutional factors affecting firm involvement in VET. Free market competition, lack of commonly accepted VET standards as well as administrative orientation can lead to difficulties of school-enterprise cooperation among other factors. To facilitate firms' involvement in VET in the Chinese context, or generally speaking the Public Private Partnership in VET, the following institutional factors can be useful: imperfect labor market institutions which constrain the labor mobility and guarantee the benefits of the involved enterprises, standardization and certification of VET program as well as interest representation mechanism.

Key word: firm involvement, imperfect labor market, VET standard, transaction cost.

Introduction

Firm involvement and investment in vocational education and training (VET) is crucial to the success and quality of VET in general. However lack of firms' willingness in investment in VET and low degree of firm involvement in VET can be observed in many countries around the globe. By initiating researches to the topic of Public-Private-Partnership in VET, it is RCP's intention to further understand the reasons behind the difficulties of firm involvement in VET and possibly offer some policy recommendation related to this.

In the framework of RCP joint research project in cooperation with YSU Indonesia, the following central research questions have been raised:

- What is the form and pattern of cooperation between industries and educational institutions in the implementation of TVET? (For China, in general and automobile. For Indonesia, in the field of heavy equipment.)
- What are the HR requirements from industry? For China, how do they influence industry involvement in TVET? For Indonesia, how is the competence of graduates of vocational education and training program in the field of heavy equipment?
- How to improve the pedagogic competence of trainer in TVET programs?
- For Indonesia, what kind of appropriate curriculum design is that can produce qualified and skilled graduates? (Curriculum Development)
- For China, Which economic and institutional elements are crucial to the successful implementation of PPP in VET in reality?

This paper, namely the Chinese part of the research project, will mainly include the following

parts: at first the backgrounds of firm involvement in VET in China will be presented as the overall background, then the past experiences and achievements in school-enterprise cooperation can offer a closer context of the topics investigated here, afterwards, difficulties and past solutions to the problem of firm involvement in VET in China are introduced; based on this, a new theoretical framework of analyzing the difficulties is provided, namely the new institutional economics theory of Oliver Williamson; then, with this analytical framework, two cases are analyzed; in the end, some conclusions are drawn and implications given.

Methodology

The methods applied in this investigation are mainly literature review and expert interview.

There has been abundant literature on the firm's involvement in VET in China, much of which has very good empirical data and analysis. It is unreasonable to neglect the works that have been done in this regard. Therefore a rather comprehensive literature review has been done to the relevant topics. The theoretical parts focus mainly on the international (English) publications, whereas the empirical parts are mainly from the Chinese context.

Based on the information obtained from literature review, relevant practitioners in the field of VET in government, vocational schools and companies are interviewed. More concretely speaking, 3 government officials, 16 vocational school teachers or principals from 6 different vocational schools in Shanghai and Taicang, and 5 personals who are in charge of human resource management and training affairs in 3 different companies/organizations are interviewed.

The interview with government officials focus more or less on the policy issues concerning school-enterprise cooperation in general. The content of interviews with vocational school teachers mainly contains the following parts:1) questions and answers concerning the overall vocational school development, including student graduation situation, admission, financing, management and teaching etc.;2) questions and answers concerning the cooperation schools carrying out with companies—patterns, forms, curriculum, facility and teaching personnel etc.; 3) a more open discussion about the achievements and difficulties encountered by schools concerning cooperation with enterprises. The content of interviews with company HR personnel mainly contains the following parts: 1) general information about the company; 2) questions and answers concerning the school-enterprise cooperation; 3) a more open discussion about the achievements and difficulties in school-enterprise cooperation from the company's perspective.

Major backgrounds of firm involvement in VET in China

Since 1980s China has established a rather large vocational school system, ranging from lower secondary to tertiary education, covering almost a wide range of vocations. However, vocational education has traditionally been labeled as a second-class education partly due to the Confucian thought that "the man who uses his brain will govern; the man who uses his strength will be governed". This leads to the situation that many students choose vocational education, not because they like it, but because they have to. Due to this reason, many of the students in vocational schools are academically weak and some even have learning problems and difficulties.

During the past three decades, the government has paid increasing attention to vocational education and taken various measures to improve quality of VET, in domains such as infrastructures, teacher training, curriculum reform, strengthening practical training. Related policies and finance are provided as well.

