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Analysis the Governance of Center Excellence Vocational School Program SMKS Yabhinka Cilegon on Improving Student Competence at the Industrial Era 4.0

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ABSTRACT

This research aims to analyze the governance of the Center of Excellence Vocational School program at Yabhinka Cilegon Vocational School in an effort to increase student competency to face the demands of the Industrial Era 4.0. The research method used is a qualitative approach with data collection techniques through interviews, observation and documentation studies. This research evaluates the planning, implementation and results of the program in improving student skills according to the needs of modern industry. The research results show that the governance of the Center of Excellence Vocational School program at Yabhinka Cilegon Vocational School has been running well through collaboration between the school, the business/industrial world (DUDI), and the government. This program has succeeded in integrating a technology-based curriculum and job market needs, increasing teacher capacity, and providing technology-based learning facilities. Overall, the Center of Excellence Vocational School program at Yabhinka Cilegon Vocational School has made a significant contribution in producing graduates who are competent, ready to face the demands of the Industrial Era 4.0, and able to compete in the global job market.

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INTRODUCTION

The development of the Industrial Era 4.0 brings significant changes across various sectors, including education. Vocational high schools (SMK) as educational institutions play a strategic role in preparing graduates who are job-ready and possess skilss that meet industry needs (Herman et al. 2023). The demand for human resources with superior competencies and adaptability to technological advancements is increasing (Damar Fatika Sari, 2023). This necessitates educarional innovate in enhancing the quality of education and student competencies to align with the needs of modern industry. Vocational education in Indonesia, especially in Vocational High Schools (SMK), faces significant challenges in preparing graduates who are ready to enter the workforce in the era of Industry 4.0. The Industrial Revolution is Characterized by rapid technological advancements, including automation, artificial intelligence, and the Internet, which demand human resources with technical skills and high-level thingking abilities (Wijaya, 2023). In this regard, cognitive learning is an appropriate approach to support the development of critical thingking and problem-solving skills, two aspects that are crucial for vocational school students to adapt and compete in the modern industrial world (Dianto & Mulyani, 2024).

There are many obstacles faced by vocational school graduates today, namely : students are unable to secure employment due to inadequate skills, a lack of competent teachers in productive fields, being out of date with technology, and limited information about the job market and industry, which contributes to unemployment (Komara et al, 2024). Furthermore, as a private scholl, it often experiences financial constraints in providing practical facilities for student, as the tools required according to industry standards are quite expensive and there must be skilled teachers/technicians to operate them (Dianto & Mulyani, 2024).

The competencies of students in facing in the era of the industrial revolution 4.0 must undergo extensive preparations such as soft skills and hard skills, in order to produce graduates who are capable of competing in the industrial world. To prepare soft skills and hard skills, students require new skills to ensure they have competent

human resources and keep up with technological advancements. Learning innovations also significantly influence the soft skills and hard skills of students in vocational schools during the industrial 4.0 era (Sakti Walenta et al. 2023).

The vocational school program focuses on the development and enhancement of quality and performance in vocational schools with priority areas strengthened through partnerships and alignment with the workforce to produce graduates who can be absorbed into the job market or become entrepreneurs, as well as to become a preferred vocational school and a center for quality improvement (Sanktiaji, 2024). According to (Suaduon et al., 2024), the vocational school program aims to :

a. Strengthening the partnership between the Ministry of Education and Culture and local governments in supporting the SMK PK Program.
b. Enhancing the quality of human resources in vocational schools, including school heads, school supervisors, and teachers to realize management and learning based on the world of work.
c. Strengthening the competencies of non-technical skills (soft skills) and technical skills (hard skills) of students in accordance with the needs of the workforce.
d. Realizing data-based planning through school-based management.
e. Increasing efficiency and reducing complexity in schools by utilizing digital paltforms.
f. Improving the facilities and infrastructure for student learning practices that meet world of work standards.
g. Strengthening partnerships and collaboration between the Ministry of Education and Culture and the workforce in development and mentoring.

The SMK-PK program is a manifestation of the enhancement of vocational education as a strategy for the development of human resources (HR) in Indonesia. SMK-PK is a comprehensive breakthrough aimed at addressing the challenges in improving the current conditions of vocational schools to better align with the needs of the workforce (Mendikbud, 2018), (Sutadji et al., 2022). The advantage of vocational schools is that student are provided with opportunities to engage in direct practical learning in the business and industrial world (DU/DI), commonly refereed to as work practice for students, generally known as Industrial Work Practice (Prakerin) (Bidandari et al., 2024). Teachers play a special role in the learnig process, as they must be able to manage learning using available technology, conduct reflections, and make improvements so that students are motivated to enhance their learning outcomes (Satriyanto, 2023).

