

Collaboration of Educational Institutions and Industry: Realizing Teaching Factory for Dedicated and Integrity-driven Human Resources

Fantika Febry Puspitasari

Islamic Educational Management Department, Universitas Islam Negeri Maulana Malik Ibrahim,
Malang, East Java, Indonesia

Email : fantika@mpi.uin-malang.ac.id

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Abstract:

This research aims to describe and analyze the process of building an electrical engineering teaching factory at SMKN 1 Paringin. This study uses a qualitative approach with a case study design. Data collection techniques were conducted through interviews, observations, and documentation. Data analysis began with condensing interview and document data, then sorting it according to the research objectives. The sorted data is presented in narrative form according to the research objectives. The narrative of the research data is summarized based on the discussion points. Data validity checks were conducted using source triangulation and technique triangulation. The results show that SMKN 1 Paringin and PT Adaro collaborated to develop productive and dedicated teachers for the teaching factory. Teachers were trained to create block schedules and job sheets based on processes and outcomes, applying teaching factory standards, quality control, and community service. The community service program at SMKN 1 Paringin is an attractive model because it focuses on developing workforce skills and altruistic aspects. This research supports further development in other vocational schools in Indonesia, especially in Centers of Excellence vocational schools, to sustainably enhance their benefits for industries and communities.

Keywords: *Teaching Factory, Peripheral School, Industrial Cooperation*

Abstrak:

Penelitian ini bertujuan untuk mendeskripsikan dan menganalisis proses pembangunan teaching factory teknik listrik di SMKN 1 Paringin. Pendekatan yang digunakan adalah kualitatif dengan studi kasus. Pengumpulan data dilakukan melalui wawancara, observasi, dan dokumentasi. Analisis data dimulai dengan mengkonsolidasi hasil wawancara dan dokumen, kemudian dipilah sesuai dengan tujuan penelitian. Data yang telah dipilah disajikan dalam bentuk narasi yang sesuai dengan tujuan penelitian. Narasi data hasil penelitian disimpulkan berdasarkan poin-poin pembahasan. Validitas data diperiksa menggunakan triangulasi sumber dan triangulasi teknik. Hasil penelitian menunjukkan bahwa SMKN 1 Paringin dan PT Adaro berkolaborasi dalam mengembangkan guru produktif yang berdedikasi dan berintegritas untuk teaching factory. Guru-guru dilatih untuk menyusun jadwal blok dan job sheet berbasis proses dan hasil, dengan menerapkan standar teaching factory, quality control, dan community service. Program community service di SMKN 1 Paringin menjadi model menarik karena tidak hanya berfokus pada pengembangan keterampilan tenaga kerja, tetapi juga pada aspek altruisme. Penelitian ini mendukung pengembangan lebih lanjut di SMK lain di Indonesia, terutama SMK Pusat Keunggulan, untuk meningkatkan manfaatnya terhadap industri dan masyarakat secara berkelanjutan.

Kata Kunci: *Teaching Factory, Sekolah Pinggiran, Kerjasama Industri*

INTRODUCTION

Vocational High Schools are crucial in preparing the younger generation to enter the workforce (Hartanto et al., 2019). SMK excel in providing practical education directly relevant to industry needs. The industrial era presents challenges for SMK in producing graduates capable of meeting industry requirements and being adaptive, innovative, and creative (Tjiptady & Yoto, 2019). The achievement indicators of SMK in realizing graduates according to industry needs can be observed through the level of graduate employability. The industry demands a workforce with IT skills, competency certifications, and work experience. However, the infrastructure in SMKs still needs to be improved to produce graduates capable of meeting industry needs (Perdana, 2019).

