

# Smart Innovation Vocational High School

## Preparing Graduates Skilled and Ready to Work

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**Abstract**—Facing the fourth industrial revolution (industry 4.0), Indonesia must be prepared to make major changes to the national manufacturing sector. For this reason, new approaches and abilities are needed in building innovative and sustainable production systems especially for vocational education. The type of research used is quantitative, using quantitative and mean descriptive analysis. The results showed: 1) requires that the practical Instructor must have experience working in the industry; 2) plan instructor development to have knowledge, skills, attitude in accordance with the demands of work and technology; 3) upgrade machinery and practical equipment; 4) cooperate with related industries in planning, implementing and evaluating student products; 5) evaluate and improve student products continuously; 6) increase creativity and innovation of student products according to market demand; 7) produce marketable products and display it in school showrooms; 8) increase the time and quality of industry work practices in the industry; 9) cooperating with industry in conducting quality control of student products; and 10) sell student products.

**Keywords**—learning difficulties; learning saturation; competence; students

### I. INTRODUCTION

Facing the fourth industrial revolution (industry 4.0), Indonesia must be prepared to make major changes to the national manufacturing sector. New approaches and abilities in building innovative and sustainable production systems are needed [1]. The aforementioned demands are very contradictory to the reality faced by the recent World Bank research which states that Indonesia needs 45 years (almost half a century) to catch up in education and need 75 years to catch up in the field of science. While Indonesia's competitiveness in 2017 is still ranked 36th out of 137 countries. This condition makes us unable to compete with other countries that first invest in human resources that use more creativity in creating and designing internet and digital applications [2].

The fourth industrial revolution that is all automation where human labor is replaced by machines capable of increasing economic growth. But on the other hand, automation increases inequality in labor problems that result in the economic sector itself because work does not only rely on muscle but has begun to demand intellectual use and thought only [3]. The Government of Indonesia through the Ministry of Industry conducted four strategies to face the fourth industrial

revolution. One of them is to encourage the workforce in Indonesia to continue to learn and improve their skills to understand the use of the internet of things technology or integrate internet capabilities with production lines in the industry. To support this step the government made a link and match program between vocational high school and industry. The aim of this program is to prepare skilled workers who are ready to work in the industry with a target of 1 million people by 2019 [1, 3]. Consequently, new approaches and abilities are needed to build innovative and sustainable production systems.

In order to build an innovative and sustainable production system, it is very necessary that workers are ready to use. The many demands of the workforce in the fourth industry, Irianto (2017) simplifies the challenges of industry 4.0, which are; 1) industrial readiness; 2) trusted workforce; 3) ease of socio-cultural arrangements; and 4) diversification and job creation and industry 4.0 opportunities, namely: a) ecosystem innovation; b) competitive industrial base; c) investment in technology; and d) integration of Small and Medium Enterprises (SMEs) and entrepreneurship [4]. From the data above, trusted labor is still a problem in Indonesia. This condition can be seen from BPS 2018 data, where the number of labor force in February 2018 was 133.94 million people, up 2.39 million people compared to February 2017. From the data, the largest number of open unemployed graduates is at the level of Vocational High Schools (SMK) which reached 8.92%, and below the Diploma I / II / III level was 7.92% [5]. In other words, there is a supply of labor that is not absorbed, especially at the level of vocational education and Diploma I / II / III. While those with low education tend to accept any job [6]. The cause of the high contribution of vocational education to the number of unemployed in Indonesia, one of which is due to the low special skills and soft skills possessed by SMK graduates.

Facing the fourth industrial revolution, vocational education has to anticipate it from now on so that Indonesian workers are ready to face these changes and not to miss other countries. Some schools have made these innovations, among others, explained by Ulansari which explains the form of school-based information technology innovation in improving the quality of vocational education in the school, such as; 1) provide information technology-based education facilities; 2) developing the capacity of teaching staff in the field of information technology; 3) cooperation with the industrial world in providing information technology-based education

facilities; (4) utilizing Computers in Learning; (5) involving students in competitions in the field of information technology [7]. Viewed from the field of work in the industrial era 4 has many fields of work such as the following figure [8].



Fig. 1. Level industri 4.0.

## II. METHOD

This study uses qualitative research methods using a case study approach. The study was conducted in PIKA Vocational School Semarang. Collecting data using in-depth interview, participant observation and documentation. The object of research are smart innovations to prepare graduates skilled. Subjects of the research are the principal, Vice Principal of Practical Curriculum, teacher, instructor, students, industry partnership and documentation data. All the school personal become research sample except student and industry partnership that is taken by purposive sampling technique. Data were analyzed using qualitative data analysis interactive model of Miles and Huberman involving four research stages, i.e. data collection, data reduction, data display and conclusion drawing [9].

