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Obstacles of Implementing a Teaching Factory: An Analysis in Vocational Secondary School

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Teaching factory is a learning model at the vocational secondary school level based on the production of goods or services, which is guided by industry standards and procedures. The teaching factory concept is conducted by implementing a combined curriculum prepared by vocational secondary schools and industrial parties so that it is implemented in an atmosphere of factory work. The purpose of this study is to analyse the obstacles that cause teaching factories to not work ideally. This research uses a quantitative descriptive approach, with the type of survey research that is carried out in 32 vocational secondary schools in Malang. The 32 schools are classified into 3 classes, those that have been implemented, not yet implemented and are in the planning stage of teaching factory implementation. Barriers to implementation are reviewed in terms of learning, human resources, facilities, and collaboration networks. The data collection method is done through questionnaires. The results showed that the teaching factory vocational secondary schools had the biggest obstacles in the learning aspect, while the vocational secondary schools that had not implemented the teaching factory had obstacles in human resources.

Keywords: *teaching factory, vocational secondary school, obstacles, industry*

1. Introduction

The development of vocational secondary schools is mostly carried out by the government today in an effort to optimise the learning process by implementing a teaching factory as described in the 2014 Presidential Decree on Tasks, Functions and Organizations of the Ministry of Education and Culture which reads: Vocational secondary schools build teaching factories and techno-parks with the latest technology. The government implements teaching factories as an effort to achieve the vision of producing entrepreneurial graduates who are ready to work, capable, competitive, and have a national identity, and are able to develop local excellence as well as compete in the global market (Martawijaya, 2012). Teaching factory is one of the learning concepts that integrates the three important points of research, innovation, and education (Mavrikios, Papakostas, Mourtzis, & Chryssolouris, 2013) which are effective to improve graduate competencies.

Students, teachers, and school management are the three fundamental components that determine the successful implementation of the teaching factory (Kasman, 2017). These three basic elements are based on the Teaching Factory Implementation Guidelines by the Directorate of Vocational Development and more supported by other aspects and sub-aspects to support the ideal conditions of teaching factory implementation.

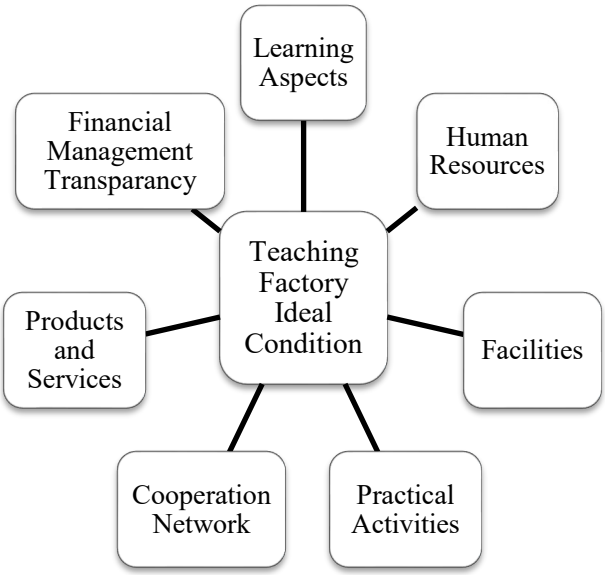

Figure 1. Ideal Condition Aspects of Teaching Factory

The teaching factory implementation requires careful preparation since this broad concept bridges the gap between the industrial process of production activities and industrial research (Mavrikios et al., 2013). Teaching factory activities will be held successfully when adjusted to the knowledge triangle notion existing as a paradigm (Chryssolouris, Mavrikios, & Rentzos, 2016) in the business and industrial world. The vocational school teaching factory in Malang is done by collaborating with industry to become partners, where industries that are used as partners are different from each school. Besides, several schools open their businesses to facilitate the implementation of production and marketing from the results of teaching factory activities.

2. Methodology

This research uses a quantitative descriptive approach. This research was using 30 vocational secondary schools from 56 total vocational secondary schools in Malang (Direktorat Jenderal Pendidikan Dasar dan Menengah, 2018), consisting of 13 public schools and 17 private schools. The schools are considered by the number of students of each school, consisting of more than 150 students. Data collection techniques were done using a questionnaire instrument plus interviews and literature studies. The collection of data from the questionnaire, grouped according to the form of the instrument used, is presented in tabular form, analysed and interpreted subsequently. The analysis technique in this study uses a quantitative descriptive design (Gall, Gall, & Borg, 2006).