Chinese vocational education bears substantial regional differences and is heavily affected by conditions of local industry development and the enthusiasm and financial resources of the government.

The willingness of the government to improve secondary vocational education is influenced by three factors: assessment implemented by the central government, local labor demand and residents' demand for education. Therefore, secondary vocational education in China is not merely about obtaining vocational certificate, it actually has two functions: vocation-preparation education (actual vocational education) and college entrance preparation education.

Experiences and achievements in school-enterprise cooperation

Most secondary vocational schools have established some form of partnership with enterprises; school-enterprise cooperation has become one of the core missions of almost all vocational schools.

To a large extent, various cooperation between vocational school and enterprise have formed a strong linkage between student and enterprise as well as labor market, which supports students employment to a large extent.

Some schools have developed deep collaboration with enterprise in terms of talents cultivation. Enterprises could engage in the whole process of training scheme formulation, curriculum, adjustment of teaching program, teaching, practical training, internship and student evaluation. And also, school-enterprise cooperation and apprenticeship provide a more institutional way for cooperation.

School-enterprise cooperation also enjoys the policy support from the nation and the local. Deep school-enterprise cooperation and industry-education combination has become the focus of vocational education policy.

The current training program and curriculum is well-organized and oriented toward the industry needs and therefore to some extent could satisfy industries' needs, which could help students have a better understanding of future employment situation and a better self-position in labor market.

The current curriculum could largely provide students with professional knowledge and skills to equip them with the character and attitude that really needed by the labor market.

Some vocational schools already obtained rich experiences in school-enterprise cooperation. These experiences brings several benefits: 1) help to select honest and capable enterprises as partners 2) the administration and teachers could express reasonable demands 3) the experience of curriculum reform, teacher improvement, curriculum resources, teaching schedule and practical training could exert a positive influence on the development of new cooperation programs.

Difficulties of firm involvement in China

The deep and effective participation of enterprises is one of the most important factors to guarantee and develop the quality of vocational education. However, although the cooperation between schools and enterprises has made a lot of achievements, the low degree and level of enterprises' participation in vocational education is still an important obstacle to development of Chinese vocational education.

In a whole, enterprises have a lower willingness for cooperation. Firstly, they lack motives for deeply participation in school-enterprise cooperation because of their worry for cost-benefit. Secondly, enterprises tend to treat students as cheap labor in many cases of school-enterprise

cooperation (Ran 2015).

Enterprises' participation in vocational education is limited and the most popular form is job placement in the last semester of the 3-year program. Most enterprises have not been engaged in the process of developing training program and designing curriculum etc. Some enterprises lack experiences and systematic planning in HR development and training themselves (Yao 2008). Therefore, it is difficult for them to support schools developing curriculum etc.

Problems arise from the school side too, they could not fulfill the tasks with limited ability; the core competence of vocational school teachers lies in the profession and teaching. The training program formulation, textbook reform and integrated curriculum development needed by school-enterprise cooperation is actually not their specialty (Yuan 2011). Meanwhile, teachers are lack of industry experiences and competence in curriculum development, because they mostly graduated from universities.

One other barrier in the cooperation from the school side is that the current payment system makes it hard for schools to mobilize internal resources; it is especially difficult to get the full involvement and extra works of teachers, which is very often required in school-enterprise cooperation, due to works such as curriculum development and textbook adjustments.

Past explanations and solutions to the school-enterprise cooperation difficulties

In the research domain of vocational pedagogy in China, the difficulties of firm involvement in VET has been a hot topic of investigation. Scholars have found the following aspects as the major problems and solutions in the current status (Liu & Guan 2015).

- There has been too much theoretical content in vocational school curriculum, but is lack of practical training – therefore, it is necessary to carry out curriculum reform in vocational schools;
- Most teachers in vocational schools, due to their education and professional background, are lack of practical experiences and competences --- better and more practice-oriented teacher training program shall be offered;
- The teaching methods applied in most of the classroom teaching are outdated and are not appropriate for the teaching and learning of vocational practical skills, because they are largely the same as that of the general education schools--- introduction of activity-oriented(originally a German concept, handlungsorientiert) teaching methods should be used on a more regular basis;
- The quality of education and training in vocational schools is generally not very good--- more and systematic quality assurance measures, such as inspection and evaluation, shall be applied.