## III. THE RESULT OF THE RESEARCH

### A. PIKA Vocational High School (SMK PIKA)

PIKA Vocational School was founded on March 25, 1953 by Br. Joseph Haeken, SJ. By pioneering the machine shop with the name *Kebun Kaju*. It continues to evolve in accordance with its time and on August 4, 1988 changed its name to the Vocational School of Woodworking Technology (SMTIK PIKA) and June 24, 2018 the SMTIK was recognized by the Semarang City Education Office under the name PIKA Vocational School until now. At present the PIKA Vocational School is directed by FX. Marsono, SJ, M.Pd.

1) *Learning pattern*: PIKA VOCATIONAL SCHOOL has a blue logo with pictures of people tapping with the words Vocational School of Woodworking Technology. Learning from PIKA Vocational School implements 4 years of learning (class X - XIII). The first to third year students study at school and the fourth year students work in the industry for 9 months. The third year (class XII) of the first semester students have been practicing designing various forms of fast products using the AUTO CAD program intensively and in the second semester students did an internship at the PIKA Vocational School program for 6 months. During the internship the factory teaching was fully carried out. The fourth year (class XIII) the first 3 months students are introduced to CNC machines and produce using CNC machines. In the 4th - 12th month, internship students in the industry have cooperation with PIKA Vocational School. At present, PIKA's Vocational School collaborates with 28 local industries and foreign investment (PMA) as a place for student internship.

2) *Quality policy*: PIKA Vocational School has a quality policy abbreviated as 4C, namely: 1) Competence, which having technical stability, knowledge, reasoning skills and expertise in their fields; 2) Compassion, which respects human dignity and the environment; 3) Conscience, always strives for right and noble things and; 4) Commitment, able to discuss with a sharp mind on the urgent needs of the moment and fight for it [10]. The learning pattern of PIKA Vocational School from 1 to 4 can be seen in the following table:

TABLE I. LEARNING PATTERN AT PIKA VOCATIONAL SCHOOL

Class	Content of Learning	Develop student' abilities
X	Sense of Quality	Have sensitivity to the quality of work and products
XI	Sense of efficiency and productivity	Have sensitivity to work planning, both time and work
XII	Sense of teamwork	Have sensitivity in leadership and the will to will to work in team
XIII	Sense of entrepreneurship	Have sensitivity to independence and entrepreneurial spirit

Based on the learning pattern above the educational process at PIKA Vocational School can be seen in the following figure.

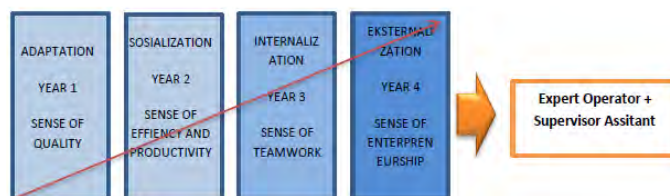


Fig. 2. Learning process at PIKA vocational school.

3) *Teaching and learning process*: The learning process at PIKA Vocational School consists of theory and practice with a ratio of 50:50. Learning theory and practice using a block system, with a learning time of 5 days per week. Sports lessons are conducted in the afternoon with the aim of refreshing students after being tired of practicing in the workshop. Student study hours on Monday-Thursday at 06.55

- 15.30 WIB and on Friday 06.55 - 16.00 WIB. At 06.55 WIB students must attend the theory and practice room in the education workshop. Students who arrived at 6:55 were declared late. At 09:40 WIB and 12.25 WIB (12.55 WIB on Friday) students are required to be in the theory room or educational workshop.

#### *B. Smart innovation SMK PIKA*

- PIKA's Vocational School develops continuously over time. Innovations that have been made are done to form a vocational production unit where students do the teaching factory in class XII semester 2. PIKA's industry has joined the production unit of PIKA Vocational School which accommodates a variety of outside work orders that must be trained by vocational students.
- PIKA Vocational School has a showroom that accommodates the work results of PIKA's Vocational and Academic students. In addition the results of the work of students of ASEAN Skills Competition (ASC) participants and Word Skills Competition (WSC) were exhibited at the PIKA Vocational School showroom.
- PIKA Vocational School is believed to be a training ground for ASEAN Skills Competition (ASC) participants and World competition skills (WSC) which are exhibited in PIKA Vocational showrooms in the field of joinery and cabinet making. When the study was conducted in late October and September 2018 the ASC championship was taking place in Bangkok Thailand on September 2 - 4, 2018. Through SMK PIKA Indonesia sent 2 participants to the ASC championship and gold and silver medals. Currently, Indonesia currently has 13 gold medals for ASC. At present PIKA Vocational School is training 4 students who will take part in the WSC which is planned for October 2019 in Kazan Russia. Of the 4 people who are practicing, only 2 people will take part in the competition: 1 joinery and 1 cabinet making field.
- PIKA Vocational School issues a Student Guidebook which contains all the rules that must be obeyed by vocational students and a Book of work practices in industry (Technical Worker) which contains rules that must be obeyed by students. BPS must be brought by students every day and if students make a violation it will be recorded in the book. Likewise with the apprenticeship book. Handling violations of students using the zero point system and zero minus hours, meaning that students who commit violations will be directly guided by looking at the number of points (a maximum of 20 points) or week, whichever is first achieved. Handling this way will make it easier for schools and teachers to conduct direct guidance to students who commit violations so that the number of violations can be reduced every week.
- Require practical instructors must have experience working in the industry. Instructors who work at PIKA Vocational Schools are required to graduate from PIKA Vocational School and have experience working in the furniture industry for at least 2 years [11]. The requirements of graduates of PIKA Vocational School are intended to have

