The competency of vocational graduates in the fields of mechanics and workshop management according to the needs of the automotive motorcycle industry

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Abstract. This study aims to determine the mechanics competence and workshop management needs of the competencies in the vocational education engineering curriculum and the motorcycle business according to the automotive motorcycle industry. Research subjects were eight motorcycle automotive companies in the field of production and services. The data of the study were collected by using a questionnaire survey and analyzed by quantitative descriptive statistics with percentages. The results of the study showed that the needed competencies according to the Automotive Motorcycle Industry were mechanics competence and workshop management competence. The vocational education curriculum produced 39 mechanics competencies and 18 workshop management competencies. There were 37 basic competencies in mechanics competence in the very needed category and 2 basic competencies in the sufficiently needed category. Workshop management competencies found 18 basic competencies that were all needed by the industry. Competency from the mechanics field and workshop management had competencies in the very needed category relatively. In total there were 15 competencies that not exist yet in the curriculum which taught in vocational education.

1. Introduction

The role of the automotive industry sector is one of the sectors that become Indonesia's investment, in 2018 the automotive industry sector had added value of 226.18 trillion and became the third largest among other industries in Indonesia [1]. The most popular automotive industry in Indonesia are the car and motorcycle industry, which consists of planning, development, production, as well as maintenance field. A total of 3.3 million workers were absorbed in the early years of 2018 with the most massive absorption in automotive industries mostly in marketing, selling, and sales services (Ministry of Industry, 2018). ASEAN's public economic policy (AEC) has affected on fierce competition for not only the goods and services market, but the opportunity to find a job. If Indonesia is not ready with this condition, it will only become a product user and will lose its place for local workers who will be replaced by more competitive foreign workers. In preparing and increasing labor competency competition, human resources become the "main force" for
Indonesia to produce superior and innovative human resources to get into the job market. The automotive industry has a high investment and employment.

Vocational education is one sector that prepares resources (HR) in Indonesia to be able to face labor competition to enter the workplace. Getting into workplace is one of the final objectives of vocational high school (SMK) graduates to achieve after graduating, whether in industry, entrepreneurship, business, or institutions and professions in government. Educational programs must be able to provide students with the competence of attitudes, knowledge, and skills in the learning process that they go through [2]. The era of globalization and the enactment of ASEAN public economic policies (AEC) caused vocational education in Indonesia to have two major impacts, i.e. opportunities and challenges. The readiness of a country will change problems become a challenge, meanwhile unpreparedness causes opportunities to become a problem. Vocational education in Indonesia currently has a work readiness level of vocational education graduates in the automotive industry sector of 81.91% or categorized as very high [3]. In fact, the open unemployment rate for secondary vocational education in 2020 increased by 8.49% from a total of 7.7 million unemployed people in Indonesia (BPS, 2020). In other words, there is a supply of labor that is not absorbed especially at the level of vocational education.

Vocational education is one type of education that is able to prepare students to graduate and work in certain fields [4]. It is intended that graduates can have knowledge, skills, and competencies. The curriculum used in vocational high school was developed by a government agency, the National Education Standardization Agency (BSNP). The 2013 curriculum structure is contained in the core competencies (KI) and basic competencies (KD). There was a change in the spectrum of vocational education in the Automotive Engineering field, i.e. Motorcycle Engineering Vocational School became the Technical Vocational and Business Motorcycle at the end of 2017 [5]. This was intended to vocational graduates not only become mechanics but also become workers in the business and management of motorcycle repair shops. However, the implementation of the 2013 Curriculum is quite good yet less than optimal and have many obstacles in the implementation, supporting the curriculum of learning models and others [6].

The curriculum becomes meaningless in the livelihood of the community if it is irrelevant. So, in the development of the existing curriculum must be based on the characteristics of vocational education to develop skills to prepare graduates to work [7]. An ideal vocational education curriculum must provide capabilities which suitable for the future that pose challenges to vocational education, so it must be developed with the integration of academic, career, and technical education based on industry needs [8]. Based on this explanation, it strongly needs research on the curriculum in vocational (engineering) high school and motorcycle business on the needs of competence in the automotive motorcycle industry.

2. Method

The subject of this research was the Automotive Motorcycle Industry companies (ATPM) which incorporated in the Indonesian motor vehicle industry association, GAIKINDO in Yogyakarta by using cluster sampling techniques, i.e. Eight industrial companies representing each automotive motorcycle industry in Yogyakarta. The company referred to the qualification of production and/or service was a company that engaged in the production of motorbikes or companies which engaged in motorcycle service or both.

