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Implementation of the Quality Control Circle for Improvement of Painting Production in PT QWE

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ABSTRACT

As one manufacturing industry which has engaged in the textile industry and produced zippers, the painting process at zipped production has a number of problems, as on zipper sticks to each other, uneven paint, etc. In this discussion, the improvements that will be made are related to the painting process. Quality Control Circle (QCC) method is applied to reflect the support of the continuous improvement program in the company. The painting process is the finishing process of a zipper that serves as a coating to be resistant to corrosion and enhance the zipper appearance. The results of the study, it is found the main problem in the zipper painting process, which are Abbeku or sticking. This is due to the factors, such as machinery, methods, and materials. Of the three factors, there is one of the biggest problem factors, namely the position of non-standard spray gun. The focus of the improvement that will be made is the modification of the spraygun holder so that the fix position does not change. The results after an improvement in the modification of the spray gun holder are Abbeku (sticking) loss on the painting production which is originally 23 lots. As a conclusion, it eliminates the biggest loss factor in the painting process, replaced the position of the spraygun that is not fixed.

1. Introduction

Textile is one of manufacturing industry which have complex raw materials and manufacturing processes that mean the textile industry is particularly dependent on good process control to produce high and consistent product quality. Monitoring and controlling process variables during the textile manufacturing process also minimize waste, costs, and environmental impact. Process control in textile manufacturing provides an important overview of the fundamentals and applications of process control methods. Part one introduces key issues associated with process control and principles of control systems in textile manufacturing. Testing and statistical quality control are also discussed before consider to control in production and manufacture. As one textile industry, PT. QWE is one of company engaged and focused on zippers production. The production is carried out in two plans in Indonesia, namely Cibitung and Cimanggis. Both plans are developed by producing zippers. The business has

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begun in the production of chain and slider. The plans have varies in production quantity and market sales.

As the business developed, there were number of issues come out from both plans. Recently, in the Cibitung plan, they are focusing to solve the problem occurred in *Enameling line.* Along with the passage of time and the condition of the engine was getting older, in most of 19 years since the first installment. Lately, the product (output) from Enameling machines is coming out with varies of quality issues. In decreasing of quality issues which occurred on enameling production line, the company thru quality department was established the Quality Control Circle (QCC) [4 and 5]. Along with the existence of QCC activities or quality control groups, it's supporting the company's core value in explore and decreased the continuous neglected in manufacturing line, especially in enameling line. The QCC method was implemented to improve the production capacity and increase the quality in Enameling line, such as in processes stripes, bubbles, sticks, thin colors, etc. By implementing QCC, it's expected that the quality of the Enameling line will increase.

Thus, the authors will focus on the implementation of the Quality Control Circle method in improving the quality of Enameling production at PT. QWE. The method will be applied to solve the quality problems that occur in field of:

- High repainting and loss on the enameling line.
- High complaints related to the quality of production.

2. Definition

2.1 Quality

Quality has been defined by two experts in quality [1 and 2]. Both of them have explored the quality as a developed mind set in management studies, especially quality management. According to Juran [1], the quality is suitability for use (conformance to use). Juran's stated that a product or service should meet to the need, and what is needed or expected by the user or customer [1]. Furthermore, Juran's pointed out five dimensions of quality:

- Design: As product specifications.
- Conformance (conformity): Suitability between the design intent and the actual product delivery.
- Availability: Including aspects of trustworthiness, resilience, and the use of product availability for costumers.
- Safety (security): Safe and does not endanger costumers.
- Field use (practical benefit): Can be used and its use by costumers.

Meanwhile, Deming [2] argues that although quality includes conformity of product attributes to consumer demands, quality must be more than that. Deming stated 14 important points that could guide managers to achieve improvements in quality [2]:

- Creating certainty on the objectives of product and service improvement.
- Adopting a new philosophy where disability is unacceptable.
- Stop depending on mass inspection.
- Stop doing business on the basis of price.