3. Results

Teaching factory has not been implemented evenly by all vocational secondary schools in Malang City. From 30 public and private vocational secondary schools in Malang, 10 schools have implemented teaching factory but it has not been optimal, 18 schools have not implemented teaching factory, and 2 schools are in the planning stage of teaching factory procurement.

Table 1. Teaching Factory Implementer School in Malang

Status	Schools' number	Percentage
Implementer	10	31.25%
Non-implementer	18	56.25%
Planning	2	6.25%

Surveys have been conducted and interviews with school stakeholders have been undertaken to investigate the obstacles in implementing teaching factories. Obstacles in the implementation of teaching factory in terms of four important aspects that support the ideal conditions of the teaching factory.

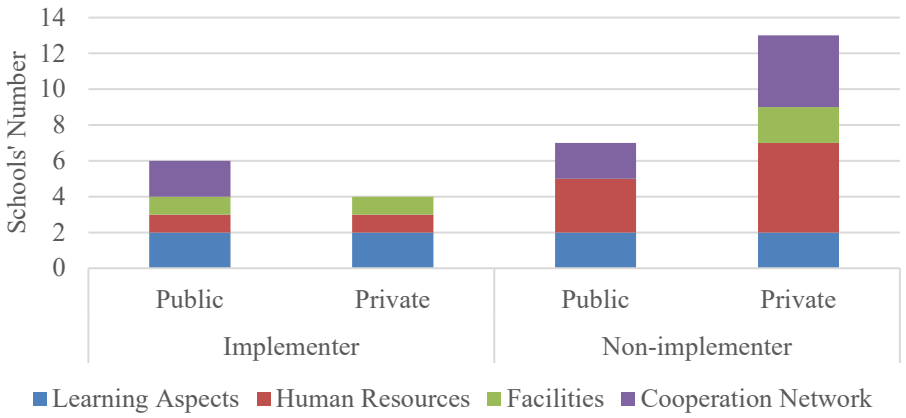

Figure 2. The number of obstacles faced by teaching factory execution in Malang City public and private vocational secondary schools.

There are differences in the level of aspects of obstacles between implementer schools and non-implementer schools in executing the teaching factory.

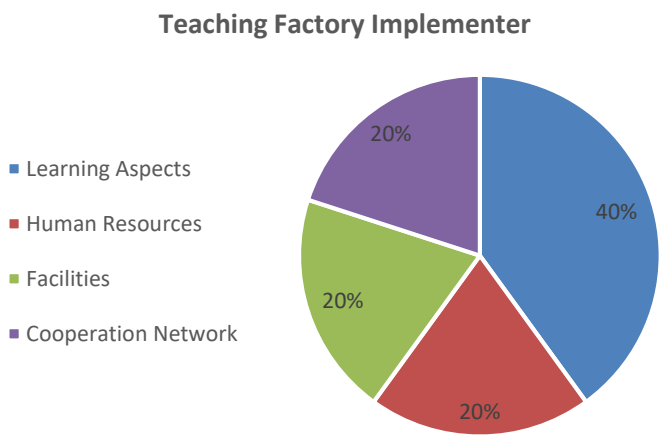

Figure 3. Percentage of obstacles in the teaching factory execution faced by implementer schools.

A. Learning Aspects

In the aspect of learning, as many as 4 vocational secondary schools (SMKN 2 Malang, SMKN 4 Malang, PGRI SMK 3 Malang, and SMK Telkom Sandhy Putra) experienced obstacles such as lack of enthusiasm and low interest so as to make the implementation of teaching factories and as such, learning activities were less conducive.

B. Human Resources

Not all vocational secondary schools that have implemented the teaching factory have adequate and sufficient human resources. Like SMKN 5 Malang and SMK Kartika IV 1 Malang who experience a shortage of human resources that must be included in a special team that directly handles the implementation of teaching factory.

C. Facilities

In the implementation of teaching factory, facilities are one of the keys in supporting the success of teaching factory, but not all schools that have teaching factory can provide full support in the form of equipment, materials, and environmental support. Some schools must receive assistance from industry to help meet the facilities that must be prepared, including SMKN 6 Malang and SMKS Kesehatan Adi Husada.

D. Cooperation Network

In the implementation of the teaching factory, it takes an industry that is able to become the best partner in establishing relationships for the successful implementation of the teaching factory. All schools have collaborated with industry, but there are some that are still lacking in references in finding industries, such as SMKN 3 Malang and SMKN 12 Malang, which have stalled orders because demand from the industry is uncertain, so vocational secondary schools need to find an industry that will be used as partners for cooperation so that teaching factory activities are not stopped.

