Fihsbone Analysis: Challenges and Strategies for Implementing Merdeka Curriculum in Vocational High Schools

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Article Info

Article history:
Received Jun 12, 2025
Accepted Jul 03, 2025
Published Online Aug 09, 2025

Keywords:
Merdeka Curriculum
Vocational High School
Challenges
Strategies

ABSTRACT

The curriculum serves as a vital foundation for educational institutions. However, the transition from the previous curriculum to the Merdeka Curriculum presents various challenges, especially at the vocational high school level. This study aims to identify the challenges and strategies in implementing the Merdeka Curriculum at SMK Negeri 2 Depok Sleman using fishbone analysis. A qualitative approach was employed, with data collected through semi-structured interviews involving vocational teachers who implement the Merdeka Curriculum, selected purposively, along with documentation as supporting evidence. Data analysis followed the Miles and Huberman model, encompassing data reduction, display, and conclusion drawing. The findings indicate that the main challenges lie in human resource preparedness, curriculum transition, and the misalignment of school programs with current industry demands. In response, the school has implemented several strategic steps, including curriculum socialization, teacher training, and industry collaboration. This research provides insights for educational institutions to develop curriculum policies and programs that meet industry needs and respond to the demands of the digital era.

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How to cite: Azahar, R., Hilhamsyah, H., Alim, M. I., Hartati, H., & Dirmayani, T. (2025). Fihsbone Analysis: Challenges and Strategies for Implementing Merdeka Curriculum in Vocational High Schools. *Jurnal Riset Dan Inovasi Pembelajaran*, *5*(2), 626–642. https://doi.org/10.51574/jrip.v5i2.3361

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1. Introduction

Background of the Study

The curriculum has a central role in education which is the basis and main guideline for all educational activities in Indonesia in preparing the younger generation to face global challenges (Erni et al., 2024; Halimah, 2020). The paradigm shift in education demands a change from traditional learning to a more innovative and adaptive approach (Handika et al., 2024). Good management in the aspects of planning, implementation, and evaluation is needed so that the education process can take place in accordance with the objectives that have been set (Komalasari & Apriani, 2023). One of the important steps taken by the Indonesian government is the implementation of Merdeka Curriculum, which is designed to provide learning flexibility that equips students with skills according to their interests and talents. (Azahar & Siregar, 2024; Hadi et al., 2023). In addition to learning, the Merdeka Curriculum also provides flexibility to schools in developing learning content, methods, and assessments that are in accordance with local characteristics and student potential (Fatah & Zumrotun, 2023; Hilmin et al., 2022). In the context of SMK, the implementation of Merdeka Curriculum aims to prepare students with relevant skills and competencies needed in the world of work. (Masbukhin & Sausan, 2023).

The implementation of Merdeka Curriculum in SMK faces various obstacles. Field studies show that many schools have difficulty in aligning the curriculum with the needs of the industrial world, especially in the context of rapid technological development (Azahar, 2023). Some of the factors that influence the successful implementation of the Merdeka Curriculum in SMK include limited human resources, infrastructure, and lack of training and assistance for educators (Pawartani & Suciptaningsih, 2024; Putri & AR, 2023; Wantiana & Mellisa, 2023). Many teachers feel that they do not fully understand the principles of the Merdeka Curriculum, such as project-based learning and strengthening the Pancasila Learner Profile (Fatah & Zumrotun, 2023; Sartini & Mulyono, 2022). In addition, the readiness of facilities and learning tools is not sufficient to support the practice-based learning process which is the core of vocational education (Vitariyanti et al., 2024). In the context of the world of work, the lack of industry involvement in the curriculum development process is also one of the main inhibiting factors. Overall, the implementation of Merdeka Curriculum in SMK requires the collaboration of various parties. With adequate support, this curriculum is expected to improve the quality of

education and prepare students to face the challenges of the globalization and industry 4.0 era. (Hermawan & Jasria, 2023; Hilmin et al., 2022).