- Remain and continue to improve the production and service systems.
- Institutionalize modern job training methods.
- Institutionalize leadership.
- Eliminate barriers between departments.
- Eliminate fear.
- Eliminate/reduce the number of objectives for workers.
- Eliminate management based on goal.
- Eliminate barriers that demean period workers.
- Institutionalize careful education and training programs.
- Create structures in top management that can carry out transformations as in the points above.

3. Research Methods

3.1 Quality Control Circle

According to [3] QCC is a small group of workers or employees who have the same or similar job, holding meetings to discuss and resolve problems in improving quality and production costs on a regular and continuous basis. The approach that is widely used by companies in improving quality is the Plan-Do-Check-Act (PDCA) cycle. This approach was introduced by [2], which consists of four main components in sequences:

- Plan: Determine or design what core problems will be faced and arranged based on the principles of 5W and 2H (What, Why, Who, When, Where, How, and How much) and set targets and targets that must be achieved with the SMART principle (Specific, Measurable, Attainable, Reasonable, and Time), namely focus, measurable, achievement of results, reasons, and scheduled times.
- Do: Carry out improvement activities and implement them in stages, evenly according to the capacity of each personnel.
- Check: Examine or examine whether the implementation is according to plan and monitor the progress of planned improvements. Then the tools used in checking are Pareto diagrams, histograms, and controlling diagrams.
- Action: Adjustments made based on analysis on the check component. Adjustments can be in the form of new standardization to avoid the emergence of the same problem again, or it can be a new goal setting for the next improvement. The quality of the business itself includes product quality, safety, and its impact on the environment. The basic concept of QCC is to explore the abilities of each worker.

3.2 Steps in Implementing Quality Control

To implement planning, controlling, and developing, the quality steps are needed as follows:

- Defining quality characteristics.
- Determine how to measure each characteristic.
- Establish quality standards.
- Establish an inspection program.
- Search for and correct causes of low quality.
- Continually make improvements.

3.3 Later in its Development

It was better known as the eight steps of quality improvement.

- Determining theme problems.
- Presenting data and facts.
- Determining the cause.
- Planning improvements.
- Repair.
- Checking repair results.
- Standardization.
- Planning the next step.

3.4 Systematics Research

Systematics research is carried out in this study by implementing the PDCA (determine and specify defect problem, calculation, Fishbone analyze (Ishikawa), and control charts (getting new production standard).

4. Results and Discussion

4.1 Improving the Quality of Painting in the Enameling Line

4.1.1 Analysis of the causes and effect diagram

Fishbone diagram in Fig. 1 shows the factors causing high loss *Abbeku painting loss*:

