Analysis Of Product Quality Control Using Cause-Effect Diagram Method

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Abstract: Research entitled Analysis of Product Quality Control Using Cause-Effect Diagram Method was conducted at CV.Borneo Conblock Mandiri, located in Samarinsa city, East Kalimantan. Manufacturing is an industry that offers goods to customers. In this case companies engaged in manufacturing need to pay attention in product quality management in order to produce good products and increase costs. The purpose of this study is to determine the number and types of product defects and can provide recommendations for corrective actions as alternative solutions to overcome product defects. This study uses quantitative methods in the form of data presentation and qualitative data derived from in-depth interviews with managerial parties at CV. Borneo Block Mandiri. The results showed that the types of product defects that often occur are cracked, broken, and uneven surfaces with an average number of 4965, 2661, and 1660 per month, respectively. By using a cause-and-effect diagram, information on the causes of product defects is obtained. which includes raw materials, machines, people, methods, and the environment. The action that this research recommends is to focus on human and machine factors.

Keyword: Manufacture, Operation Management, Defective Product Management, Quality Control, Seven Tools, Cause-Effect Diagram, Human, Machin

1 INTRODUCTION

Manufacturing sector is one of the sectors that drives the Indonesian economy. It has important roles such as contributing to Gross Domestic Product (GDP), increasing investment, absorbing employment, and also increasing exports.(Carolina, 2017). Based on the 2016 International Yearbook of Industrial Statistics published by the United Nations Industrial Development Organization (UNIDO), Indonesia was included in the list of the top 10 largest manufacturing industrial countries in the world, ranking 10th. Then in 2017 it rose to rank 9 (UNIDO, 2016). Manufacturing is the activity of converting raw materials into products with a series of operating activities (Rusi & Muhammad, 2017). According to the International Conference on Production Research (CIRP), a series of related processes in the manufacturing process must involve design, material selection, planning, manufacturing production, quality assurance, management and marketing of manufactured products (CIRP, 1983). Quality is defined as the state in which the product meets customer requirements and is free from defects(Juran, 1998). Some of the problems faced in dealing with production quality are defects and product damage produced by the production department(Sreedharan V., R., S., R. Kannan S., S., P. & Trehan, 2018). Minimizing production problems will provide benefits to the company in the form of cost savings and an increase in industry income, or in other words increasing production operational efficiency(Shivajee et al., 2019). Quality control activities are intended so that the quality of the products produced is in accordance with what is desired, according to the standards set. The quality of the product received or perceived by the customer has a positive effect on customer satisfaction and purchase intention(Tsiotsou, 2006). In addition, product quality also has a close relationship with customer loyalty to the business and has a significant effect(Xhema et al., 2018). In a market with many competitors, where competitors also offer homogeneous products, there is a tendency to do "quality competition" over "price competition" to build a comparative advantage (comparative advantage).(Whang, 2017). So that quality assurance becomes an important point that needs to be considered, especially in manufacturing companies that produce goods. Therefore, in managing product quality problems, it is necessary to analyze the deviations that occur in the production process and look for the causes of product defects and a repair strategy is also needed as an effort to minimize product defects so that defective products do not recur (Matondang & Ulkhaq, 2018) . One of the methods that can be used to ensure the quality of manufactured products is quality control. Quality control activities are carried out by inspection or checking production output, whether the products produced are in accordance with existing quality standards(Walujo et al., 2020). This quality control aims to identify the type of defect and the cause of the defect (ARIFIN et al., 2019). One of the industries that need to do quality control is the paving industry. This industry produces products in the form of paving with various sizes and shapes. The paving standards that have good quality are having a pressure strength of up to 300 kg per cm2, not chipping, cracking, and not breaking (Prihatiningtias et al., 2014). CV. Borneo Conblock Mandiri is an industry engaged in the production of paving with various qualities, sizes, colors, and types. Paving produced is used as a floor for gardens, streets, sidewalks, parking lots and others. As an industry that produces products, this industry strives to produce quality products. Improving product quality can increase a company's income. Research conducted at CV. Borneo Conblock Mandiri, starting from before the production process, during the process and after the production process. This is done so that product quality can be achieved, so that product sales do not decrease, and company productivity can be maintained. The product is said to be of good quality if the physical form is not cracked or broken, the color is good, the surface is not chipped.