However, the above and other past analyses have some limitations, namely they focus on the meso and micro level of school-enterprise cooperation, using the theoretical instruments in pedagogy, while neglecting the macro aspects such as labor market arrangement and social-economic policies, which have crucial influence on the cooperation between schools and enterprises.

In order to analyze and understand the dilemma of school-enterprise cooperation, it is necessary to carry out multi-dimensional analysis of this problem from different disciplinary perspectives. As the cooperation between enterprises and schools inevitably involves enterprise behavior, for the enterprises in the market economy environment, the interaction between enterprises and other

actors have the characteristics of market transaction, therefore, investigation of the cooperation between vocational schools and enterprises from an economic point of view is likely to provide a new perspective.

Analysis of difficulties & success factors from economic perspective

According to Oliver E. Williamson's theory of new institutional economics, transaction is the basic unit of economic analysis, and the core issue in economic organization is the problem of contract signing. Costs arise from both before and after the contract signing. The cost of the contract before signing the contract includes the cost of information collection, negotiation costs, agreement costs; the core issue here is the incentive. The cost arising after the contract signing includes the supervision costs, implementation costs and it is always associated with a specific governance structure (Williamson 1979). To analyze the problem of enterprises to participate in vocational education from the perspective of new institutional theory, the training market in the trading behavior should be the basic unit of the analysis and the core issue is the signing of the training contract. It is also one of the core characteristics of the modern apprenticeship system that scholars at home and abroad have recognized (Guan & Shi 2011; Ryan 2012).

Therefore, the key to the analysis of the enterprises' participation in vocational education lies in analyzing the transaction costs before and after the signing of the training contract, among which the core is the incentive problem before the signing of the training contract and the governance structure after the training contract is signed.

According to Williamson's theory, the key factors that affect the contract signing and transaction process include: bounded rationality, opportunistic behavior and asset specificity. When there is only opportunistic behavior and asset specificity, and the actors are fully rational, then the contract process involved in the transaction is planned and design; when the actor has bounded rationality, and trading goods has asset specificity, but no opportunistic behavior, then the transaction can be guaranteed by promise; when bounded rationality and opportunistic behavior exist, and asset specificity is zero, then the transaction must be achieved through market competition; when all the three factors exist--bounded rationality, opportunistic behavior and asset specificity, then the realization of the transaction must be ensured through the establishment of institution.

Using the above theoretical framework and according to the relevant analysis of Chinese scholars, to analyze the process of enterprises' participation in vocational education, we can summarize the following contents: 1) Before the signing of the training contract, because the participants (enterprises, apprentices and vocational schools) only have bounded rationality, and there is tendency towards opportunistic behavior, asset specificity is low, so the contracting process must be a decentralized market contract, and competition is difficult to avoid, so the focus of the contract before the signing of contract is incentive, conditions shall be created for participants to benefit from training, therefore helping the realization of credible commitment among enterprises, apprentice and the school; at the same time, search and information costs, bargaining costs and decision-making costs and other factors in this process shall not be ignored. 2) after the training contract is signed, along with the training process progressing, due to the training of more specialized technical skills, the increased complexity of the training and working task, the accumulation of tacit knowledge, the asset specificity of the labor force gradually increases, the transaction cost therefore turns into the governance structure which exist both within the

enterprise internally as well as in the school-enterprise cooperation; during the process, the transaction cost also involves the cost of communication and coordination; at the same time, the competition still exists, and its intensity is influenced by the institution and other factors.

In addition, the core characteristics of the training, such as objectives, content, quality, duration, benefits and prices all have crucial impact on the success of the transaction; only when these core characteristics of the commodity in the training market are sufficiently clear and recognized by the various actors involved in the transaction, the market transaction is most likely to be reached. When these core features of training are not clear enough or not recognized by all the parties involved, market transactions will face many difficulties, on the one hand, the trading partners may lack clear and compatible expectations for training content and price, and therefore lack sufficient incentive to sign the contract in the first place; on the other hand, after signing the contract, the training process may cause very high transaction costs.