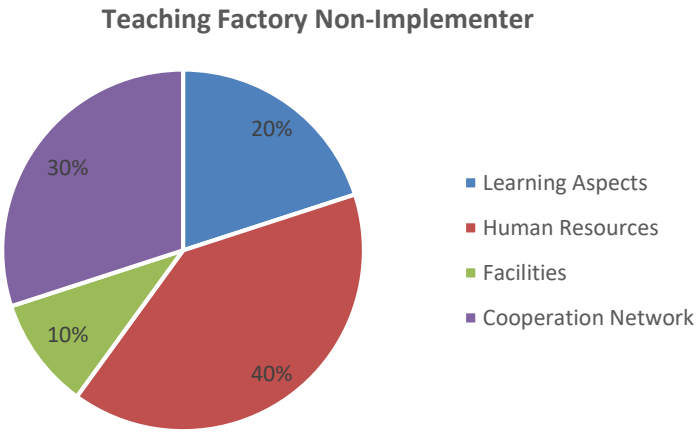

Figure 4. Percentage of obstacles in the teaching factory execution faced by non-implementer schools

A. Learning Aspects

The teaching aspect of teaching factory demands the alignment of the industry with vocational secondary schools. Every element in the vocational secondary schools must support one another in the teaching factory implementation. In classroom-based teaching-learning in teaching factory, it is necessary to have conducive conditions to run effectively. The obstacle of not implementing the teaching factory of vocational secondary schools in Malang in terms of learning is felt by 4 schools namely SMKN 1 Malang, SMKN 7 Malang, SMK Nasional, and SMK Pekerjaan Umum Malang which are still preparing students to follow the learning to run well.

B. Human Resources

In the teaching factory implementation, it takes more educators who are devoted to the teaching factory implementing team. Human resources are one of the main reasons 14 schools have not implemented teaching factories yet, including in SMKN 8 Malang, SMKN 10 Malang, SMK Ardjuna 2, SMK PGRI 2 Malang, SMK PGRI 6 Malang, SMK Prajnaparamita, and SMK Putra Indonesia.

C. Facilities

In addition to human resources, facilities are also an aspect needed to support the successful implementation of the teaching factory. In implementing a teaching factory, facilities and infrastructure are needed as well as the environment following the conditions in the industry. Vocational secondary schools that have the technology and engineering majors certainly need more equipment so that regular classes and teaching factory classes can run together. SMK Cor Jesu is the school that has not yet implemented a teaching factory because it is still in the stage of fulfilling facilities that support learning.

D. Cooperation Network

Building a network with industry is one of the keys to the success of the teaching factory. Industry and vocational secondary schools are two inseparable elements in the implementation of teaching factory. Among them there are 2 schools, namely SMKN 11 Malang and SMKN 9 Malang, are schools that are looking for industries for cooperation in implementing teaching factories. The lack of cooperation with loyal industries in supporting human resources as well as facilities and infrastructure also causes 7 other schools namely SMK Bhakti Luhur, SMK Muhammadiyah 2 Malang, SMK PGRI 7 Singhasari, and SMK National Media Center not implemented teaching factory yet because they are still looking for industries that are linear in nature and support the implementation of teaching factories in accordance with the majors in vocational secondary schools.

4. Discussion

Teaching Factory is a concept where industry practitioners "teach" Vocational School students about practices and problems in industry that aim to gain experience and skills that are adapted to industry requirements, leading to their gradual integration in industry. This concept also involves the flow of information from the classroom to the factory, where students and teachers "teach" industry practitioners about the progress and results of research and development made in school laboratories (Abele, Metternich, & Tisch, 2019). The implementation of teaching factory itself increases their time spent at work, and improves their soft and hard skills, motivation, sense of responsibility and work ethics (Martawijaya, 2012).

4.1 Effectuation of teaching factory in vocational secondary school

Teaching factory is one of several programs in vocational secondary schools that can help create a school that is link-and-match with industry. The implementation of the vocational secondary school teaching factory program in Malang is a motivation that can become a reference for other vocational secondary schools in and outside Malang. Generally, vocational secondary schools in Malang have been implementing teaching factories since 2017 and 2018, so the implementation of teaching factories has not been optimal because there must be synchronisation to align the conditions of vocational secondary schools with the actual industry. The alignment process certainly takes quite a long time because it must be carried out renovations and improvement of school human resource standards that must meet industry qualifications.