SMKS Yabhinka Cilegon is one of the private vocational schools that received assistance from the government in the form of a vocational school program matching in June 2024. By implementing the governance of the vocational school program, and its position in a strategic industrial area, this school has a great opportunity to equip students with relevant skills. This research to analyze the governance of the vocational school program at SMKS Yabhinka Cilegon, particularly in enhancing students competencies to face the challenges of the Industry 4.0 Era, and is expected to provide a comprehensive overview of the programs effectiveness as well as recommendations for further development for future research.

RESEARCH METHOD

This research employs a qualitative approach using a case study method. Data were collected through interviews with teachers, students, and industry represntattives, direct observations at the school, and analysis of documents related to the Vovational High School Center of Excelence program. Data analysis was conducted using a thematic approach to identify the main themes related to the implementation of the program and its impact on student competencies (Creswell, 2013). This research utilizes a qualitative research design with a case study approach (Sugiyono & Budiyono, 2015). This approach was choosen as it allows for an in-depth investigation of the implementation of the Independent Curiculum in the Vocational High School (SMK) Center of Excellence, focusing on the specific school context.

This research was conducted by SMKS Yabhinka, which received funding assistance for the vocational school center of excellence by implementing an Independent Curriculum. The research location was chosen based on the consideration that the Center of Excellence Vocational School represents vocational schools that emphasize the development of the excellence in various fields of expertis.

Data resource

1. Main Respondents: Teachers and school staff involved in the planning and implementation at the Center of Excellence Vocational School.
2. Additional Respondents: Students participating in the SMK PK program.
3. School Documents: Curriculum planning documents, learning program documents, and documents related to the implementation of SMK PK.

Data Collection Techniques

1. Interviews: In-depth interviews are conducted with teachers, school staff, and students to gain insight into their experiences and perceptions of the implementation of SMK PK.
2. Observation: Direct observation is used to observe the process of all SMK PK activities that take place in the classroom and school environment, including interactions between teachers and students.

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3. Document Analysis: Documents used during the implementation process of SMK PK.

Preparation of Research Instruments

1. The interview instrument is designed to cover questions related to the planning and implementation of SMK PK, stakeholder perceptions of the advantages and obstacles of implementation, and their impact on student learning.
2. Observation instruments include observation guidelines designed to record interactions in the learning process, use of technology, and development of student skills.

Research Procedure

1. Identify the location of the research and select respondents.
2. Conduct interviews with teachers, school staff, and students.
3. Direct observation of the learning process in the classroom.
4. Analysis of documents related to the planning and implementation of the SMK PK Program.
5. Processing and analysis of collected data.

Data analysis

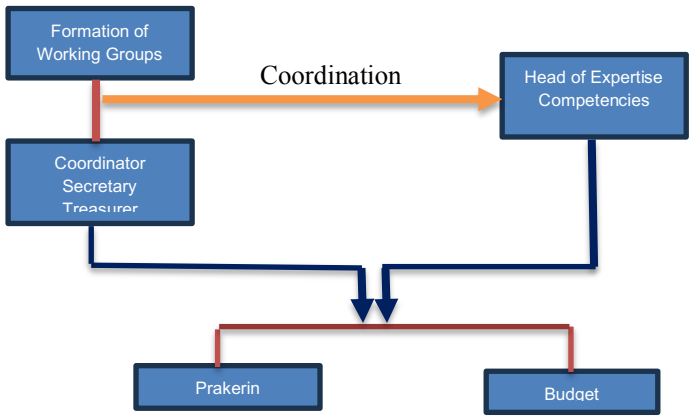
The collected data will be analyzed qualitatively. Data analysis includes the identification of themes, patterns, and key findings that emerge from the results of interviews, observations, and document analysis. The results of the analysis will be used to formulate research findings. This research method will provide a deep understanding of SMK PK, including the challenges faced, its impact on student learning, and the perception of related stakeholders. It is hoped that the findings of this study will provide valuable insights for education stakeholders and contribute to better understanding the implementation of SMK PK.