However, previous studies have not specifically applied the Fishbone Analysis approach to identify the root causes of problems in the implementation of the Merdeka Curriculum in vocational secondary schools. Most previous studies tend to focus on general implementation challenges without providing a structured framework for systematically identifying interrelated causal factors. These studies often lack comprehensive diagnostic tools to map the complexity of implementation barriers, such as teacher competency gaps, inadequate infrastructure, or weak school-industry collaboration. Fishbone Analysis is more suitable because it offers a visual and analytical framework to track specific factors that influence implementation success. This approach facilitates deeper exploration of the problem and supports the formulation of more targeted and strategic interventions. In line with this, this study aims not only to identify challenges but also to explore core issues in the implementation of the Merdeka Curriculum, particularly at SMK Negeri 2 Depok Sleman. Additionally, this research seeks to provide strategic recommendations to strengthen school-industry collaboration, enhance infrastructure readiness, and improve teachers' competencies in implementing project-based learning as essential efforts to support the curriculum's effectiveness in preparing students to face global competition and the demands of the 4th Industrial Revolution.

Development of Vocational Education in Indonesia

History is the foundation for organizations in formulating their vision and mission, including vocational education (Abdullah & Surjomihardjo, 1985; Frederick & Soeroto, 1984). Vocational education was born out of industry's need for professional labor, aiming to improve the economy through labor independence (Finlay et al., 1999). Cantor (1991) states that the vocational education system reflects the society. In Indonesia, vocational education developed from the Dutch colonial system to meet the needs of the labor force (Pambudi & Harjanto, 2020). Vocational education in Indonesia includes SMK and higher education such as polytechnics and diplomas. Its history dates back to the Ethical Policy of 1901, although during the colonial period it was limited to Dutch interests (Scott, 1974). During the Japanese era, the system suffered a setback due to language and curriculum changes, causing many dropouts and school closures (Khurniawan, 2016; Scott, 1974). Post-independence, vocational education developed slowly due to limited resources and the government's focus on basic education (Jalal & Supriadi, 2001). Until the 1998 reforms, the number was still limited, with a ratio of higher education and vocational education of 70%:30%. The government began to prioritize vocational education, changing the ratio of SMA:SMK to 30%:70% (Finlay et al., 1999). In 2018, the ratio

of SMA:SMK reached 49.2%:50.8%, but challenges arise due to a lack of infrastructure, teaching staff, and industry support. Vocational education is still considered a second option, similar to other developing countries (S.N., Mason et al., 2018). An excess of graduates without the appropriate skills lowers the quality of vocational education, while other countries experience a shortage of skilled workers (L. & J., 2018).

Implementation of Merdeka Curriculum in Vocational High Schools

The Merdeka Curriculum is designed to give schools flexibility in tailoring learning to the needs of students and the world of work (Maisyaroh et al., 2024), which aims to create contextual and future-oriented learning (Kemendikbudristek BSKAP, 2022). This is supported by Yoto et al. (2024), which emphasizes that implementing an independent curriculum can help students acquire skills according to industry demands, thus becoming a strategy to face globalization. Research shows the positive impact of the Merdeka Curriculum, especially through project-based learning that improves students' critical skills and innovation (Hayat et al., 2023; Maisyaroh et al., 2024). Other studies have also noted that real-world projects make students better prepared for the world of work (Islamiati et al., 2024; Rachman et al., 2024). In addition, the curriculum strengthens SMK's relationship with industry, facilitating internships and competency alignment (Christensen et al., 2023; Yoto et al., 2024). The role of the teacher as facilitator is also crucial to the success of this curriculum (Hutamy et al., 2024; Reza & Aufa, 2024). Shoufika et al. (2024) highlighted the importance of teacher training in project-based and digital methods, in line with Ricardo Sisco Turnip (2023) which emphasizes the use of technology in learning. Overall, Merdeka Curriculum improves student competencies, aligns education with industry, and supports the transformation of vocational education in Indonesia.

2. Research Method

This research method uses a qualitative descriptive approach related to the challenges and implementation strategies of the independent curriculum in Vocational High Schools. Qualitative descriptive research focuses on understanding natural phenomena in a social context and emphasizes the meaning behind problem solving (Ormston et al., 2014). This research was conducted at SMK Negeri 2 Depok Sleman. Data were collected through semi-structured interviews and document analysis. The primary informant in this study was the Deputy Head of the Curriculum Department, who was purposively selected due to their crucial role in curriculum planning and supervision. To enhance the richness and credibility of the data, two additional informants were involved: subject teachers directly involved in the implementation of project-based learning and curriculum activities. The use of multiple informants allowed this

study to capture perspectives from both administrative and classroom levels. Although the number of informants was limited, data triangulation through document analysis helped minimise potential bias and address this limitation.