From the research findings, it can be formulated that the teaching factory of vocational secondary schools in Malang has been implemented, but it has not been optimal. Teaching factory is one of the efforts made by the government to realise a link and match between industry and vocational secondary schools (Kasman, 2017). If the teaching factory can be optimally implemented, the link and match between vocational secondary schools and industry will be realised. Teaching factory is a program that is conducted to provide a two-way knowledge transfer in engineering education so that a win-win collaboration is achieved and both vocational schools and industries parties are mutually benefit reciprocally (D Mourtzis, Boli, Dimitrakopoulos, Zygomalas, & Koutoupes, 2018).

4.1.1 Teaching Factory Planning

The teaching factory that is carried out in Malang vocational secondary school can improve the quality of students to be more productive and able to adjust to the industry. The initial step that must be taken by vocational secondary schools in preparing for the implementation of a teaching factory is to find an industry that is capable of being a partner. The intended industry must have a profile that is in line with the needs of the vocational secondary school concerned so that it can provide what is needed by the vocational secondary school. The intended industry can meet the needs of vocational secondary schools in realising teaching factories both in fulfilling HR qualifications and supporting facilities.

In the process of finding an industry that is used as a partnership, some several criteria or considerations must be owned by the industry. When the teaching factory facilities can be filled with industry, vocational secondary schools will be more optimal in the implementation of teaching factories, the industry will also get results per the intended order. Support from industry and good vocational secondary schools in the implementation of teaching factories can facilitate the running of teaching factories.

After finding an industry that will be a working partner, the next step is to contact the industry for further discussion regarding the teaching factory employment contract. The employment contract aims to convey what is needed by the vocational secondary school and what the industry can fulfill. After finding harmony, vocational secondary schools with industry signed a Memorandum of Understanding (MoU) which would be physical evidence of the agreement made by both parties. While conducting a work contract, the vocational secondary school curriculum is adjusted to the industry, so that the objectives of the teaching factory can be achieved.

Based on the statement above and also the research findings, it can be concluded that the preparation of teaching factory in vocational secondary schools requires communication and relationship between vocational secondary schools and benefits industries that can be used as industrial cooperation partners. After that, it is necessary to harmonise the curriculum, facilities, and infrastructure, as well as the environmental conditions between vocational

secondary schools and industry. The research conducted in Cal Poly (Alptekin, Pouraghabagher, McQuaid, & Waldorf, 2001) showed that in the establishment of the teaching factory providing an integrative framework to link courses throughout the well-analysed curriculum and provide the realism of modern industrial concepts to better prepare students for challenges in the industry today. Therefore, teaching factories that have or have not been implemented must pay attention to the curriculum that must be adapted to the industry processes.

4.1.1 Teaching Factory Execution

Teaching Factory allows two-way communication of knowledge by bringing real factory situations to classrooms and academic laboratories to factories (Rentzos, Doukas, Mavrikios, Mourtzis, & Chryssolouris, 2014; Rentzos, Mavrikios, & Chryssolouris, 2015). In the implementation of teaching factories, vocational secondary schools bring industry as instructors. Some vocational secondary schools do not determine the students participating in the vocational secondary school teaching factory in Malang, with the aim that all students can enjoy the learning process that is truly adapted to the conditions in the industry.

The technical implementation of the vocational secondary school teaching factory that has been implemented in Malang City has in common, its application is following the technical guidelines for the teaching factory implementation that has been issued by the Directorate of Vocational secondary school Development. In preparation for the teaching factory, renovations and adjustments to the school environment, both the workshop and the surrounding environment, are in the industry. The preparation phase is also carried out the alignment of the curriculum that will clarify the implementation of teaching factories that are tailored between vocational secondary schools with industry. Not just stopping at the preparation of facilities, the industry also sends people to become teacher trainee instructors to adjust HR qualifications that must be met.

The next stage is the implementation of the teaching factory. In its implementation, instructors from the industry together with subject teachers conduct teaching factory learning for students. The implementation stage consists of several steps, namely the requesting or order from the

community or industry, the execution of orders, marketing and sales. Orders carried out in teaching factory teaching are adjusted to consumer demand, so there needs to be a high degree of appropriateness and accuracy.

4.2 Supporting and inhibiting factors for teaching factory

At the time of the teaching factory implementation, certain factors would influence its implementation. These factors include supporting factors and inhibiting factors. Supporting factors include industry and vocational secondary schools that have run communication and cooperative relationships outside of teaching factory activities, so that good relations between the two have been established. With this good relationship, the industry will be more supportive of the full human resources and facilities needed in the implementation of teaching factories. Support from schools also makes the teaching factory run more optimally because schools are an important main part of the collaboration process. Also, the existence of a teaching factory will make students more enthusiastic and more competent so that they can adjust to the actual industry conditions.