However, transactions in pure markets are not always smooth, and market failures may occur in the context of firms' involvement in vocational education. Margaret Stevens's study demonstrates the principle of market failure in pure free markets in training: because no training is effective for all firms, and there is little training that is only useful for one particular enterprise, thus, if the firm is purely a competitor, the wages of the workers will be equal to the marginal product, and if company pays the worker less than his marginal product, poaching will inevitably happen; but in the imperfectly competitive market, firms are likely to pay workers less than their marginal product and the workers still stay in the firm, because the payments are not solely determined by demand and supply relations (Stevens 1996). Kenneth Burdett and Eric Smith discuss the mechanism of market failure from the perspective of matching externalities. When a job-seeking worker is not sure whether or not they can be hired, and the recruiter's firm is uncertain about whether or not there is a job seeker, whether they can reach salary agreement will depend on how quickly the job agreement is matched between the job applicant and the vacant position, and the wage level that other potential traders want to negotiate; when many job seekers compete, firms tend to recruit those people with lower pay expectations as soon as possible, thereby reducing the return from training and resulting in less investment in training (Burdett & Smith 1996).

An important reason for market failure is the poaching issue; in this regard there have also been some specialized research. Alexandra Léné deduced theoretically, and pointed out that, even in the imperfectly competitive market, poaching will still exist, it will lead to the situation of technical personnel shortage faced by training enterprises, and in this case the government's intervention may encourage enterprises to participate in training (Léné 2002). Not only in the theoretical level of the deduction, has the reality of the situation also verified this point. Through an empirical analysis of the labor market in different regions of Switzerland, Samuel Muehlemann and Stefan C. Wolter pointed out that even in places where an apprenticeship training is well developed, poaching still present as a real threat to the enterprises; in order to make enterprises willing to participate in training, the design of training regulations and the corresponding institutional arrangements should be conducive to enterprises to obtain reasonable benefits from training; there is thus a "*policy tradeoff between the goals of a mobile and employable workforce and of firms' willingness to provide and finance training*" (Muehlemann & Wolter 2011).

Furthermore, from the perspective of institutional economics, the form of economic activity is determined by the transaction costs, while the institution on the macro-level has a significant impact on transaction costs of the skill formation system.

Therefore, in the case of market failure, to promote and foster the participation of enterprises in vocational education, other institutional arrangements and policies and measures need to be applied to reduce the negative effect of poaching; this involves the governance structure of vocational education and is related to the labor market institutional arrangements, as well as corporate governance and political and economic system in a general sense.

Based on the analysis on both theoretical and empirical level, Daron Acemoglu and Jörn-Steffen Pischke argue that "labor market imperfections have to be an ingredient of any model attempting to understand why firms pay for general training". The core of the incomplete labor market is some kind of restrictions and norms to the perfect competition of the free labor market due to the monopoly power of enterprises or collective wage negotiation.
Under such circumstances, a compressed wage structure is created within the firm. The difference in the wage level between the low-skilled worker and the highly skilled worker is smaller than the difference in their actual productivity. Employers then naturally have the incentive to train low-skilled workers, increase their labor productivity, thereby enhancing the efficiency of the entire enterprise (Acemoglu & Pischke 1999).

According to the way in which firms resolve the coordination problems, Hall and Soskice distinguish the capitalistic economies into two types of political economic systems: liberal market economies and coordinated market economies. The two market economic systems differ from each other in the labor market norms and other areas of governance models; in the field of vocational education and training, the differences between the two systems can be viewed as differences between the general skill formation system and the specific skill formation system, with the former system fostering domain-general knowledge and skills. They also point out that, compared to liberal market economy, the institutional arrangements in coordinated economies can avoid the problem of poaching in labor market more effectively, which makes the companies more motivated to provide its employees vocational education and training (Hall& Soskice 2001).Marius Busemeyer makes some criticism and complement to the theories developed by Hall and Soskice, point out that other institutional factors besides skill specificity also have considerable impact on VET, such as labor market arrangements, industrial relations and the degree of standardization and certification of vocational skills (Busemeyer 2009).