Document analysis focused on various school documents related to curriculum implementation, including learning objective flowcharts (ATP), learning outcomes (CP), teaching modules, teacher training reports, workshop documentation, and industry partnership documents. These documents provided contextual information to support and validate interview findings. The data analysis technique follows the interactive model developed by Miles and Huberman (1994), as shown in Figure 1. This systematic process helps researchers explore the root causes of problems and formulate strategic recommendations to improve the implementation of the Merdeka Curriculum in vocational school environments.

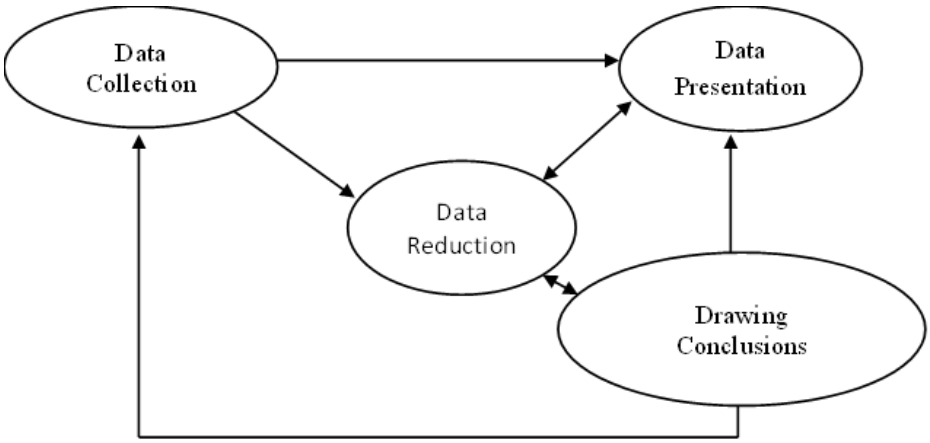

Figure 1. Data Analysis Process
Source: Personal data (2025)

3. Result And Disscussion

Fihsbone Analysis of Curriculum Implementation Challenges in Vocational High Schools

The results showed that the implementation of the independent curriculum at SMK Negeri 2 Depok Sleman faced challenges since the implementation of the curriculum. The perception of the Merdeka curriculum for principals and teaching staff is something new and needs adjustment, both from the curriculum, teaching methods, teacher competencies, educational programs and students. The transition to curriculum change has caused various problems such as the replacement of the school's flagship program which is considered the most crucial. Here is a fishbone analysis to map the problems in implementing the independent curriculum. Before that, problem identification is carried out to draw overall conclusions to avoid mistakes. This identification is done to highlight the facts that occur and become school

problems. The aspects analyzed are based on the categories of man, method, material, machine, environment, and measurement. The following are the details of the challenges in implementing the independent curriculum in Figure 2.

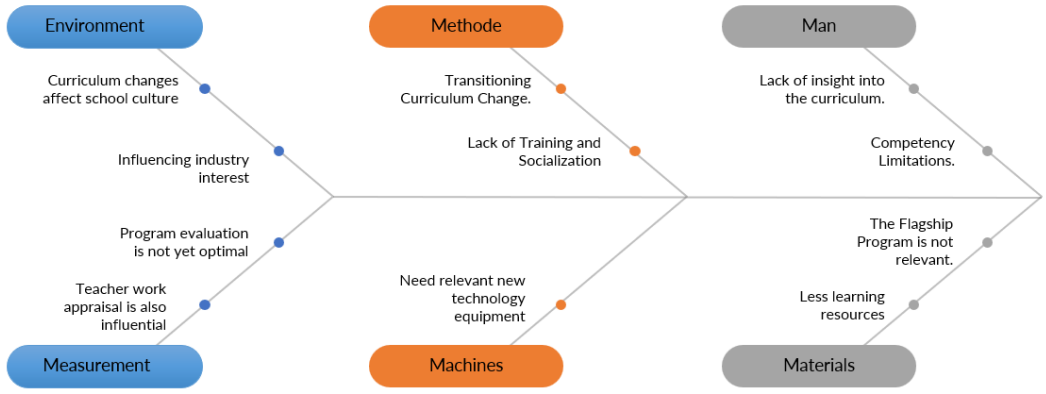

Figure 2. Fihsbone Analysis
Source: Personal data (2025)

Based on the analysis results shown in Figure 2, the following results are obtained:

a. Man

The results showed that there are problems in human resources that occur in schools, namely that teachers do not have sufficient insight to implement the Merdeka curriculum, teachers and schools have limited abilities and competencies to implement the independent curriculum. Teacher has different readiness in responding to changes in the Merdeka curriculum. This is due to the lack of training and socialization regarding the independent curriculum, making the transition process so difficult. This is because the school has only been implementing K13 for about 1.5 years.