Table 1. Name of automotive motorcycle industry (ATPM)

| No. | Company Name                  | Field   |
|-----|-------------------------------|---------|
| 1.  | PT. Astra Motor Honda         | Service |
| 2.  | PT. Yamaha Deta Yogyakarta    | Service |
| 3.  | PT. Suzuki Indojaya Ambarukmo | Service |
The instrument of this study was based on the applicable vocational high school curriculum and validated with the Indonesian National Work Competency Standards (SKKNI) established by the Competency Standards Committee at the Ministries and Institutions in charge of the Automotive Motorcycle Industry. The data of the study were collected from the questionnaire survey with a Likert measurement scale of four alternative answer choices, i.e. very needed (4), needed (3), sufficiently needed (2), and less needed (1). The research instrument used content validity to determine the validity of instruments to be generalized widely. The content validity of the instrument was carried out by expert judgment in the automotive field.

The data analysis of the study was done by the quantitative descriptive statistics with percentages to describe the variables studied. The first step was to add the scores for each respondent, then did the percentage of competencies needed by dividing the number of respondents in the acquisition of scores with the total respondents. The final step was to look for the average competency requirements in the Automotive Motorcycle Industry from vocational high school graduates.

3. Result and Discussion

The description of the results of this study was about analyzing the needs of competencies in the Automotive Motorcycle Industry from vocational high school graduates including competency needs that had not been provided in the vocational high school curriculum as presented below.

3.1 Mechanics Competence in the Automotive Motorcycle Industry

Based on the results of the analysis conducted using percentages, the results are obtained as follows:

| Competence                       | Basic Competence                      | Percentage | Category     |
|----------------------------------|---------------------------------------|------------|--------------|
| General                          | Reading and Doing Technical Drawing   | 71.87      | Needed       |
|                                  | Understanding Engine Basics           | 95.83      | Very Needed  |
|                                  | Understanding Occupational Safety and Health | 100      | Very Needed  |
|                                  | Understanding Desoldering and Basic Formation | 62.5    | Needed       |
|                                  | Using OMM (Operation Maintenancece Manual) | 81.25    | Very Needed  |
|                                  | Understanding Pneumatic and Hydraulic Systems | 78.13    | Very Needed  |
|                                  | Understanding Simple Electricity      | 100        | Very Needed  |
|                                  | Understanding and Using Handtools     | 96.88      | Very Needed  |
|                                  | Using a Measuring Instrument          | 97.5       | Very Needed  |
|                                  | Using Grease, seal, fasten etc.       | 100        | Very Needed  |
|                                  | Caring for the Battery                | 100        | Very Needed  |
| Engine                           | Repair cylinder heads and their accessories | 100      | Very Needed  |
|                                  | Repair the lubrication system         | 100        | Very Needed  |
|                                  | Repair the cooling system             | 100        | Very Needed  |
|                                  | Repair the intake and disposal system | 100        | Very Needed  |
|                                  | Repair cylinder blocks and their accessories | 100      | Very Needed  |
| Competence | Basic Competence                          | Percentage | Category    |
|------------|------------------------------------------|------------|-------------|
|            | Repair fuel injection system             | 100        | Very Needed |
|            | Repair the carburetor system             | 100        | Very Needed |
|            | Repair the manual transmission system    | 100        | Very Needed |
|            | Repair the automatic transmission system | 93.75      | Very Needed |
|            | Repair the manual clutch system          | 100        | Very Needed |
|            | Repair the automatic clutch system       | 87.5       | Very Needed |

| Chasis     | Repair the hydraulic brake system        | 100        | Very Needed |
|            | Repair the mechanics brake system        | 100        | Very Needed |
|            | Repair the ABS brake system              | 100        | Very Needed |
|            | Repair the tyre                          | 87.5       | Very Needed |
|            | Repair suspension                        | 93.75      | Very Needed |
|            | Repair the steering system               | 100        | Very Needed |
|            | Repair the rear-wheel-drive chain        | 100        | Very Needed |
|            | Repair the types of frame                | 84.38      | Very Needed |

| Electrical | Repair the lighting system               | 96.88      | Very Needed |
|            | Repair instrument and signal systems     | 100        | Very Needed |
|            | Repair the starter system                | 100        | Very Needed |
|            | Repair conventional ignition systems      | 100        | Very Needed |
|            | Repair electronic ignition systems        | 100        | Very Needed |
|            | Repair the charging system               | 100        | Very Needed |
|            | Repair security system repairs           | 100        | Very Needed |
|            | Repair the injection system and reset the fault code | 100 | Very Needed |

Mechanic competence provided four main skills, i.e. general, engine, chassis, and electrical. The vocational education curriculum provided workshop management competencies consisting of 18 competencies. Each skill has essential skills to determine the skills which must be mastered by students to become a mechanic after graduation. General competence is the basis of engineering scientific area, engine competence is a competence which relates to existing machines on motorcycles, chassis field relates to the frame, steering system to brakes on motorcycles, and the electrical field relates to electricity in the motorcycle. The results showed that 37 basic competencies in the very needed category and 2 basic competencies categorized as sufficiently needed, i.e competence of reading and understanding technical drawings, as well as understanding desoldering and basic formation. The two essential skills had less work intensity, because the service sector tended to do more repairs and replacements, while in the field of production was needed in the field of design and assembly.