Based on data from the Central Statistics Agency, the highest unemployment rate since 2015 is among graduates of Vocational High Schools (SMK/ SMAK). In 2020, the unemployment rate for SMK graduates reached 13.55%; in 2021, it was 11.3%; in 2022, it decreased to 9.42% (Badan Pusat Statistik, 2022). The unemployment rate for SMK graduates has decreased over the past three years. The declining percentage of unemployment among SMK graduates indicates an increasing level of employability. The rise in employability aligns with the Center of Excellence Vocational High School (SMK Pusat Keunggulan) program. SMK Pusat Keunggulan is oriented towards establishing an optimal teaching factory in SMK to meet workforce needs.

The Teaching Factory is an essential program that must be optimized to produce a workforce aligned with industry needs. Practical learning aligned with corporate culture helps learners enhance hard and soft skills (Putri et al., 2019). In addition to improving students' capacity and competence, the Teaching Factory also enhances students' independence and entrepreneurial skills. SMK graduates are expected to be responsive to the constantly changing market conditions. Interaction, communication, collaboration, and creative thinking skills are honed through the Teaching Factory, where students engage in real projects or immerse themselves in industry culture. The Teaching Factory is designed to prepare graduates ready to enter the workforce according to company needs and with an awareness of creating job opportunities (Ridwan, 2021).

Efforts to align SMK graduates with the workforce's needs are carried out through school collaboration with the business world. Rojaki et al. (2021) research states that the management of school-industry collaboration involves planning, organizing, and implementing. The implementation of collaboration includes Memoranda of Understanding (MoU) with industries, curriculum alignment, industry visits and benchmarking, guest teachers, internships, On-the-Job Training (OJT), and the establishment of teaching factories. However, one of the practices of SMK and industry collaboration was found to be suboptimal in the research by Munthe and Mataputun (2021). Curriculum alignment and the expert teachers have not touched on the substantive aspects of industry practices and graduate absorption. Perdana (2019) also states that the limitations of SMK graduates are due to the limitations of educators' skills and infrastructure.

Therefore, a collaboration scheme is needed to optimize graduates' skills through industry collaboration, even in school-constrained conditions.

The research on the development of teaching factories includes the development of the SMK-Zyrek brand computer assembly teaching factory model by SMKN 7 Semarang in collaboration with PT Zyreksindo Mandiri Buana to address deficiencies in the school's computer laboratory (Wijaya, 2013). Another study indicates the implementation of a talent-based teaching factory involving experienced industry instructors (Dewi et al., 2023). However, research by Rangga et al. (2020) at SMKN 2 Adiwerna suggests that despite an average evaluation of teaching factory implementation at 71%, there are still areas for improvement in two areas: lack of cooperation with industry and learning that is not synchronized. The majority of research on teaching factories focuses on improving student skills. However, this study will discuss learning for students and the benefits of the teaching factory model at SMKN 1 Paringin for the community in suburban areas.

SMK Negeri 1 Paringin is a vocational school located on the outskirts of South Kalimantan. SMKN 1 Paringin established collaborations in building a teaching factory before the Center of Excellence Vocational High School (SMK Pusat Keunggulan) program emerged. Implementing the teaching factory at SMKN 1 Paringin involves collaborating with a partner industry, CV Sumber Sekawan. In 2018, SMKN 1 Paringin collaborated under the guidance of one primary industry, PT Adaro Energy Indonesia, and the Industrial Mechanical Engineering Academy (ATMI) Solo to optimize the electrical engineering teaching factory. PT Adaro is highly selective in determining the Productive Teachers who will pioneer the teaching factory project. Moral Hazard is also a severe concern for the company, as they believe that progress requires integrity (I. Syarif, personal communication, Mei 2023). Despite being a school on the outskirts with limited infrastructure, SMKN 1 Paringin has developed the teaching factory to the level of corporate culture. From 2019 to 2021, SMKN 1 Paringin won various championships in the electrical field at the provincial and national levels. This research aims to describe how the collaboration between a peripheral school and industry can build an industrial culture in the school through the teaching factory.