In summary, we can draw the following interim conclusions: 1) Enterprise's participation in vocational education is a market transaction with characteristics of both labor market and commodity and services market, which is influenced by several institutional factors; 2) the key to promoting the participation of enterprises in vocational education is to create conditions for vocational education to bring some form of benefits to the participating actors, including enterprise and the apprentices; 3) from the general market point of view, to promote the participation of enterprises in vocational education, the key element is the standard of vocational

training that is clear and accepted by all participating actors, including enterprises and apprentices and so on; the VET standard should clearly define the core characteristics of training, including objectives, content, quality, duration, benefits and prices etc., can therefore effectively reduce the transaction costs before and after the training contract is signed; 4) pure market mechanism however cannot effectively promote the participation of enterprises in vocational education, which is influenced by broader institutions of the social system; imperfect labor market arrangements, among other things may provide the institutional assistance.

Case of south Shandong, Basic Information

This case is actually a project participated by CDIBB a few years ago in Shandong province. But it is used here as a typical case demonstrating several major difficulties involved in school enterprise cooperation in VET.

The background is as follows: one Chinese machinery company in a county planed to expand its production capacity and therefore intended to recruit a large number of skilled workers in machine work and assembling. Thus it is interested in cooperating with a local (higher secondary) vocational school with majors in machinery. Because the CEO of the company has overseas experiences in Germany, he wants to introduce in some way vocational education and training system with certain German characteristics, namely a dual vocational training track in the machinery domain on a micro level. After contacting with local education administration, one local vocational high school also showed interests in cooperation. CDIBB Tongji is invited by the CEO of the company as scientific accompanying and consulting body with the responsibility of providing cooperation plan with its expertise in vocational pedagogy relevant to machinery.

It is impossible to describe the process of the project in detail. But for the sake of analyzing basic steps shall be given here. Simply written, the project contains approximately the following 3 stages.

At the first stage, for approximately over 6 months, both the company and vocational schools have established certain internal teams for the cooperation and they discuss with each other on a regular basis to discuss and negotiate the objective, measures and implementation of the project. CDIBB also sent a team with experts from both vocational pedagogy and machinery to offer assistance. The communication was relatively good and the motivation was high.

At the second stage, for a period of about one year, various difficulties arise, especially from curriculum reconstructing, development of coherent training plan taking consideration of both vocational school and company circumstances, as well as the design of a concrete implementation plan. Communication among the actors was not as good as it was at the beginning and the teams deeply involved in the cooperation tasks are less motivated as in the beginning. CDIBB also found it difficult to provide feasible plan which is compatible with the wishes and realities of both the company and the school.

At the third stage, for another few months, the project basically went into a kind of stagnation; with all the parties involved found it not very possible to actually build a real dual vocational training system in the status quo. CDIBB gradually exited from the consulting position.

In summary, several major problems can be observed during the project: there were constantly long and repeated rounds of discussion & negotiations among the three parties but the achievements were low; there's clear reliance of both company and school on CDIBB to solve all the problems; cooperation stagnated in the end with very limited achievements concerning its

original goals. It has to be mentioned that the company and the school did somehow train the students together, but in a more traditional way, namely the internship for students at their last year of 3-year program in the school.

Based on the processes and problems described above, it can be analyzed, that the following influencing factors are the major reasons of the stagnation/failure of the project.

- The participating parties are lack of cooperation experiences in the past, especially the company, which expects the process of curriculum development and reform to be a fast process, neglecting the complexity behind it.
- Another major problem with the company's side is that, despite the supports from the top management, there's an obvious lack of awareness of the difficulties of the project from the managers in middle level; the company side is to a certain degree even unwilling for full cooperation, which can be seen in the fact that they sometimes are not willing to share necessary basic documents (partly can also be understood due to business worries);
- One of the major difficulties of the project is that of developing curriculum plan which meets the needs of both the company and the vocational school (including the competence standards, teaching plan, practical training arrangements etc.);
- There's a lack of mechanism and structure of cooperation from the beginning, which led to enormous communication problems and misunderstanding during the project;
- Unrealistic expectations from the company and vocational schools' sides for CDIBB to solve all the problems while it does not have the capacity to develop training plan solely with its own resources.

In summary, the lack of commonly accepted VET standard in the first place made it necessary for local actors to develop training plan and curriculum standard on their own, which is extremely difficult if it needs to meet the needs of both sides. Although the incentives were high in the beginning, the high transaction costs generated during the cooperation process presented major challenges for the involved parties. This is actually very common in lots of school-enterprise cooperation in China.