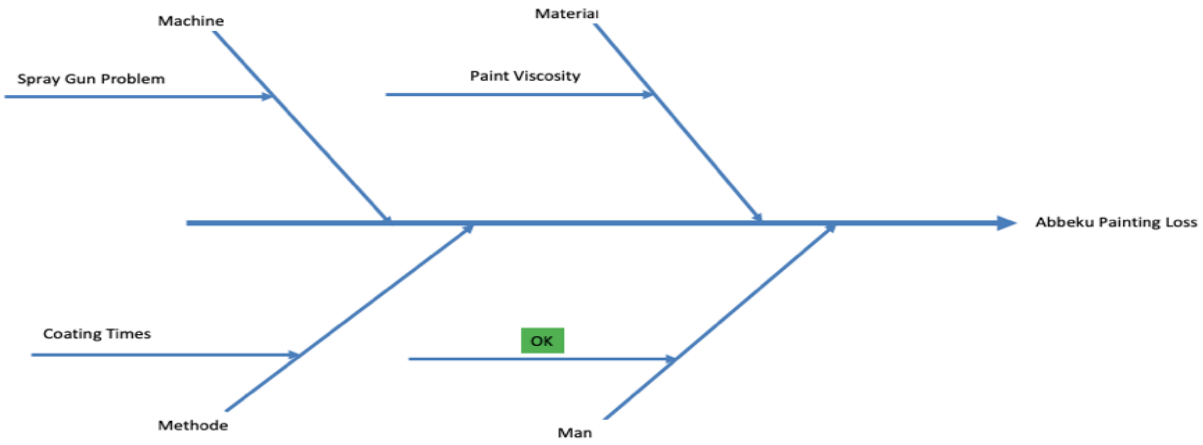

Fig 1. *Fishbone diagram.*

- Machine: Painting machine that is 19 years old is not a short age. Many minor and major damage. For example spray gun, exhaust, chiller, heater, etc.
- Method: Use and setting of paint, volume of spray gun cc / min, and barrel rotation still have variations of operators with one another.
- Material: Use of non-standard paint viscosity, especially operators the production of shift 2 and shift 3.

4.1.2 Losses factors of Abbeku in painting

Based on the fishbone diagram above, it can be determined the dominant causes of high repainting and loss painting by looking at work elements and time in Table 1 analysis of fishbone diagrams.

Table 1. *Analysis of fishbone diagram.*

No	Factor	Problem	Times
1	Machine	Spraygun position	11
2	Material	Paint viscosity	5
3	Method	Coating times	4

Pareto diagram that describes the comparison of each type of data to the whole. By using the Pareto diagram, which problem can be seen to be dominant so that it can know the priority of problem solving Pareto diagram function is to identify or select the main problem for quality improvement from the largest to the smallest [11]? Thus, a Pareto diagram come up, as based on the analysis of fishbone diagrams. This is to determine the work elements that are put on priority focus in response to the problem and in in other hands, that problem should be resolved immediately.

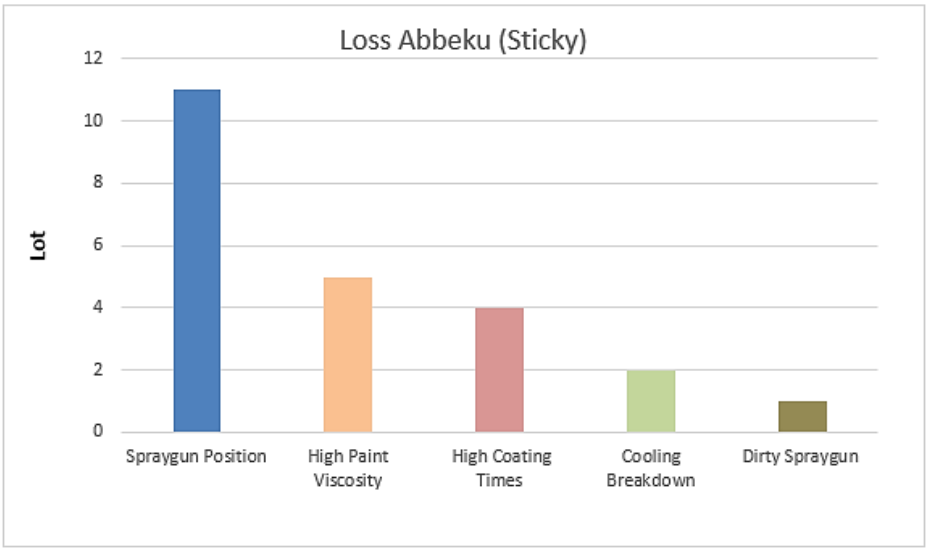

Fig 2. *Pareto diagram.*

In finding of the causes of high loss problem in the painting process; a dominant factor, by analyzing of total number problem which occurred in each factor. Thus, this is to facilitate the overcoming the priority problems to be addressed. From the Pareto data diagram above the engine factor, that is, machine painting is the priority with a number of problems which is more than 10 times while the other work element process varies. The problem of the painting machine which is breakdown based on the problem can be seen in Table 2.