The readiness and insight of teaching staff varied significantly, especially because the curriculum shift came too soon after the adoption of the previous curriculum.

> *"At that time, we had just started implementing Curriculum 13, which had only been running for 1.5 months... suddenly we were forced to use the Merdeka Curriculum. There had been no training, no socialization whatsoever."*

Teachers expressed fatigue and confusion during the crash-course training.

> *"The training was 10 days of full online learning... it was very intense. There was no time to relax, we had to be on camera all the time, discussing things constantly... many teachers were not mentally or technically prepared for it."*

Resistance to change also emerged due to varying levels of openness to innovation.

"It's called change, not everyone can accept it right away... some are positive, some find it difficult to accept. That was a major obstacle in the beginning.

To address this, the school intensified peer mentoring and internal capacity building.

"We conduct regular training, and teachers even provide informal mentoring to one another. There is peer mentoring.

b. Methode

The results showed that there were problems in implementing the Merdeka curriculum. The transition of change causes many problems, because teachers have to move quickly to adjust to the new and constantly changing education system, making it difficult for teachers to adjust because there is no readiness for this change.Materials. Hasil analisis menunjukkan bahwa program unggulan yang diminati siswa dan juga industri harus ditiadakan karena tidak relevan dengan kurikulum merdeka sehingga membuat intensi siswa dan industri berkurang. Selain itu juga membuat setiap perangkat pembelajaran harus dibuat ulang dan berubah. Tentu hal ini memakan waktu yang lama sehingga perangkat pembelajaran yang pernah dibuat sebelumnya tidak digunakan karena tidak relevan dengan kurikulum merdeka. The coexistence of two different curricula (Merdeka for Grades 10–12 and 2013 for Grade 13) led to inconsistency and confusion.

"Grades 10 to 12 are already using the Merdeka Curriculum, but grade 13 is still using the 2013 Curriculum. This means that teaching materials must be constantly adjusted."

Rapid transitions were worsened by policy uncertainty at the national level.

"The problem is, if you replace the minister, you can change the policy again... this is just a transition, just learning, but then you have to change again. The challenges continue."

c. Materials

The analysis shows that there are significant challenges in terms of materials, particularly in relation to the school's flagship programs and learning tools. One of the direct impacts of the implementation of the Merdeka Curriculum is the elimination of a number of specialized programs that were previously the school's mainstay and were highly sought after by students and industry. These programs are no longer considered relevant to the new structure of the Merdeka Curriculum, forcing schools to discontinue them. This situation has led to a decline in student interest and industry confidence in school programs. This was highlighted by the Deputy Head of Curriculum in an interview:

"What was already established and favored by the industry suddenly changed. So

sometimes, changes to the curriculum result in the loss of what was already established."

This statement indicates that curriculum changes not only impact administrative aspects but also disrupt the continuity of established relationships with the industry. Additionally, curriculum changes require teachers to redesign all teaching materials, including lesson plans, teaching modules, and assessments. The tools previously developed based on the 2013 Curriculum become irrelevant and cannot be reused. This inevitably consumes time, effort, and causes confusion at the beginning of the transition, especially since the development of new materials is not accompanied by adequate training or guidance.

"Learning materials are also unavailable, and textbooks are limited, which is a major obstacle."

This indicates that the scarcity of learning resources and the lack of references relevant to the Merdeka Curriculum pose additional challenges in ensuring optimal learning outcomes.

d. Machine

Although the results of the study do not show directly that there are problems with the technological devices used, of course this will have an impact. This is because the independent curriculum demands differentiated learning methods that adapt to the needs of students. This is a problem because schools do not necessarily provide infrastructure that quickly. Moreover, the implementation of the previous curriculum has just been implemented and must change again. While infrastructure was not cited as a primary problem, technological readiness played a critical role in the training and adaptation process.

"The online training alone is challenging. One must be prepared with a stable internet connection, devices, cameras, and more, not to mention the energy of the instructor.

The demands of differentiated instruction required tools and digital resources that many schools had not yet fully developed.

e. Environment

Based on the research results, environmental indicators are also a factor that causes problems in implementing an independent curriculum such as losing some partners who are not relevant to the school program. then affecting the school culture that has been formed must repeat from the beginning to attract students and the need for in-depth

training and socialization. Curriculum reform affected the school's external partnerships and internal learning culture.