Almost all competencies are needed in the present, but in the future, it is likely that motorcycle vehicles will change to full electric power. Data on sales of electric vehicles in 2018 amounted to 5.2 million units from a total of 60 million motorcycle sales units worldwide and increased by 63% from 2017 [9]. Indonesia has made regulation on the Acceleration of the Battery-Based Electric Motor Vehicle Program in the Republic of Indonesia's Presidential Regulation Number 55 the Year 2019 to support environmentally friendly technology. The development of a vocational curriculum for automotive engineering in the future must consist of environmentally friendly budgeting management programs for 20% of schools, supporting infrastructure and technology, student participation in the creation of environmentally friendly technologies, and integrated into curriculum components [10]. Because the principle of vocational education is for education in the future, so that if it does not change, it will be left behind.
### 3.2 Management Competence in the Automotive Motorcycle Industry

The results of workshop management competency found 18 essential competencies in workshop management competencies were needed by the industry. Competency to be an employee in the workshop management sector of the vocational high school curriculum and motorcycle business is strongly needed by the motorbike automotive industry with high work intensity relatively. The new competency in the motorcycle engineering and business curriculum as a whole has met the demands of the automotive motorcycle industry in the field of production and/or services in Yogyakarta. So, vocational high school graduates are required to be able to master the whole, and teachers must be able to provide suitable material because this competency is a new competency so that the source of teaching materials is still limited. The field of workshop management must be taught as in the workplace by using a teaching factory or an apprenticeship system, especially in the management section, not the mechanics section. So vocational education will be effective by given real work and in accordance with their fields (Prosser & Quigley, 1950).

**Table 3. Workshop management competence**

| Competence | Basic Competencies | Percentage | Category         |
|------------|-------------------|------------|-----------------|
| Workshop Management | Creating an automotive workshop organizational structure | 93.75      | Very Needed     |
|            | Register the successful factors of the workshop | 93.75      | Very Needed     |
|            | Implementing labor invitations | 93.75      | Very Needed     |
|            | Determine the administration of the workshop | 100        | Very Needed     |
|            | Make work plans | 93.75      | Very Needed     |
|            | Carry out complaint handling | 100        | Very Needed     |
|            | Carry out workflows in the workshop | 100        | Very Needed     |
|            | Evaluating work performance reports | 87.5       | Very Needed     |
|            | Carry out the training and development of workshop human resources | 87.5       | Very Needed     |
| Workshop Safety management | Overcoming various occupational accidents | 100        | Very Needed     |
|            | Handling emergencies | 100        | Very Needed     |
|            | Performing handling automotive maintenance workshop waste | 100        | Very Needed     |
| Management of Mechanics Performance | Apply the principles of professional technicians | 100        | Very Needed     |
|            | Carry out a teamwork | 100        | Very Needed     |
|            | Using work quality control methods | 93.75      | Very Needed     |
| Service Advisor | Carry out periodic maintenance of equipment | 100        | Very Needed     |
|            | Explain the types of workshop services | 100        | Very Needed     |
|            | Analyze the initial damage to the vehicle system | 100        | Very Needed     |

### 3.3 Whole Competence in the Automotive Motorcycle Industry

The results of the study showed that there were eight competencies consisting of four competencies each in the field of mechanics and in the field of workshop management by concluding that all competencies in the category of very needed. In general, the goal of transforming motorcycle engineering competence into motorcycle engineering and business is to accommodate the career paths of vocational high school graduates working in the field of motorcycle production and service. It was caused by there was no field in vocational high school which can understand the management of automotive repair shops. So that graduates of vocational engineering and motorcycle business will not only become mechanics, but can be recruited to become a workshop manager because they have obtained material that meets the competency requirements.
to become experts in motorcycle workshop management in the automotive motorcycle industry in the field of production and/or service services in Yogyakarta.

Table 4. Whole competence

| No | Function                     | Competence            | Percentage | Category       |
|----|------------------------------|-----------------------|------------|----------------|
| 1  | Mechanics                    | General               | 89.45      | Very Needed    |
| 2  | Engine                       | Engine                | 98.30      | Very Needed    |
| 3  | Chasis                       | Chasis                | 94.79      | Very Needed    |
| 4  | Electrical                   | Electrical            | 99.61      | Very Needed    |
| 5  | Workshop Management          | Workshop Management   | 94.44      | Very Needed    |
| 6  | Workshop Safety Management   | Workshop Safety       | 100.00     | Very Needed    |
| 7  | Management of Mechanics      | Management of Mechanics Performance | 97.92     | Very Needed    |
| 8  | Service Advisor              | Service Advisor       | 100.00     | Very Needed    |
|    | Average                      |                       | 96.81      | Very Needed    |