RESULTS AND DISCUSSIONS

The SMK PK program is a vocational school development initiative that focuses on special competencies to improve school quality and performance (Satriyanto, 2023). This is strengthened through partnerships and integration with the business world, industry, and employment, making vocational schools a driving force in improving the quality and performance of other vocational training institutions. SMKS Yabhinka was selected to carry out the SMK Center of Excellence program with a focus on the Robotic Welding Expertise Program. This expertise program is a challenge as well as a motivation for schools, as well as encouraging the preparation of the younger generation to become a superior and competent workforce in the robotic welding industry (Damar Fatika Sari, 2023). In addition, welding skills programs change the learning system in schools that require more practice than theory so that graduates have high competitiveness and have the skills needed in the industry (Punuh et al., 2023). To realize this, support and cooperation from various parties in the school are crucial to achieve the goals that have been set (Hanafiah et al., 2024)

A. Planning for the Implementation of Curriculum Management for SMK PK Robotic Welding Expertise Program

Planning is considered an important management function and is closely related to all other management functions. This is because the plan includes everything that is a comprehensive guideline in carrying out all organizational activities (Hanafiah et al., 2024). The following are the steps in planning the implementation of the curriculum management of the SMK PK Robotic Welding Expertise Program revealed from the results of the research. The planning process begins by compiling the Operational Curriculum of the Education Unit (KOS), which allows the implementation of educational programs in accordance with the characteristics, potential, and needs of students. This allows for education focused on the school environment and enriches existing local excellence. The initial stage of preparing this KOS can be seen in Picture 1 below:



Picture 1 : Stage of Preparation of the Operational Curriculum of the Education Unit

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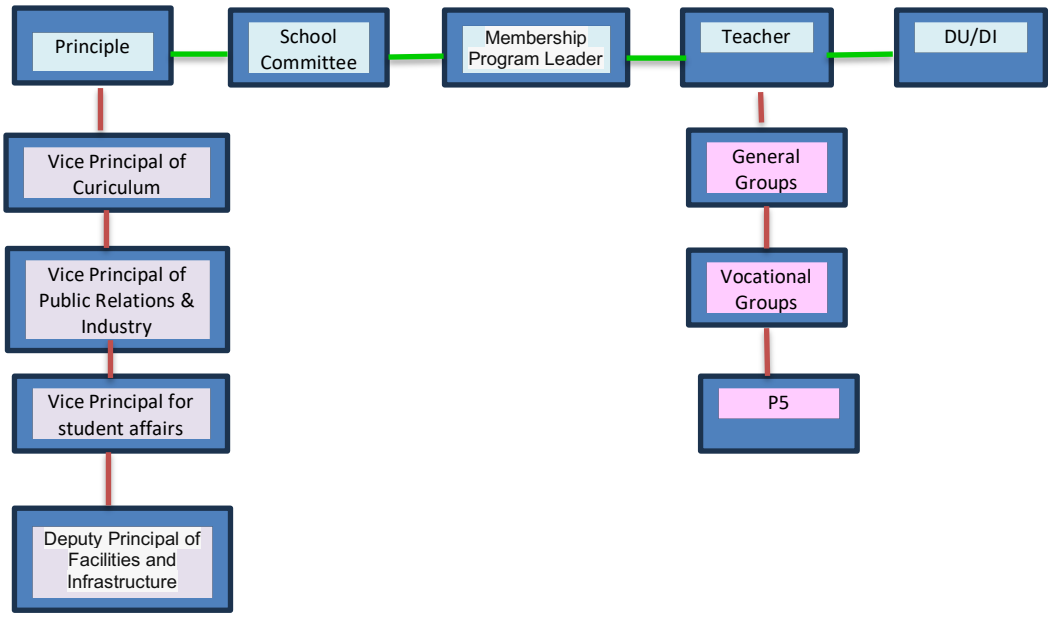
The working group is formed based on its responsibilities related to the prakerin curriculum (industrial work practice). The formation of this group is intended to study the needs of the prakerin along with the budget needed to finance the preparation of the KOS. Realizing the results of this working group coordination, several teachers were subsequently appointed to participate in special training at CV. Anugrah who allocated 74 JP (Lesson Hours). After participating in the training, knowledge was disseminated back to the teachers of SMKS Yabhinka Cilegon, especially those who teach in class X, which was then adjusted to the SMK PK activity program. The series of activities carried out in Compiling the Education KOS include:

1. In House Training
2. Workshop on Alignment with Industry
3. Making Modules and Teaching Materials

The curriculum of SMKS Yabhinka was developed based on several principles, including: 1) strengthening faith, piety and noble morals, 2) strengthening overall skill development, 3) the need for future skills, and 4) paying attention to the dynamics of global development and the socio-cultural conditions of local communities. This curriculum is prepared according to the characteristics, potentials and needs of students and has been approved by the School Committee. The development of the curriculum at SMKS Yabhinka has referred to the content standards and graduation standards and used the curriculum development guidelines prepared by the Ministry of Education, Culture, Research, and Technology.