> *"The program changes have made some partners uncertain. What was previously suitable is now irrelevant."*

Nonetheless, SMK 2 Depok made deliberate efforts to maintain strong industry ties.

> *"The children who are sent on internships must be carefully selected... it can't be done randomly. This is also to maintain the school's good reputation."*

f. Measuremnet

The results also showed that program evaluation was disrupted because some programs had to be adjusted and eliminated because they were not relevant. In addition, teacher performance appraisals were also affected, so they had to involve senior teachers to conduct performance appraisals. This also requires adjustments to the format, competencies assessed and the suitability of the teachers themselves. The new curriculum disrupted previously stable evaluation systems, particularly in appraising teacher performance and program effectiveness.

> *"Teacher performance evaluations now involve assessors from senior teachers... they observe classes, give feedback, everything has to be adjusted."*

The school also went through rigorous validation stages involving external stakeholders.

> *"After synchronizing with the world of work, we invite government agencies, supervisors, education practitioners, etc. to validate the curriculum before it is approved by the province."*

This multilayered validation process, while ensuring quality, demanded additional administrative and emotional labor from school staff.

Challenges in Curriculum Implementation in Vocational High Schools

The head of SMK Negeri 2 Depok Sleman has a policy in implementing the curriculum. The curriculum used is the independent curriculum for grades 10-12 and the K13 curriculum for grade 13. The role of the principal in curriculum implementation has an influence in directing an adaptive curriculum for schools (Sa'adah et al., 2023). The principal at the School is still implementing the 4-year program which consists of 4 programs namely mining geology, analytical chemistry, metal applications and network systems. For the next year all programs will follow the independent curriculum. The lack of training and socialization about the independent curriculum makes the transition process so difficult. This is because the school has

only been implementing K13 for about 1.5 years. To overcome this, the school conducted intensive training for 10 days online with a tight schedule. The school experienced problems with the curriculum change. This is because it cannot implement the 4-year program that is in demand by the industry. This is because students are more mentally prepared and competent, learning hours are also more and Field Work Practices are longer. The stages in implementing an independent curriculum in SMK are the curriculum development process begins with the establishment of a Development Team comprising the Principal, Vice Principal, and Head of the Expertise Program. This team is responsible for drafting a curriculum that aligns with the Graduate Competency Standards (SKL) set by the Ministry of Education. Subsequently, curriculum synchronization with the industrial sector is carried out by engaging industry partners from each expertise program, as well as involving the school committee and school supervisors. Following this, the curriculum undergoes validation by the District Education Office, school supervisors, and education practitioners from universities to ensure its relevance and feasibility. The final stage of the process is the official endorsement of the curriculum by the Provincial Education Office, signifying its approval and readiness for implementation in schools.

When it comes to fulfilling their curriculum and administrative duties, SMKs have various difficulties and solutions that require careful consideration and strategic management. The Vice Principal for Curriculum is responsible for making schedules, assigning teaching tasks, and conducting assessments. However, due to the continuous changes in the world of education, these obligations have become increasingly complicated. For example, changes in exam schedules, workshops and other curriculum-related activities are required for the implementation of educational programs. Along with these developments, schools must adjust to new demands while still upholding strong academic standards.

Strategic Implementation of Merdeka Curriculum in Vocational High Schools

From these problems, an effective strategy is needed to overcome the challenges in implementing the independent curriculum in SMK. The following strategies can be implemented by schools:

Table 1. Strategies in Implementing the Merdeka Curriculum

Observed factors	Strategy
Man	a. Provide training and workshops for teachers to improve their competence and readiness. b. Motivating teachers to keep developing. c. Make policies according to teachers' needs.

Observed factors	Strategy
Methode	a. Equipping teachers with the knowledge to adjust. b. Provide personal approach and assistance to teachers who are difficult to adapt.
Materials	a. Facilitate teachers with adequate facilities and infrastructure. b. Supporting teacher activities with support from the government.
Machine	a. Provide teachers with an understanding of learning methods in the classroom. b. Provide welfare support for teachers.
Environement	a. Reinvigorate school culture that is aligned with the values and objectives of Merdeka Curriculum. b. nvolving all parties, such as teachers, students and parents, in activities that introduce and internalize these cultural changes.
Measurement	a. Review programs that are not relevant to the Merdeka Curriculum to adjust them to the needs and demands of the new curriculum. b. Irrelevant programs can be discontinued or modified to support educational objectives.