Success Case of Taicang

Despite the difficulties encountered by many companies and vocational schools in their cooperation, some cities have found a systematic solution to the problem at least to a certain degree. Among these cities, Taicang in Jiangsu province is a very good example which deserves investigating.

Many companies, especially foreign companies in Taicang are willing to invest in vocational education in the form of apprenticeship cooperation with local vocational schools. The partnership in skilled worker training among companies, vocational schools and colleges as well as local government has been stable and fruitful for more than two decades and the cooperation projects are still keeping growing in terms of both companies involved and apprentices trained. Official training contracts have been signed among the participating parties, namely apprentices/students in vocational school, vocational school and the training company. But the questions naturally arise from this success, particularly when much other cooperation encounters considerable difficulties: why are the firms in Taicang willing to get involved in apprenticeship training? Do they meet the difficulties that are very common among other cooperation? What are the determining factors behind this?

With the theoretical framework set up above, this stable and institutional public private partnership in VET has succeeded due to the following factors.

- There are many foreign, especially German firms in Taicang, many of them specializing in machinery and car industry;
- Some kind of "friendship agreement" among some of the European companies are signed to avoid poaching problem;
- Training companies and apprentices sign contract before training, some of which include certain period of service after training, which further guarantee the interests of the companies;
- Some of the training program is established and implemented according to the German VET standard, namely the training regulation (Ausbildungsordnung) developed by BIBB and its social partners in Germany; after the successful completion of training, German certificate is issued to the student by the German Chambers of Commence Shanghai(AHK Shanghai);
- Government has provided financial as well as policy supports to the VET programs through building good training facilities and allowing reform initiatives etc.

In summary, the existence of large number of German companies provides a unique human resource requirement as well as "atmosphere" of training in the city of Taicang. Their agreement of avoiding poaching further enhanced the training incentives by creating a kind of imperfect labor market mechanism on a local level. The German training regulation plays a central role in reducing the transaction costs during the school-enterprise cooperation since it is accepted by the company side and allowed by the local government. Some major typical difficulties arising from this type of cooperation are thus removed or minimized with these special circumstances measures.

Conclusion

Based on the analysis on both theoretical and case level, some conclusions can be drawn as to firms' involvement in VET in the Chinese context.

Major economic and institutional obstacles for firms' deep involvement in VET include: 1)Free market competitions of skilled workers among the companies; 2) Lack of commonly accepted curriculum and competence standards by all participating parties; 3)Government guided, administratively organized school-enterprise cooperation. In the Chinese context, two factors particularly lead to the high transactions costs in firms' involvement in VET, namely the risk of poaching and the lack of training standards recognized by participating actors (caused by absence of interest representation of industry as well as the workers).

Certain institutional arrangements can be helpful in solving the problems.

In order to avoid the poaching risks, imperfect labor market institutions and arrangements, such as collective wage bargaining, labor market frictions etc., shall be established, which constrain the labor mobility to a certain degree, guarantee the benefits of the involved enterprises while protecting the rights of trainees. But in the Chinese context, because the government guided, administratively organized school-enterprise cooperation is still very common, market mechanism shall be set up as the fundamental mechanism of resource allocation in enterprise's involvement in VET.

Meanwhile, in order to reduce the transaction costs and improve governance structure, standardization and certification of VET program, which contains both company and school

standard, is necessary, so that all the participating parties have coordinated and transparent objectives. Furthermore, the interest representation mechanism is indispensible pre-condition for the development of VET standards recognized by all stakeholders and the creation of imperfect labor market mechanism.

Other factors that affect the school-enterprise cooperation on the micro level include the following aspects:

- Careful selection of cooperating companies from the school side is important, it should be made based on financial conditions, long-term perspectives, HR requirements and structure of the company;
- Tradition of schools matters. The schools that can carry out real apprenticeship cooperation with companies are very often those with longer and richer experiences in school-enterprise cooperation;
- Financial supports or incentives can be indispensible, which provides assistance in: subsides of training costs, supporting training of the trainers, more regular teacher-trainer exchange between firm and schools.

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