RESEARCH METHODS

This research employs a qualitative approach using a case study research design. It describes the collaboration between vocational high schools (SMK) in peripheral areas and industry in building a community service-based teaching factory. Data collection involves interviews, observations, and documentation. Interviews are conducted with the Executive Director of the teaching factory, the managing director, and alums. Observations are made on the development of the teaching factory through secondary data from the school's website. Documentation involves gathering documents related to curriculum development for teaching factory construction in collaboration with industry. Data analysis techniques include collecting data related to the development of the teaching factory in collaboration with industry.

Researchers gathered data from interviews with the teaching factory's executive director and managing director regarding building the teaching factory

from its inception to becoming self-sufficient. Interviews are also conducted with alumni to confirm their experiences with implementing the teaching factory at school. Researchers also review documents related to teaching factory development, standard operating procedures (SOPs), scheduling, and sample jobsheets. Some data are also obtained from the 'Percaya Listrik Paringin website. The collected data are then selected, focused, simplified, abstracted, and transformed into transcripts (data condensation). After the condensation stage, the data are presented (data display), and conclusions are drawn and verified. However, data analysis is conducted interactively, meaning that data analysis is not done after all data have been collected. However, data analysis can be conducted from the beginning of data collection (Miles et al., 2014).

RESULTS AND DISCUSSIONS

Construction Stages

The mentoring plan conducted by PT Adaro Foundation and ATMI Solo is divided into four years. The first two years focus on mentoring human resources, the third and fourth years involve preparing facilities and equipment, and there is mentoring in corporate culture and marketing in the fourth year. However, due to the COVID-19 pandemic, the mentoring realization by PT Adaro and ATMI Solo only reached the second year, completing the human resources mentoring stage. The pandemic in 2019 paralyzed educational activities, making it impossible to continue the planned program.

The collaboration between the PT Adaro Foundation and SMKN 1 Paringin began with mentoring and human resource development. PT Adaro decided to initiate the development of the teaching factory, starting with human resources. The commitment, skills, and dedication of productive teachers supported the sustainability and continuity of the program. PT Adaro was highly selective in selecting productive teachers, emphasizing the moral hazard of potentially productive teacher candidates. The development of human resource skills includes three aspects: cognitive, affective, and psychomotor. Therefore, productive teachers are expected to teach well and have high integrity in building the teaching factory.

PT Adaro provided various training sessions for the three productive teachers as part of the effort to develop the teaching factory at SMKN 1 Paringin. The training encompassed curriculum development, scheduling through the block system, and job sheet creation. Among the training components, these three elements served as the core substance that the productive teachers would further develop in establishing the teaching factory. In addition to curriculum development, the training sessions also emphasized the societal benefits of the educational institution, particularly in the field of electricity. Strengthening integrity and dedication emerged as foundational principles contributing to the growth of the teaching factory at SMKN 1 Paringin.

Despite the challenges posed by the COVID-19 pandemic, SMKN 1 Paringin demonstrated its capability to independently continue the development of the teaching factory after the two-year collaborative process with the industry was disrupted. The subsequent phase involved preparing adequate learning facilities. Through the initiative of productive teachers, the school explored

alternative financing options to procure these learning facilities. One approach undertaken was financing through a matching fund scheme facilitated by research projects from universities and other potential funding sources. The development of infrastructure conditions could also be supported through various alternative financing mechanisms.

Through the initiative of productive teachers, the school explored various financing alternatives to facilitate the establishment of adequate learning facilities for the teaching factory. One strategy employed was the matching fund scheme, which involved securing funding through research projects from universities and other potential sources. This innovative approach allowed SMKN 1 Paringin to mobilize resources and overcome financial challenges in building the necessary infrastructure.

In continuing the development of the teaching factory, SMKN 1 Paringin demonstrated resilience and adaptability in the face of the unprecedented challenges posed by the COVID-19 pandemic. Despite the disruption caused by the pandemic, the school exhibited a proactive stance by seeking alternative means to sustain the momentum of the teaching factory initiative. The commitment and dedication of the school's leadership, teachers, and industry partners played a pivotal role in navigating these challenges and ensuring the program's continued progress.