instructors have a work culture that has been applied by PIKA Vocational School, such as discipline, thoroughness, hard work, responsibility, fast and correct work, etc. Whereas the work experience must be applied to prospective instructors because instructors who have work experience in the industry are expected to be able to produce products in accordance with industrial work culture such as using technology, thorough, skilled, hard-working, fast working, able to do quality control industry, etc. (figure-3).

- Planning instructor development to have the knowledge, skills, attitude in accordance with the demands of work and technology. Instructor development is carried out by giving instructors the opportunity to continue their higher education, sending instructors at domestic and foreign furniture trainings, inviting industry to provide trainings at PIKA Vocational Schools, etc. (figure-4).



Fig. 3. Instructors have experience working in the furniture industry.



Fig. 4. Instructors have knowledge, skills, attitudes in accordance with the demands of work and technology.

- Upgrade machines and student practice equipment. Engine upgrades are carried out by asking for help from machines from industry or from Switzerland and German countries in collaboration with PIKA Vocational School (figure-5).





Fig. 5. Upgrade machine practice.



Fig. 6. Evaluation of the results of class X students.

- Cooperate with related industries in planning, implementing and evaluating student products. PIKA's Vocational School involves the industry in planning curriculum until the product and its quality is produced by students. The purpose of the collaboration is to make the production produced by students in accordance with the wishes of the industry, market demand and selling.
- Evaluate and improve student products continuously. Evaluation is carried out in terms of product quality, such as fineness, the correctness of construction, appearance, etc. figure-6).
- Increase creativity and innovation of student products in accordance with market demand. Creativity is carried out continuously by looking at market demand. Students and instructors are asked to observe furniture models that the market wants. The production unit of PIKA Vocational School does not stockpile production but makes production according to market demand and is immediately sold.
- Produce products that are suitable for sale and displayed in school showrooms. Products produced by PIKA Vocational School's production units are directly displayed at the PIKA showroom for sale. In addition, PIKA's showroom also receives fast orders from the public directly or online (figure-7).



Fig. 7. Products of PIKA Vocational School are sold in showrooms.

- Increasing the time and quality of industry work practices (Industrial Engineering) in the industry. Class XIII students do industrial work practices carried out for 9 months in the furniture industry. Preparations have already begun in the second semester of the year (class XII) where students work for 6 months in the production unit of PIKA Vocational School and get an intensive design drawing lesson. In the first 3 months in class XIII students were trained in drawing and doing furniture production using CNC machines.
- Cooperating with industry in conducting quality control of student products. Product quality control at PIKA Vocational School is not only carried out by instructors and heads of vocational workshops, but also by the production unit of PIKA Vocational School. The aim is to maintain quality before the product is released.
- Selling student products. The product produced by PIKA Vocational School is a ready-to-sell furniture product. Which can be used according to their needs. Like guest chairs and tables, dining chairs and tables, cabinets, beds, etc.

#### IV. CONCLUSION

Automation in the fourth industrial revolution provides many advantages and convenience to humans. The perceived usefulness is an increase in the quality of life of the community due to the increasing income of the people with increasing world economic income. But on the other hand, automation increases inequality in labor problems that result in the economic sector itself because work does not only rely on

muscle but has begun to demand intellectual use and thought only. For this reason, the government has encouraged vocational education to improve the implementation of link and match between vocational education and industry to prepare skilled and ready-to-use workers. An important step that has been done by PIKA Vocational School in conducting smart innovation in preparing ready-to-use workforce is: 1) requires that the practical Instructor must have experience working in the industry; 2) plan instructor development to have knowledge, skills, attitude in accordance with the demands of work and technology; 3) upgrade machinery and practical equipment; 4) cooperate with related industries in planning, implementing and evaluating student products; 5) evaluate and improve student products continuously; 6) increase creativity and innovation of student products according to market demand; 7) produce marketable products and display it in school showrooms; 8) increase the time and quality of industry work practices in the industry; 9) cooperating with industry in conducting quality control of student products; and 10) sell student products.

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