2 RESEARCH METHOD

Researchers recorded the average number of defective paving products per month at CV. Borneo Conblock Mandiri. The research was conducted in the production section of the holand type paving block 10.5x21x6 cm, 10.5x21x8 cm, 10.5x21x10 cm. Paving products are said to be defective if the product is cracked, broken, or the surface is uneven. In this study, researchers used Seven Tools to support the analysis of quality control. The problem in this research is how to determine the number of product defects that occur and what factors cause product defects and how to recommend optimal corrective actions to improve product

quality. Therefore, the main objectives of this study are as follows;

- To find out the number of defects in paving holand products in CV. Borneo Conblock Mandiri and find out the dominant cause of the product defect
- To provide optimal corrective action recommendations in order to improve product quality.

3 RESULTS AND ANALYSIS

The types of product defects in this study include cracked paving, broken paving and non-smooth or chipped surfaces of paving. From the results of observations obtained types of defects that occur and the number of defects as in the histogram and the following table:

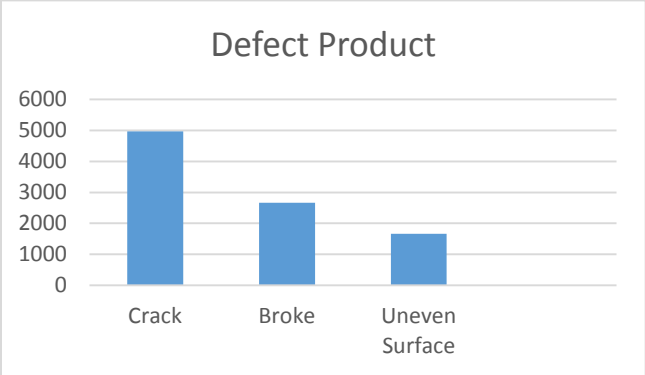

Figure 1. Histogram: Average Product Defects per Month

Products produced in a month an average of more than 50.000 units with average product defects per month more than 4.500 units.

TABLE 1.
AVERAGE NUMBER OF PRODUCT DEFECTS PER MONTH

Type of Disability	amount	Percentage (%)
Cracked	4965	53%
Broken	2661	29%
Chipped	1660	18%
Total	9286	100%

From the data in the histogram and the table, a causal diagram can be drawn in cause-effect diagram in Figure.2.

Cause effect diagrams or causal diagrams describe the relationship with the causal factors, the purpose of making this diagram is to find out the causes of defects so that later they can make the right decisions in making improvements. The results of the causal diagram are as follows:

1. Human
   Workers are an important factor in the production process but the workers themselves can also be a factor in the occurrence of defective products. This is because workers who feel bored with the work done and at the end of production hours, because they feel bored make the workers negligent in carrying out quality control. The workers also lack the initiative to check the moisture content in the dough, the dough is not wet enough causing the paving to be less dense so that the paving cracks.
   Pay attention to the machine when printing, less pressure makes the paving break. Workers also have to inspect the material before it is mixed into the mixer, this is a contributing factor, when the material contains dirt and the composition of the dough that is not right can make the product produced not in accordance with applicable company standards.
2. Machine
   Cleaning the rest of the production material must be considered, especially in the mixer section, the remaining raw material that hardens and sticks to the mixer makes the mixer's performance less than optimal, this is what makes the material clump. It is also necessary to pay attention to machine calibration to reduce the causes of underpressure and so that the machine is always in prime condition.
3. Method
   Supervision and work direction from the foreman to the operator is also very important, if the operator does not carry out in accordance with the foreman's directions, the resulting product may not be in accordance with company standards. Stacking paving during the drying process also needs to be considered not to overload the paving so that it often causes the paving to break during the drying process.
4. Raw material
   The causes of defects are raw materials that are not mixed evenly, sand mixed with mud, sand that is too wet, lots of roots and small debris are mixed in, and the mixture of materials does not match the predetermined composition. Workers should be more careful and pay attention to the material before entering the mixer so that the quality of the raw materials can be maintained and product quality can be achieved.
5. Environment
   The factory environment is dusty, making workers uncomfortable at work, this dust comes from materials scattered on the production floor. The high ceiling of the production area also causes splashing rainwater to wet the production floor and can mix with the material making the material wetter than normal. Water entering the production floor causes production activities to stop during heavy rains. Paving that has just been printed must not be directly exposed to water because it will cause cracks and chips on the product.