As SMKN 1 Paringin embarked on the path of self-reliance in the teaching factory's development, it underscored the importance of strategic planning and resource mobilization. The ability to secure funding through creative initiatives such as matching funds from research projects showcased the school's commitment to providing quality vocational education. Additionally, pursuing multiple financing alternatives highlighted the resourcefulness and determination of SMKN 1 Paringin in overcoming constraints and advancing the teaching factory's objectives.

SMKN 1 Paringin can build on its achievements and experiences to enhance the teaching factory's impact on student learning outcomes and industry collaboration. The school's success story in navigating challenges and fostering self-sufficiency inspires other vocational institutions facing similar circumstances. Despite unforeseen challenges, it exemplifies the resilience and determination to establish and sustain effective partnerships between schools and industries.

Teaching Factory Standards

The teaching factory at SMKN 1 Paringin has established standards to be adhered to in its implementation. These standards include product, block system learning, job sheet, and corporate culture standards. Applying these standards represents one of the successes of the human resource mentoring program by the industry with high commitment. The training acquired during industry mentoring is implemented comprehensively and earnestly in the school.

Product standards encompass the tasks performed by students at SMKN 1 Paringin, which are offered to the community. The projects undertaken by the teaching factory at SMKN 1 Paringin include electrical installation checks, repairs, installations, and innovative products based on microcontrollers. Meanwhile,

block system and job sheet standards are learning standards that support the achievement of the teaching factory. Corporate culture standards involve cultivating health and safety practices (K3) during practical work, promoting the use of personal protective equipment (PPE), and implementing the 5R principles (Ringkas [Neat], Rapi [Tidy], Resik [Recycle], Rawat [Care], Rajin [Diligent])

Table 1. Block System Pattern

Class	Pattern
X	1-3
XI	2-2
XII	2-2

Source: Primary data processed, 2023

Table 1 outlines the pattern for the block system at SMKN 1 Paringin. The applied learning system utilizes a block system with the pattern specified in Table 1. For Class X, patterns 1-3 mean that in one month, there is one week of practical work and three weeks of theory. Similarly, for Classes XI and XII, a pattern of 2-2 indicates two weeks of practical work followed by two weeks of theory. The scheduling for Class X involves three weeks of theory followed by one week of practical work. Class XI begins with two weeks of theory and practical work. Meanwhile, Class XII starts with two weeks of practical work and two weeks of theory, aligning with the curriculum target requirements. All learning targets are then specified in the form of job sheets, where evaluation focuses on two aspects: the process and the outcomes.

Quality Control

In implementing a community-based teaching factory, it is essential to ensure that the installations carried out by students meet high-quality and safety standards. Providing assurance serves the dual purpose of enhancing the community's or client's trust. The improvement in community trust also contributes to the enhancement of SMKN 1 Paringin's teaching factory projects. Recognizing this urgency, SMKN 1 Paringin has devised a quality control scheme to boost community confidence and demonstrate the school's commitment to providing electrical services in a sincere and dedicated manner.

The quality control process is implemented synergistically with the community and the industry. In Figure 1, a coordination line is evident between the community, the school, and the industry. This indicates that the school collaborates with the community and the industry to ensure the quality of electrical services at SMKN 1 Paringin. On the left side of the quality control flow, feedback from the community regarding the results and installation service is collected. If there are complaints, the school provides a guarantee for rectification. On the right side of the image, the industry assesses the practical installation services the students perform. The warranty period is set at 7+30 days after the installation process. A warranty for rectification will be provided if complaints are raised within this timeframe, aiming to thoroughly test students' competence. Students also carry out projects following Standard Operating Procedures (SOP) during service implementation.