B. Management of the Curriculum for Vocational High School PK Welding Expertise Program

After completing the training phase for several teachers, the next step is to manage the resources and facilities that will be used. Management is a process or series of stages that is carried out systematically and structurally to plan, organize, analyze, and establish planning (Diana, 2023). Management of the team involved in the development of the Curriculum Management for the Vocational High School PK Welding Expertise Program as shown in Picture 2 below:



Picture 2 : Curriculum Governance

C. Implementation of the governance of the SMK PK Curriculum Robotic Welding Expertise Program

After The teaching and learning process at vocational schools is designed to be more focused on the practical application of knowledge and skills relevant to a particular field of work, so that students can be better prepared to directly enter the job market after graduation. The implementation of the curriculum governance of the SMK Center of Excellence for the Robotic Welding Expertise Program that must be present includes:

1. Preparation of Teachong Tools Teaching tools are one of the important things that need to be prepared before starting a learning activity. Teaching tools consist of various kinds of teaching materials and can be understood as teacher guidelines that can support teaching and learning activities. This tool must at least include learning objectives, materials, methods, sources, and assessment of learning outcomes.

2. Learning Process and Assessment

Learning is a process of educational interaction that takes place between teachers and students in the classroom. The learning process includes two activities, namely the learning process and the teaching process. This means that the learning process is always an interaction process between two human elements, namely students as learners and teachers as teachers. The learning process contains various learning contents, including facts, principles, concepts, and procedures. Furthermore, learning assessment is an integral part of the entire learning process, so teachers should carry out assessment activities throughout the learning process. The advantage of the assessment itself is that it can provide a complete picture of the learning objectives of how to improve students' knowledge, understanding, attitudes and progress in the learning process.

3. Learning outcomes

Learning outcomes are an expression of educational goals, which show what students will know, understand, and be able to do after completing a learning stage. Learning outcomes are skills acquired through the internalization of knowledge, attitudes, skills, abilities, and the accumulation of work experience.

4. Street Vendor Activities

PKL (Field Work Practice) is a learning system that takes place in a company and industrial environment, in addition to the teaching and learning process in schools. Street vendors are companies and industries that collaborate with schools, and the interaction of street vendor activities for companies is by receiving worker assistance from students who practice for free. Street vendors are carried out by considering the world of work, so that students can accept and develop practice plans according to local conditions.

D. Evaluation of Curriculum Management Governance of SMK PK Welding Expertise Program

Evaluation of the implementation of curriculum management at SMK PK, SMK Yabhinka is divided into two categories, namely learning evaluation and curriculum evaluation. Learning evaluation aims to obtain data and information about the scope and implementation of the learning process. Some of the aspects that are the focus of learning evaluation include: (1) the readiness of learning tools prepared by teachers, (2) the learning process which includes daily exams, assignments, midterm exams, final semester exams, fieldwork practices, and skill competency tests (Du/Di/LSP); (3) students' perception of the learning process; (4) the role of IDUKA in the implementation of the curriculum; and (5) the views of the parents of the learners regarding the development of their children. The evaluation process involves various parties, ranging from the principal, deputy head of curriculum, IDUKA, parents of students, to students who are the main subjects. Evaluation of the operational curriculum at SMKS Yabhinka Cilegon is carried out periodically every year. The goal is to make the necessary improvements immediately to answer the needs of the industry. A fundamental question that often arises in curriculum evaluation is "What are the main needs of the industry today?". At the end of each semester, the curriculum evaluation team evaluates learning achievements. The sources of information used in curriculum evaluation include various assessment data, such as student assessment results per semester, student portfolios, graduate surveys, and reflections on the learning process conducted by IDUKA.