Table 2. *Causes of Abbeku (Sticky) problems.*

No	Factor	Problem	Loss(lot)
1	Machine	Spraygun position	11
2	Material	High paint viscosity	5
3	Method	High coating times	4
4	Machine	Cooling breakdown	2
5	Machine	Dirty spraygun	1

Based on Tables 1 and 3, the problems were taken which had the highest problem as can be seen in Fig. 3. This is to facilitate the determination of the dominant problem and become a priority to overcome. From the table above, the highest amount of loss is the Spray Gun Position, which is 11 lots. Judging from the process allows for repairs. Then the prevention plan that will be carried out is to eliminate the problem in the position of the spray gun by modifying the spray gun holder into a non-sliding slide. With the hope that the position of the spray gun on the barrel is always the same it doesn't change so there are no more Abbeku sliders [6 and 7].

4.2 How to Reduce Loss of Enameling Line

4.2.1 Make an improvement plan

In this case, we make a plan for improvement and carry out these improvements and an improvement plan based on 5W + 1H (What, Why, Where, Who, When, How). The explanation of 5W + 1H can be seen in.

Table 3. *5W + 1H.*

No	What Problem	Why Hope	Where Location	Who PIC	When Time	How Activity
1	Spraygun position	Fixed spraygun position	Painting machine	Diky herdiawan	Apr-18	Modification spraygun holder

Based on Table 3 above, the problem faced is the position of the spraygun always changes in the hope that after repairs are carried out there will no longer be a sticky slider due to the position of the spraygun not suitable. The plan for repairs that will be done is to modify the spray gun handle so that the spraygun position is always the same without changing.

4.2.2 Implementing improvements

After planning improvements, the next step is to carry out repairs. Repair activities that will be carried out are modifications to the spraygun handle so that the position of the spray gun does not change. As for this step, we will discuss the conditions before and after repairs as shown in Figs. 3 to 7. The following spraygun position is correct.

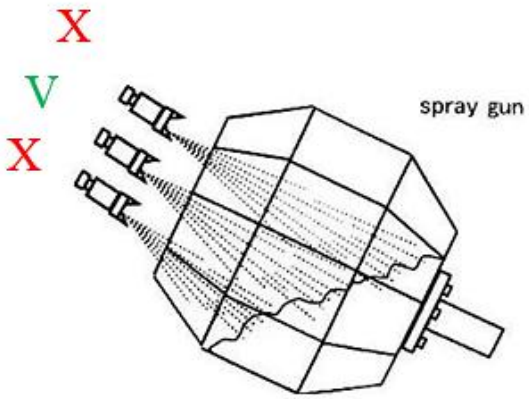

Fig 3. *Position of the correct spraygun.*

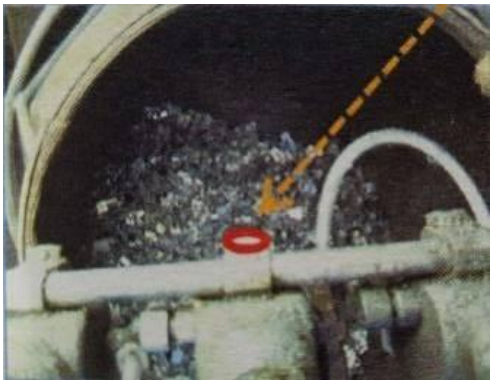

Fig 4. *The part to be modified.*

To modify the gun holder so that the gun position is always in place change. This is to eliminate the loss stuck on the slider. The modification of gun holders before and after is in Figs. 5 and 6 as follows.