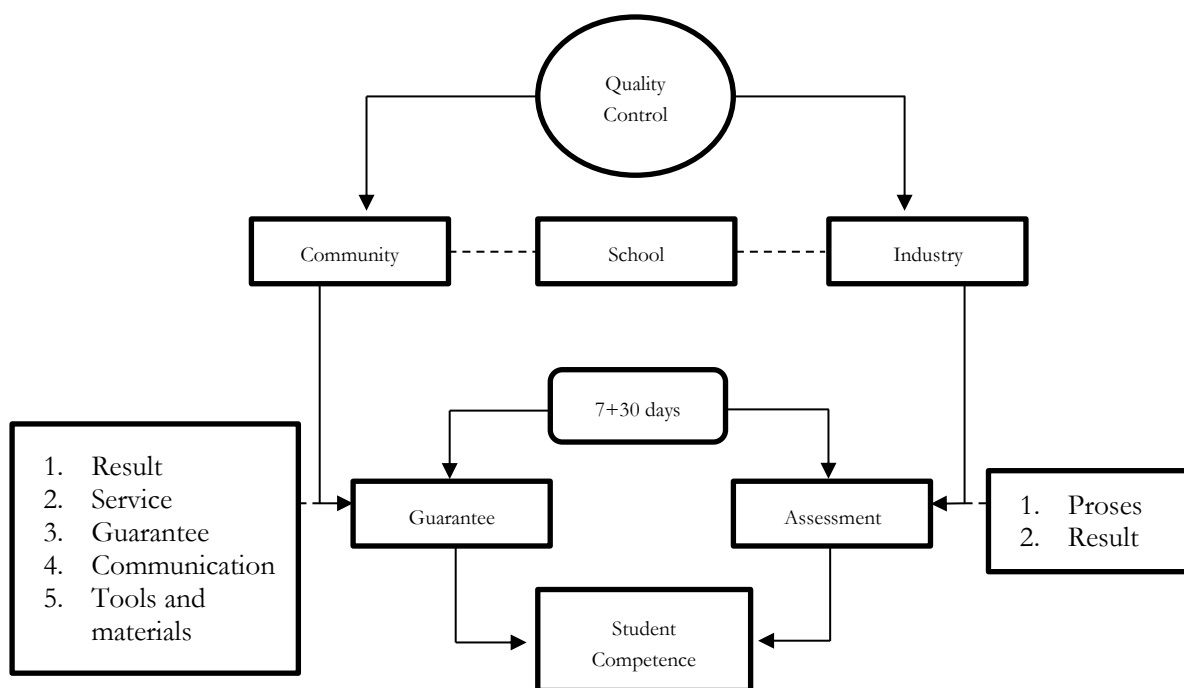


Figure 1. Quality Control Scheme (Source: Paringin, 2022)

Community Service

The empowerment and development of the teaching factory undertaken by SMKN 1 Paringin are based on the 'DELTA' principles, encompassing Dedication, Loyalty, and Integrity. Dedication entails dedicating one's work and efforts for the benefit of others and the surrounding environment. Loyalty refers to the commitment to the best-established goals by the Paringin electrical community for the benefit of society. Integrity involves aligning thoughts, words, and actions to benefit the community and the environment. The teaching factory developed by SMKN 1 Paringin goes beyond the goal of enhancing students' skills. The electrical department of SMKN 1 Paringin, part of the 'Electrici-Team', dedicates its teaching factory to assisting the surrounding community in need. In implementing teaching factory projects, SMKN 1 Paringin establishes three categories of recipients of installation services.

Figure 2 represents the schematic categories of services provided by the electrical department of SMKN 1 Paringin. The service categories are divided into three clusters: premium, economical, and full service. Premium customers are those with upper to middle-class economic conditions and pay the full-service fee according to the installation price. Economical customers have average economic conditions, so the service fee is below the regular price. Full-service customers are those with lower to middle-class economic conditions and receive free service, which is considered a fieldwork practice.