Corrective Action Recommendation

TABLE 2.
Recommendation for Corrective Action

Impact	Causative Factor	Direct Cause	Root Cause	Corrective Action Recomendations
	Human	Raw material mix	Lack of super vision	Added a foreman who focuses on overseeing the production process from the start until the end.
			Lack of initiati ve	Conduct pre-work and post-work briefing by the management for employees and evaluate the results of previous production.
	Machine	Material is not mixed well	Resid ual harde ned materi al in the mixer	All employees together clean the rest of the material on all production equipment 30 minutes before the break and the hour is over production.

Source: Data Processing

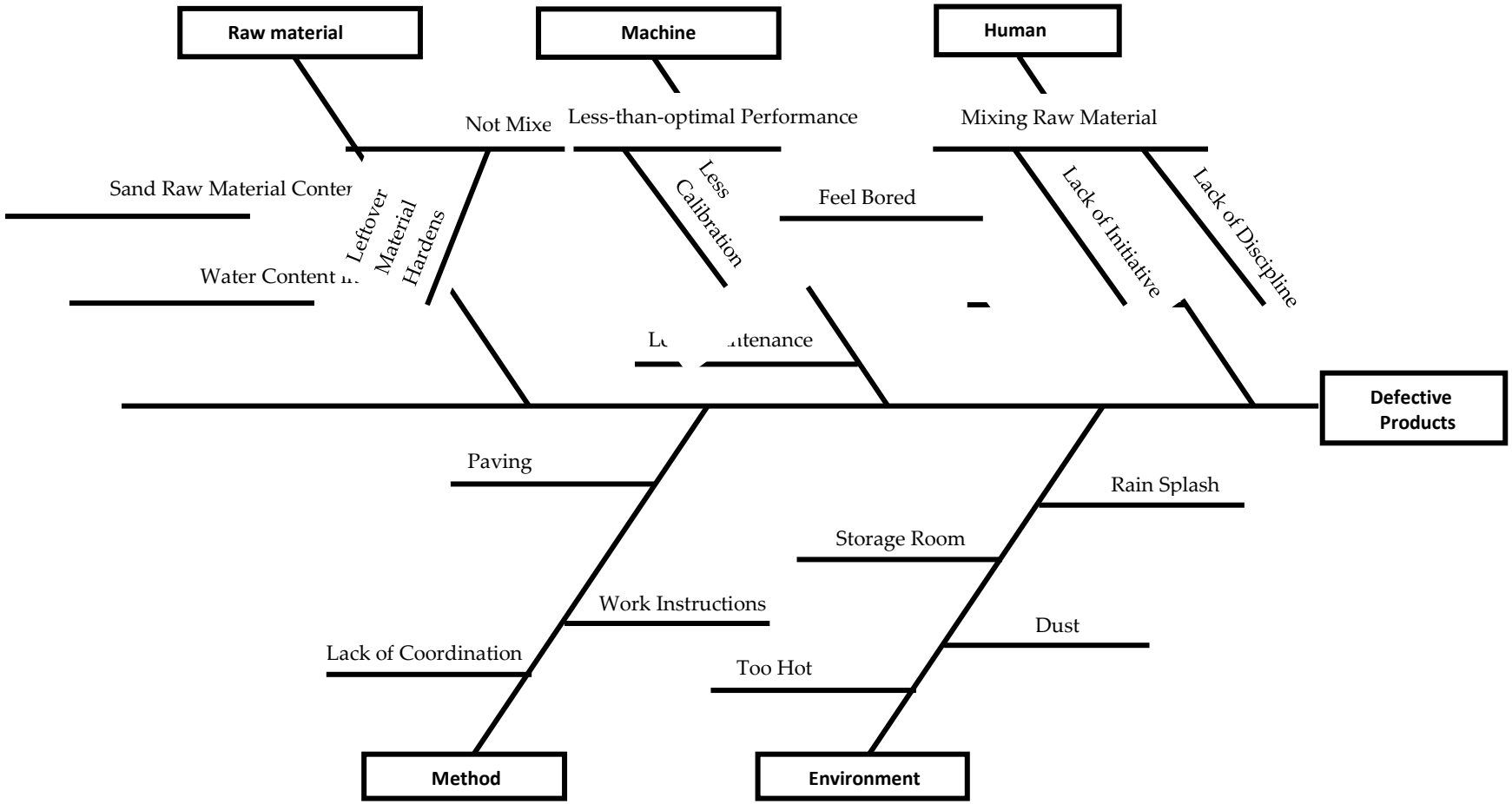

Figure 2. Cause Effect CV. Borneo Conlock Mandir

4 CONCLUSION

Based on the research that has been done, the following conclusions are obtained:

1. The number of defects in the production of Holand type paving cracks is 4965 units (53%), broken defects is 2661 units (29%), non-smooth defects are 1660 units (18%).
2. The main factors causing paving defects are human and machine factors. The human factor is caused, among others, because the mixture of raw materials is not properly inspected. less wet dough makes the paving less dense this causes the paving to crack. This is due to the lack of supervision and lack of initiative from the workers. The engine factor is caused, among others, because the material is not evenly mixed. The material is not mixed evenly because there is a lot of residual material that hardens on the production machine so that the performance of the machine decreases. Machines that are not calibrated make the machine's performance less than optimal, so that the pressure applied when printing paving is reduced. The proposed improvement is to add one more foreman as a supervisor in the production division, especially in the production process to better inspect the material before it is spilled into the mixer, providing an understanding to every employee