The vocational education curriculum consists of curriculum concepts, curriculum support, mastery of learning materials, as well as learning models, implementation, and assessments which are the development of student competencies to be able to work. The second Prosser Principle of effective vocational education if given the same way, tools, machines, and learning as real work at the workplace (Prosser & Quigley, 1950). Improvements in the implementation of learning must be carried out, so that the curriculum is implemented in accordance with these principles. The development of the industry is very fast, this is a limitation in producing competent graduates who provide vocational education. The development of competencies that are appropriate to the industry is the competence of integrating the workplace, the content provided, and the technology needed to develop competencies [11].

3.4 Competencies needed but not provided in the curriculum

Some of the previous studies which concerned on the current Vocational High School curriculum are still unable to meet all the work skills needed by the workplace and industry [12]. Totally, there were 15 competencies that not exist yet in the vocational high school engineering and motorcycle business curriculum. But the development of the vocational education curriculum requires competencies that exist in the industrial to be taught in schools. some schools that have collaborated and developed with industry have higher compatibility with industry, and have access to get a job directly [13]. It is expected that in the future curriculum development can add advice and input from the motorcycle automotive industry, so that there will be a match between the graduate providers, i.e. vocational education and graduate users as well as the motorcycle automotive industry. This will adjust the needs of the workplace, so that there is communication between schools and industry about the needs of the workforce as an important thing to establish relationships and compatibility between education and the workplace.

Table 5. Competencies needed but not provided according to the industry:

| No | Competence | Basic Competence                                                                 |
|----|------------|-----------------------------------------------------------------------------------|
| 1  | Chassis    | Repair Propeller, Axle Shaft, Differential                                        |
| 2  | Chassis    | Replace the combi/unified brake system (CBS/UBS)                                  |
| 3  | Electrical | Understanding and Using Diagnosis Tools, Scanners, etc;                          |
| 4  | Electrical | Repairing the idling/start and stop system (ISS/SSS)                              |
| No. | Role                        | Task                                                                 |
|-----|-----------------------------|----------------------------------------------------------------------|
| 5   | Engine                      | Carry out maintenance of a Continuously Variable Transmission (CVT) system |
| 6   | Engine                      | Understanding and maintaining a two-stroke valve system (KIPS)       |
| 7   | General                     | Understanding of the types of lubricants, grease, etc.               |
| 8   | General                     | Understand Electricity Wiring Diagrams                               |
| 9   | Workshop Management         | Carry out cleaning workshops and workplaces;                           |
| 10  | Management of Mechanic      | Understanding briefing and prayer activities when going to work       |
| 11  | Management of Mechanic      | Implementing and understanding new product training and product mastery |
| 12  | Service Advisor             | Inspection after treatment                                           |
| 13  | Service Advisor             | Determine the type of motorcycle service work                         |
| 14  | Service Advisor             | Provide technical consultation                                       |
| 15  | Service Advisor             | Offering service products, parts, and accessories                     |

4. Conclusion

The needed competencies according to the Automotive Motorcycle Industry are the competence of mechanics and workshop management. Mechanics competence is classified into four main skill, i.e. General, Engine, Chassis, and Electrical. The vocational education curriculum provides mechanics competence consisting of 39 skills, the results of the study found that there are 37 essential competencies in the very needed category and two essential competencies categorized as sufficiently needed. In the workshop management competency group consists of four main skills, i.e. Workshop Management, Workshop Safety Management, Mechanics Performance Management, and Service Advisor. The vocational education curriculum provides workshop management competencies consisting of 18 competencies, the results obtained all of 18 essential competencies highly needed by the industry. There are eight skills from the mechanics and workshop management fields which have the competencies in the highly needed category. Totally, there are 15 competencies that do not yet exist in the curriculum taught in vocational education.

Based on the results of the study and discussion above, it can be concluded that the competence of mechanic, business and workshop manager in the department of motorcycle business of vocational high school are urgently needed according to the needed competency of the Automotive Motorcycle Industry in Yogyakarta. Even though it is already in the curriculum, proper teaching methods must be provided so that the competencies provided are in accordance with what is intended by the industry intention. But there are still many competencies that have not been provided in the vocational high school curriculum. The success of students in schools will be able to deliver graduates to the desired workplace and can improve their lives.

The findings of this study are competency recommendations that can be included in the curriculum development of the department of motorcycle business of vocational high school, and it is expected that schools can provide content and teaching materials according to industry needs. Cooperating with industries such as target schools will be able to minimize the distance between schools and industries, but must be compensated as a commercialization of education by selling one of the brands in vocational education. The industry will benefit more easily in employee recruitment systems and can reduce the company's budgetary costs for training new employees.
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