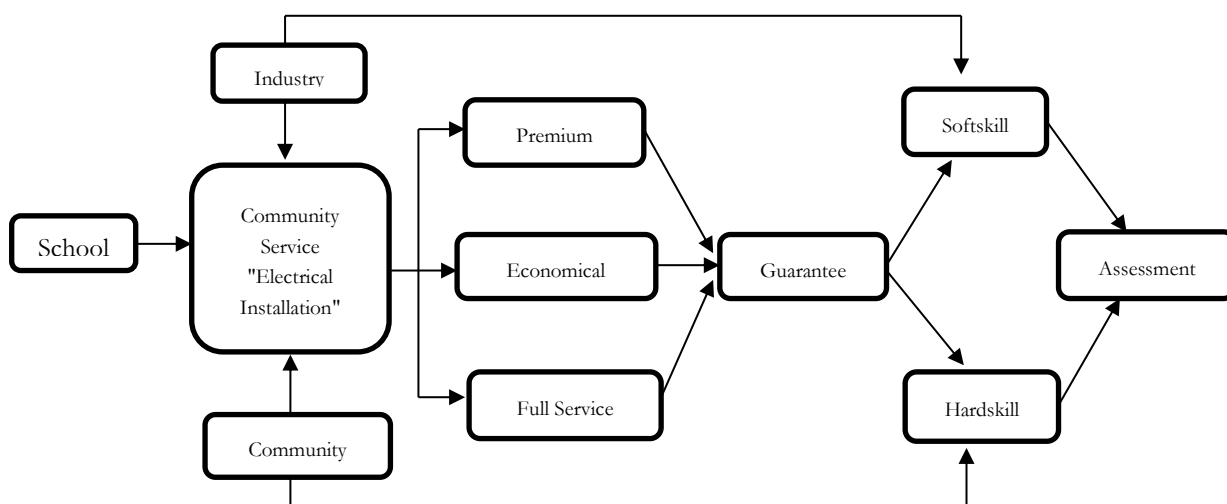


Figure 2. Community Service (Source: Paringin, 2022)

Teaching Factory Concept

The concept of a teaching factory originates from the knowledge triangle, which represents the relationship between education, innovation, and research (Mavrikios et al., 2018). The education and research conducted in educational institutions can contribute to the innovation process in industrial production. This process involves a mutually beneficial relationship between educational institutions and industry. This reciprocal relationship can be facilitated through two models: “Lab to Factory” and “Factory to Classroom” (Stavropoulos et al., 2018). The technical implementation of a teaching factory fundamentally involves integrating the learning process with a real-world working environment (Mavrikios et al., 2018). A natural working environment can serve as a source of realistic and relevant learning experiences for students before they enter the actual workforce.

The “Factory to Classroom” model is the foundational framework for the teaching factory at SMKN 1 Paringin. This model brings the actual factory setting into the classroom (Mavrikios et al., 2019), meaning that processes that typically occur in a factory are transferred to the learning spaces. The production processes in the factory are integrated into the learning activities. In this context, SMKN 1 Paringin establishes a corporate culture as a form of safety practice in the electrical installation service process. Additionally, direct installation practices are carried out in the field, providing installation services to the community.

The “Lab to Factory” model transfers knowledge from the educational world to the industry. Researchers from academic institutions conduct factory equipment experiments by introducing new knowledge concepts. The aim is to validate the newly introduced knowledge concepts. The validated knowledge is then reused by the industry for the development of technology and production systems (Mavrikios et al., 2018). Universities typically use the “Lab to Factory” model through academic research activities. Therefore, this mode is usually not directly related to the learning process in vocational schools (SMK). However, industry developments also influence the synchronization of curricula with

vocational schools to meet the industry's workforce needs. The Teaching Factory communicates knowledge between academics and industry practitioners (Chryssolouris et al., 2016).

In her research, Suhartini (2022) states that teaching factories in Indonesia, particularly East Java, exhibit diverse system characteristics. Typically, schools manage teaching factories through production processes based on industry production systems. SMKN 1 Paringin conducts installation service processes by the standards taught in synchronized learning with industry partners. The adjustment of service offerings to the standards of industry partners is a response to the challenge of meeting the workforce skills that align with the needs of the community and the industry. Mourtzis et al. (2018) also state that establishing SMEs can optimize the potential of schools within the teaching factory development paradigm.