Strategies carried out in realizing the Center of Excellence of Vocational High Schools to carry out educational innovations:

1. Improving the competence of vocational school teachers through training, upskilling, and reskilling

Training for vocational school teachers at SMKS Yabhinka is intended for vocational school teachers who have a background in technical education and teach productive subjects at vocational schools. The goal is to support the teaching factory at SMK, which is a series of stages towards SMK PK. Upskilling is an effort to improve skills or expertise and knowledge for vocational school teachers who have a scientific background in the field of Engineering that is relevant to the work or career they are currently living. Upskilling is carried out by vocational school teachers, namely participating in certain trainings, courses, and skill certifications that are intended to upgrade job skills and knowledge that are adapted to technological developments and the demands of the ever-changing job market. Training activities are given to productive teachers who have expertise in the vocational field. This is intended to further improve the ability and quality of these teachers in carrying out learning activities at Vocational High Schools. However, in the 2021 industry-standard vocational teacher upskilling and reskilling program, teachers who want to take part in these activities must have an account registered on the PKB driver's license. SIM PKB is one of the services used by the Ministry of Education and Culture to carry out professional and sustainable development management for teachers and education personnel under the auspices of the Ministry of Education and Culture (Bidandari et al., 2024). Industrial internships aim to increase the relevance of the competency of productive teacher skills carried out by the teacher through the development of science and technology in the business world and the industrial world. In this industrial internship activity for vocational school teachers, teachers can have the opportunity to learn directly in the business world and the industrial world with guidance from trusted experts so that teachers can know in detail and practice in the field, not just theory.

2. Prakerin Activities for Vocational Students

Prakerin or industrial work practice is a development activity for students and a mandatory program at the vocational school level. This activity is a training and learning that is carried out directly in the business world and the industrial world. Prakerin is part of the curriculum that applies in Indonesia at the vocational education level. This program aims to allow students to gain direct work experience in the industrial world or the business world, which is commonly called the business world and the industrial world. In addition, they also acquire practical skills that support knowledge and work experience that are relevant to their field of expertise or specialization at SMK. So that students are expected to be ready to face the world of work with competencies that have been adjusted to the job market of the business world and the industrial world, which is often referred to as link and match. The Link and match system aims to reduce the gap between theoretical knowledge gained in school and practical application in the professional world. This concept is an equitable distribution or synchronization of the curriculum in schools that is adjusted to the business world and the industrial world. This is intended so that the implementation of the curriculum in vocational schools can meet the national target where vocational school graduates can fill the world job market.

3. Optimizing the Role of the Special Job Exchange (BKK) in the Vocational Center of Excellence in the acceptance of vocational school graduates in the business and industrial world.

Vocational high schools are focused on training students to face the future job market, the needs of leading companies in the market, and competition for skilled workers or personnel (Vachruddin et al., 2023). Education and Culture No. 080/U/1993 concerning the Vocational School Curriculum as amended by the 1999 Edition of the Vocational School Curriculum, called Prakerin. The purpose of organizing this Prakerin is to produce a skilled and professional workforce that has knowledge and skills supported by a work ethic that is in accordance with the business world and the industrial world. The Special Job Exchange (BKK) is a unit in secondary education, college, and job training institutions that provide employment services to help serve job seekers, especially alumni. Therefore, vocational high schools in Indonesia are dedicated to preparing students to become workers and develop their professional attitudes. Cooperation with industry is considered very important, because it is related to technological developments, so that schools participate in innovation and collaborate gradually. This is because the industry has collaborated with schools to produce graduates who meet their needs. This form of cooperation is considered the most effective because it is mutually beneficial for schools and industry.

The results of the study show that the governance of the SMK Center of Excellence program focuses on strengthening the curriculum, developing technological facilities, and improving teacher competence. The main challenges faced are limited resources and obstacles in carrying out sustainable cooperation with industry.

1. Curriculum Reinforcement: The program introduces subjects relevant to the latest technologies, such as programming and automation, tailored to the needs of the industry (Suaduon et al., 2024). Good education begins with the formulation of a well-planned and mature curriculum so that its implementation is in accordance with expectations. The curriculum is a learning plan. In other words, the curriculum is an educational or learning plan (Dianto & Mulyani, 2024). The curriculum determines the material taught in the classroom. The curriculum also affects the speed and teaching methods used by teachers to suit the needs of students (Hasanuddin et al., 2024). The curriculum can be said to be the essence of the implementation of education which includes how education is implemented, what the content of the educational process is, what goals are to be achieved, how to achieve it, who organizes it, and how to improve the quality of education (Hanafiah et al., 2024).
2. Technological Facility Improvement: Vocational schools involved in this program receive assistance with technological facilities, although some schools still need additional support to meet industry standards (Sanktiaji, 2024).