In addition to supporting factors, there are inhibiting factors that hinder the implementation of vocational secondary school teaching factory in Malang. Inhibiting factors are grouped into four aspects, including aspects of learning, human resources, facilities, and cooperation networks. In the aspect of learning, some vocational secondary schools that have implemented teaching factories experience constraints such as lack of enthusiasm and low interest that implement teaching factories so that learning activities are less conducive, whereas in vocational secondary schools that have not yet implemented teaching factories are preparing students to be more competent.

The next aspect is human resources. Not all vocational secondary schools that have implemented teaching factories have adequate and sufficient human resources. Some vocational secondary schools experience a shortage of human resources which must be included in a special team that directly handles the teaching factory implementation. Vocational Schools that have not yet implemented a teaching factory experience a lack of human resources both in terms of quantity and quality to support the implementation of teaching factories.

The third aspect is the facilities. In the implementation of teaching factories, facilities are one of the keys in supporting the success of teaching factories, but not all schools that have teaching factories can provide full support in the form of equipment, materials, and a supportive environment. Several studies showed that implementing teaching factory using innovative technologies are able to improve supporting advanced life-long training of the skilled workforce (Kuts, Otto, Caldarola, Modoni, & Sacco, 2018; D Mourtzis, Vlachou, Dimitrakopoulos, & Zogopoulos, 2018; Dimitris Mourtzis, Zogopoulos, & Vlachou, 2018; Stavropoulos, Bikas, & Mourtzis, 2018). Both vocational schools and industry parties must support each other in providing full facilities so that teaching factories can run optimally.

The last aspect is the network of cooperation. In implementing a teaching factory, an industry that can be the best partner in establishing working relationships is needed for the successful implementation of the teaching factory. All schools have collaborated with industry, but some are still lacking in references in finding industry. Some schools that have not yet applied teaching factory have constraints in finding a truly loyal and linear industry to implement a teaching factory.

Of the several obstacles that hinder the implementation of the teaching factory, several alternative solutions can be taken. Among them is expanding communication networks with reference schools, in this case, schools that have established good cooperation in the implementation of teaching factories, so that obstacles related to the lack of industries that will be used as cooperation will be resolved. Besides, vocational secondary schools hold technical guidance by inviting companies that will become partners for cooperation so that good communication is established so that the planning, implementation, and evaluation of teaching factories are under existing implementation instructions. Prior research (Alptekin et al., 2001; Dimitris Mourtzis, 2018) implied that in overcoming the teaching factory constraints, direct supervision of most teaching factory activities are necessary. The supervision covers the scope of computerised planning, implementation, and evaluation of the teaching factory conduct. Another suggestion is for students to make a report provide it to the instructors, who will act as supervisors, to discuss accomplishments, or recommend corrective actions.

5. Conclusions

Teaching factory that has been implemented in Malang City is quite good, but it is still not optimal as a whole so it needs improvement and improvement of cooperation that has been done so that it can produce competent students in their fields. There are three stages in the teaching factory implementation, namely: planning, execution, and evaluation. First, planning is done to prepare everything that supports the course of the teaching factory. Second is the execution of teaching factory production and commercialisation of the services or products. Finally, there is monitoring and evaluation to find out the obstacles that occur in the implementation of teaching factory and to determine alternative solutions that must be taken.

In teaching factory implementation, there are several supporting and inhibiting factors. Factors supporting the implementation of the teaching factory include industry and vocational secondary schools that have run communication and cooperative relationships outside of teaching factory activities, so that good relations between the two have been established. With this good relationship, the industry will be more supportive of full human resources and facilities needed in the implementation of teaching factories. Support from schools also makes the teaching factory run more optimally because schools are an important main part of the collaboration process. Also, the existence of a teaching factory will make students more enthusiastic and more competent so that they can adjust to the actual industry conditions.

In addition to supporting factors, there are inhibiting factors that hinder the implementation of vocational secondary school teaching factory in Malang. One of them is the vocational secondary school is late in implementing a teaching factory because it has not found a suitable industry so there is no socialisation and technical guidance related to the teaching factory implementation. Besides, orders given by industry or the community are sometimes erratic so the teaching factory program is paused.

Of the several obstacles that hinder the implementation of the teaching factory, several alternative solutions can be taken. Among them is expanding communication networks with reference schools, in this case, schools that have established good cooperation in the implementation of teaching factories, so that obstacles related to the lack of industries that will

be used as cooperation will be resolved. Also, vocational secondary schools hold technical guidance by inviting companies to become partners in cooperation so that good communication is established so that the planning, implementation, and evaluation of teaching factories are following existing implementation instructions.

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