In Indonesia, vocational education is closely related to the industry. Therefore, the teaching factory has become one of the primary programs in vocational education institutions, especially vocational high schools (SMK). There are several models of teaching factories in vocational high schools in Indonesia. The teaching factory model used by SMKN 1 Paringin in the electrical field involves utilizing the community as a practical laboratory for electrical installation. This aligns with the model outlined in the research by Azizah et al. (2019), stating that one of the teaching factory models in Indonesia involves using production units as student practice locations.

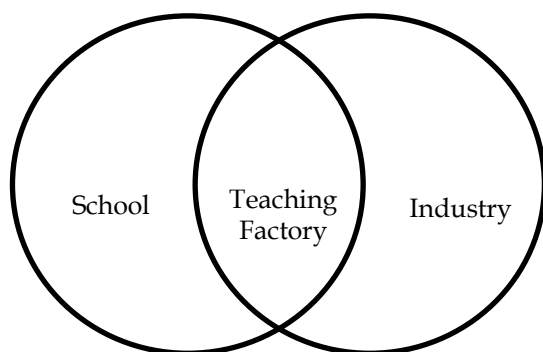


Figure 3. Teaching Factory Scheme through Industrial Cooperation
(Source: Directorate of Vocational Development, 2018)

Figure 3 depicts the teaching factory scheme, representing an intersection of the collaboration between schools and the industry. According to the 2018 Directorate of Vocational Development regulations, vocational education is implemented in vocational high schools. Despite the actual implementation in the field, there are instances of teaching factory practices conducted through internship schemes in the industry. Additionally, some forms of collaboration include (1) partner industries providing production facilities, (2) partner industries placing orders for teaching factory projects, (3) production system standards aligning with partner industry standards, (4) supervisors being trained personnel or from the partner industry, and (5) industries conducting research and development on vocational schools' teaching factories. This concept involves a mutualistic relationship where both parties benefit mutually (Azizah et al., 2019).

Kautsar et al. (2022) elaborate that the conceptual development of the teaching factory encompasses several stages. The conceptual aspects of teaching factory development include information technology, human resources, block scheduling systems, worksheets, products or services, practical laboratories, partner industries, and system management. This aligns with the stages designed by SMKN 1 Paringin in collaboration with PT Adaro to establish a teaching factory, starting with the development of human resources. This involves providing intensive and structured training to prospective productive teachers. Prospective, productive teachers are also trained to create block-based scheduling systems and worksheets or job sheets based on processes and outcomes. SMKN 1 Paringin also establishes the teaching factory standard, the benchmark for providing installation services to the community as a laboratory.

The concept of the teaching factory not only emphasizes the benefits gained by schools and industries but aims to meet the needs of adequately skilled industry professionals. Through the teaching factory, the work and production standards carried out by schools are aligned with industry standards (Rentzos et al., 2014). The adjustment of work system standards at SMKN 1 Paringin is achieved through guidance and coaching processes facilitated by PT Adaro and supervised by ATMI Solo. The continuous guidance of productive teachers is an effort to ensure the quality of vocational school graduates by synchronizing the curriculum with PT Adaro. The synchronization of curriculum and learning with PT Adaro aims to ensure that the competencies of vocational school graduates meet the needs of the electrical industry workforce.

Implementing the teaching factory involves providing products or services to the community by industry standards. Quality control and assurance are crucial to ensure the quality of products or services' quality. Kristanto et al. (2023) state in their research that to reduce the margin of error in teaching factory practices, supervision by teachers, the availability of a quality control team, and certification of expertise from industry partners are essential. The quality of service implementation is ensured by applying Standard Operating Procedures (SOP) during production or service provision (Akyuwen et al., 2023). In addition to ensuring the quality of the services provided, SMKN 1 Paringin also offers quality assurance through a warranty provided to the community with complaints within a 30-day grace period after the installation process. Information technology can also be utilized in the process of service booking, in addition to website development. Technology can enhance students' readiness to face ICT developments in the workforce (Rentzos et al., 2015; Mourtzis et al., 2021).