In this SMK PK program, SMKS Yabhinka received 2 machines, namely:

a) CNC lathe machines

Namely machines that are generally used to make / produce objects in the shape of a circle with Outer Diameter (DL) and Inner Diameter (DD) sizes with precision. CNC lathe (Lathe CNC) is a lathe process using a CNC lathe machine is carried out using standard codes. The codes used to operate CNC lathes are G-code and M-code. CNC lathes have the same axis as conventional lathes, namely the X-axis and Z-axis. Some of the advantages of using CNC lathes are as follows:

- The production will be uniform in both shape and size.
- Tolerances can be adjusted to operator expectations.
- Fast work process so that it can save work time.
- The cost of the dakan process is getting cheaper.
- CNC lathe tool uses Insert, much more economical than conventional lathe tool.

Just like the lathe process, the codes used to operate this CNC milling/milling machine are G code and M code. In a milling machine, there are 3 axes that can move simultaneously, namely X, Y and Z axes. The Z axis of its orientation is the same as the rotation of the spindle, the X axis with the direction of horizontal motion and the

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Y axis which follows the rule of the right hand so as to form the XYZ axis system to express the translational movement of the tool.

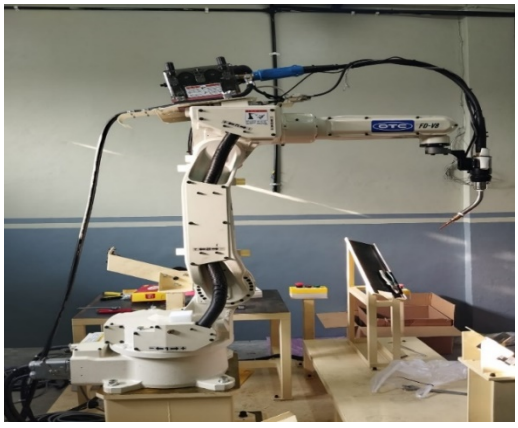
Picture 3 : CNC Lathe Machine

b. Robotic Welding

Robotic welding is a welding process that uses robots to assist in the welding process. The function of robotic welding is to simplify and speed up the welding process.

The benefits of robotic welding include:

- Saves labor costs
- Saves materials
- Improve welding quality
- Increase productivity
- Reduces the risk of accidents
- Improve security



Picture 4 : Robotic Welding

c. Cooperation with Industry

In the implementation of SMK PK, SMKS Yabhinka has carried out industrial cooperation with several companies, including: PT. Charged, PT. Daekyung, PT. Unggul Semesta, CV. Anuggrah, PT. Denso, PT. Surya Sarana Dinamika (SSD) and PT. Spectrum Unitec. From some of these companies, there are those who accept interns, teacher internships in the industry and there are also for the recruitment of employees, both students and alumni. Most of the grade XII students are included in internships and take recruitment tests, to meet the needs of the industry according to the required competencies. Until now, many alumni of SMKS Yabhinka have been accepted to work in various national companies in Banten province with positions as operators, welders, production personnel, administration and others.

CONCLUSION

The Governance of the Center of Excellence Vocational School Program plays an important role in improving student competence in accordance with the needs of industry 4.0. The program has succeeded in improving students' technical skills, but requires further support in terms of facilities and more intensive industry cooperation. Based on the results of the research, it can be concluded:

1. Central Vocational School Program Governance.
   The governance of the Center of Excellence Vocational School program at SMKS Yabhinka Cilegon has been designed in a structured manner through good collaboration between the school, the business world/industrial world (DUDI), and the government. The program includes industry-based curriculum planning, teacher competency improvement, and the procurement of modern technology-based facilities.
2. Improving Student Competence.
   The implementation of this program has succeeded in improving student competence, both in terms of technical and non-technical skills. Students are not only equipped with practical skills according to industry needs, but also with soft skills such as communication, teamwork, and adaptation to digital technology.
3. Relevance to the Industrial Era 4.0.
   This program is relevant to the needs of the Industry Era 4.0 because it emphasizes the integration of technology, automation, and AI-based applications in learning. The collaboration with DUDI also ensures that the skills taught are in line with the current labor market trends and needs.
4. Challenges and Recommendations
   Although the program has shown positive results, there are several challenges such as limited funding, teacher readiness to adopt technology, and lack of participation from several industry partners. Therefore, it is recommended that schools continue to increase teacher capacity through intensive training, expanding networks with industry, and optimizing existing resources.

Overall, the Center of Excellence Vocational School program at SMKS Yabhinka Cilegon has made a significant contribution in improving student competence, making them better prepared to face challenges and opportunities in the Industrial Era 4.0.

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