Fig 5. *Before modification.*

Fig 6. *After modification.*

4.2.3 Results evaluation

After overcoming, the next step is to evaluate the results, the number of Abbeku loss (stuck) in the following month has decreased very significantly, especially for the problem of spraygun position. More details can be seen in the picture chart nine below

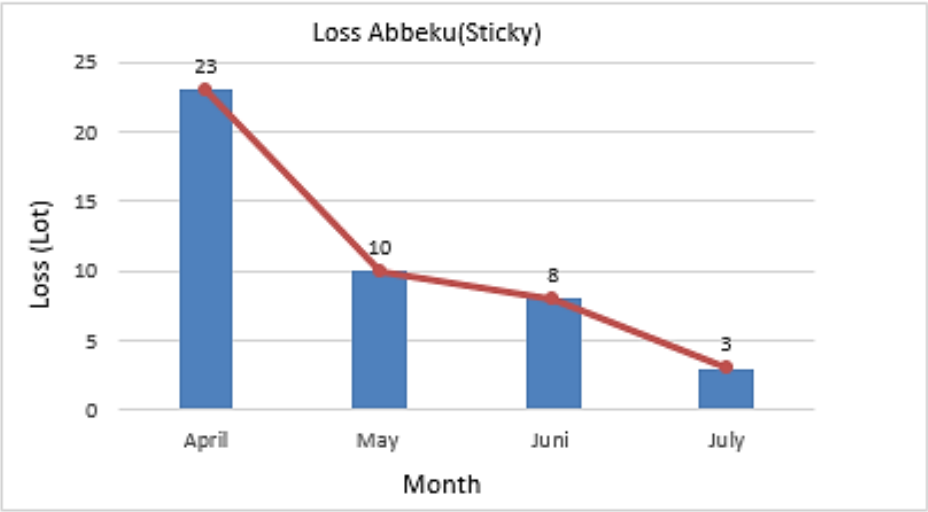

Fig 7. *Chart before and after repairs.*

Table 4. *Loss of May month after improvement.*

No	Factor	Problem	Loss(Lot)
1	Method	High coating times	4
2	Material	High paint viscosity	3
3	Machine	Cooling breakdown	2
4	Machine	Dirty spraygun	1
5	Machine	Spraygun position	0

After making improvements by making the gun position cannot change or fix the gun position. This can make the loss previously reached 11 lots to zero or 0 loss due to the problem of the position of the spray gun. By making a spray gun into a fix position. However, there are still many problems that must be done in the next upgrade.

4.2.4 Standardization

The new standardization of the work process is intended so that what has been improved on the spray gun holder in the painting process can be included in the work instruction so that new work standards with new processing time can be applied in the standard operating procedures of the painting production process. In this case, it eliminates the position of the spray gun because the position of the spraygun has been fixed cannot change. In the absence of loss sticking to eat productivity will increase.

As for making SOP (Standard Operating Procedure) and also WI (Work instruction) made by *foreman* known production and signed by section head and head department the relevant. So that this writing does not include the operational standards of procedures or work instructions. The factors that become standardized are as follows:

- Eliminating spraygun direction settings for goods product.
- Add check sheet for the spray gun holder.
- The work order of the operator must be in accordance with the work instruction.

5. Conclusions

From the analysis using the QCC, to increase productivity by eliminating loss of sticking with the position of the spray gun; this was summarized as follows:

- How to eliminate Abbeku (Sticky) loss? The problem of positioning the spray gun painting machine is to use eight QCC steps and some of the seven tools including tools, fishbone diagrams, and pareto diagrams, to find the dominant problem to be overcome, production agar painting can be reduced.
- By using tools, fishbone diagrams, and pareto diagrams. It was finally found that the cause of the high loss of painting production the most dominant was from machine factors, namely, position of spraygun.
- Ways to reduce loss in the painting process by improving the position of the spray gun that can be regulated by the operator to be a spraygun position that fixes and passes with the workpiece that will be in the painting process.
- In order to find out the dominant cause of spray gun position and overcome the need for careful analysis of existing conditions using tools QCC and involving the operator of the process painting.
- So that production loss is not the highest, in the next activity, there needs to be continuous improvement by looking at the work elements that have the potential to done improvement.

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