Altruism Value of Community Service

Community service is an intriguing program resulting from the development of the teaching factory at SMKN 1 Paringin. This community service has two forms of social programs: free services for the lower-middle-class community and alumni donations through the "electric team". The electric team initially started as a donation activity by successful alums to assist in smoothly operating electrical workshop practicums. However, as time progressed, the funds raised could be utilized to support various purposes, including assisting with the

educational expenses of students at SMKN 1 Paringin who are in need. This program embodies the social values of altruism within the educational institution. Altruistic behavior of this kind is motivated by a sense of social responsibility rooted in shared difficulties experienced and a caring attitude towards the community (Hadori, 2014).

This initiative enhances the practical aspects of education and fosters community and mutual support among the school's stakeholders. Altruism education constitutes a distinct and significant space within education where students are taught to cultivate concern for the well-being of others or the community (White, 2016). Jackson (2014) emphasizes that instilling altruism toward others is a crucial element in education toward ethical living. The electric team's evolution from a workshop-specific focus to a broader community welfare approach demonstrates such social programs' positive impact and adaptability. Moreover, the program aligns with the principles of social responsibility outlined by Hadori (2014). The altruism exhibited by the alumni, driven by a genuine concern for the community and a shared understanding of past challenges, reflects a commitment to making a positive difference.

By extending support to students in need, especially in covering educational expenses, the program contributes to breaking down barriers to education and promoting equal opportunities. This not only benefits individual students but also contributes to the overall development and well-being of the community. In their experiment, Bettinger and Slonim (2006) also employed economic activities to foster students' altruism. In conclusion, the community service program at SMKN 1 Paringin, specifically the electric team, exemplifies integrating academic principles with social responsibility (Abbas & Nurbaya, 2018). This combination enriches the educational experience and nurtures a culture of giving back and supporting one another within the school community.

Furthermore, the success of the community service program hinges on the collaboration between the school, alums, and the broader community (Idris et al., 2021). The active involvement of alumni, who contribute financially and through their expertise, creates a valuable bridge between the academic institution and the professional world. This symbiotic relationship fosters a dynamic learning environment where real-world experiences complement classroom teachings. The program's dual nature, encompassing free services for the less privileged and alum donations, showcases a holistic approach to social impact. It recognizes the diversity of needs within the community and tailors its initiatives accordingly, reinforcing the idea that education goes beyond the classroom walls.

As this program evolves, it becomes a model for other educational institutions seeking to integrate social responsibility into their core values. It prepares students with practical skills and instills a sense of duty to contribute positively to society (Suryana, 2020). The community service program at SMKN 1 Paringin exemplifies a proactive and adaptive approach to academic social responsibility, creating a ripple effect of positive change within the school and its surrounding community.

CONCLUSION

The development of the teaching factory through collaboration and industry mentorship at SMKN 1 Paringin has successfully established a self-sustaining teaching factory. The electrical-focused teaching factory at SMKN 1 Paringin has been able to develop unique programs that significantly impact the community. The implementation of the teaching factory meets standards, has standard operating procedures (SOP) and quality guarantees, and provides a dedicated space for community service. Community service has become a distinctive feature of the teaching factory developed by SMKN 1 Paringin. The development model of a teaching factory based on Community Service enhances students' skills and provides them with real responsibilities when working.

Additionally, it acquaints them with altruism by offering services to the community, such as low-cost or free services to those less fortunate. Currently, the development of teaching factories in Indonesian vocational schools has gained massive support from the government through funding from the Center of Excellence Vocational Schools (SMK Pusat Keunggulan). The development of community service-based teaching factories deserves further research attention, especially in schools designated as Centers of Excellence. It would be interesting to measure the effectiveness of Centers of Excellence vocational schools by evaluating their sustained benefits to industries and communities. This presents a potential avenue for future research and development in vocational education.

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