a. Creating a Merdeka Curriculum Socialization and Training Program

An important challenge arises from curriculum changes, which may result in a loss of focus on established and popular programs, potentially causing some established majors to lose relevance (Nasution, 2022). This uncertainty is compounded by the lack of knowledge and understanding among school staff about these changes, making it difficult for them to accept and adapt to the new curriculum. Lack of awareness and readiness among students and teachers can lead to resistance, further complicating the transition process. To address these issues, the Head of SMK N 2 Depok has taken proactive measures by organizing socialization sessions and training programs to provide staff and students with a deeper understanding of the changes. Experts and speakers have been invited to help clarify the new curriculum and its implementation. As a result, teacher responses have improved, and Merdeka Belajar platform has been successfully integrated, although further refinement is still needed. In research Cholilah et al. (2023) implementation of the independent curriculum must be oriented towards the Indonesian National Qualifications Framework (KKNI) to support quality graduates. Bringing in resource persons and practitioners to help explain the new curriculum and how it will be implemented. Merdeka Belajar Platform has been successfully implemented, and teacher responses have improved as a result, but there is still much to be done. this is supported by research Yahya et al. (2023) that training involving teachers can improve the quality of productive vocational schools. Also emphasized by Wahira et al. (2023) training activities such as socialization, workshops, seminars are strategic steps to improve teachers' understanding of the independent curriculum.

b. Maintaining Relationships with Partners

In addition, the school places great emphasis on keeping the lines of communication open and efficient to foster good relationships with industry partners. In the research of Sobari et al. (2023) It is important to maintain relationships between schools and partners from various industries and synchronize the curriculum in schools with industry needs. This ensures that students sent to partner industries are competent and have the appropriate qualifications. To ensure the continuity of collaboration, SMKs also strive to prevent administrative delays and maintain open lines of communication. The communication gap that sometimes exists between principals and teachers, however, is another issue that can hinder decision-making and jeopardize the cohesiveness of the education team as a whole. It takes hard work to overcome these barriers by improving communication, encouraging teamwork and ensuring that school administrators and teachers have the same goals for the success of their students. Maintaining good external and internal relationships is important to maintain the quality of graduates (Islamiah et al., 2022). According to Sa'idah & Hermina (2025) relationships with partners need good management to build effective relationships between schools and partners.

The SMK Principal continues to maintain relationships with various parties such as industries, companies, campuses and social services. The partners of SMK N 2 Depok are spread across various regions in Indonesia such as Bogor, Serpong and Kalimantan. Currently in Bogor, there are companies that take more than 70 students, in Serpong there are those who ask for 12 students, in Kupah, Miyako, and Perupahan there are also many. Outside the region, such as in Kalimantan, there are those who ask for 22 children, this is almost one class. This relationship is to facilitate students in carrying out Field Work Practices and also fulfill school facilities and improve school quality. as for the place of Field Work Practices there are several ways, namely provided by the School, the industry is looking for, the students themselves are looking for. During Field Work Practices students get several facilities such as MES for housing and pocket money. Before the Covid-19 Pandemic, many students practiced Field Work in the Jabodetabek area rather than in Yogyakarta. After the pandemic, many students practiced Field Work in Yogyakarta.

According to Abdillah & Puspitasari (2025) there is a need to align the curriculum with industry to maintain the quality of the school. The proximity of educational institutions, industries and other businesses helps SMK to provide many options for collaboration. This location advantage gives the school the opportunity to forge solid alliances with the academic

and business worlds, which will enhance the educational experience for the students. In addition, the school's network and resources are also strengthened by the participation of local government organizations including the police and social services. Each vice-principal oversees four employees, each of whom is responsible for a different area of expertise, helping the school run smoothly.

4. Conclusion

The implementation of the curriculum in SMK is experiencing challenges in harmonizing industry needs with educational institutions and the development of the digital era. Based on the fihsbone analysis of the implementation of the independent curriculum at SMK Negeri 2 Depok Sleman, there are several problems, namely teacher readiness, teacher competence, changes in the education system, incompatibility with industry needs, and programs that are no longer relevant to the development of the digital era. Departing from these problems, SMK N 2 Depok Sleman takes strategic steps in implementing an independent curriculum such as curriculum socialization, training by inviting practitioners and experts, maintaining good relations with partners and maintaining communication so that it remains established. The results of this study can contribute to educational institutions in other SMKs to be able to implement these strategic steps and create programs and policies that are in line with the needs of industry, the world of work and the development of the digital era.

5. Conflict of Interest

The author declares no conflict of interest.

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