that the achievement of quality must be done together. Conduct pre-production meetings by management and employees to set targets for the day and post-production meetings to evaluate production results on that day. Maintain cleanliness of tools and the environment after work in order to create a comfortable environment while working. Always pay attention to pressure, thickness before printing and after printing. Supervision on paving arranged in storage area. provide an understanding to every employee that the achievement of quality must be done together. Conduct pre-production meetings by management and employees to set targets for the day and post-production meetings to evaluate production results on that day. Maintain cleanliness of tools and the environment after work in order to create a comfortable environment while working. Always pay attention to pressure, thickness before printing and after printing. Supervision on paving arranged in storage area. provide an understanding to every employee that the achievement of quality must be done together. Conduct pre-production meetings by management and employees to set targets for the day and post-production meetings to evaluate production results on that day. Maintain cleanliness of tools and the environment after work in order to create a comfortable environment while working. Always pay attention to pressure, thickness before printing and after printing. Supervision on paving arranged in storage area. Maintain cleanliness of tools and the environment after work in order to create a comfortable environment while working. Always pay attention to pressure, thickness before printing and after printing. Supervision on paving arranged in storage area. Maintain cleanliness of tools and the environment after work in order to create a comfortable environment while working. Always pay attention to pressure, thickness before printing and after printing. Supervision on paving arranged in storage area.

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