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Analysis of Roof Tile Defective Products Using the Seven Tools Method in PT. XYZ

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ABSTRACT

Objectives*: This study aims to analyze and reduce the number of defective products produced by PT XYZ which is 3% per month. This research uses a quantitative descriptive method as a method used to find the root causes. The purpose of this study is to determine the number of defective products that occur, the factors that cause them, and provide recommendations for improvement to improve the quality of roof tile products.*
Methodology*: This research uses the Seven Tools method which includes check sheets, histograms, control charts, pareto diagrams, and fishbone diagrams to identify and analyze the causes of defective roof tile products.*
Findings*: Check sheets help in the collection and analysis of defect data. Stratification shows that the most common defect is Face Crack, which accounts for 39.01% of the total defects.*
Conclusion*: The pareto diagram shows that Face Crack and Lap Fault are the two most dominant types of defects. The histogram shows that the total product defects are 113,138 for the Face Crack category. The control map shows that the dominant product defects are outside the control limits, indicating the need for improvements to the production process. The fishbone diagram identifies the factors affecting product defects are human, machine, environment, and material.*

Keywords*: Defect; Seven Tools; Quality.*

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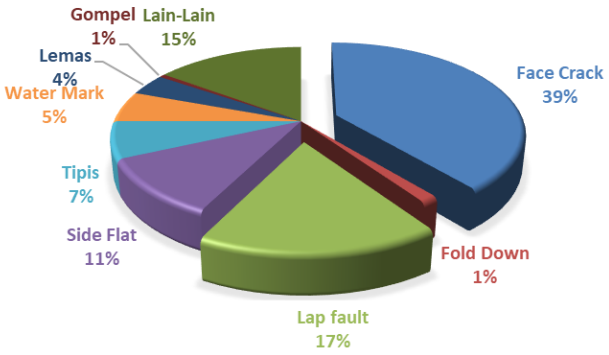
INTRODUCTION

PT XYZ is one of the companies engaged in the roof tile manufacturing industry. The process of making roof tiles goes through various stages of production, starting from mixing raw materials, molding, measuring, heating (oven) to drying.

In the production process, PT XYZ produces roof tile products with asbestos-based materials and cement paper on a wide scale and always makes quality a top priority in an effort to produce high quality products. However, until now there are still defective products found during the production process. In the production of roof tile products during March 2022 to February 2024, production defects were still found with a percentage of defects exceeding the tolerance limit set by the company of 3% each month. Data on the number of production and defective products in March 2022 - February 2024 can be seen in table below:

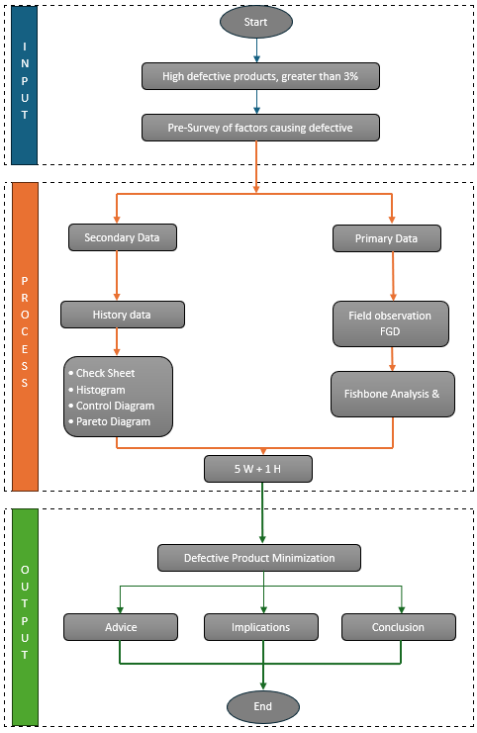


Data on the amount of production each month is not always the same because production is determined based on estimated demand from consumers or influenced by available stock. In accordance with the quality guidelines at PT XYZ that production is said to achieve good quality if there is conformity between production results and the targets set by the company where product defects each month are no more than 3% of the total production. However, the reality in the field shows the sorting results for the production of March 2022 - February 2024 which explains the total defective products that occur in roof tiles.

LITERATURE REVIEW

Framework

This framework focuses on theory development and data analysis of defective products. This research uses a theoretical analysis approach and a field study. The results of this research are expected to contribute to the development of theory and practice while helping the sustainability of the company with the innovation for the product, this is in accordance with sustainable goal number 9 which is Industry, Innovation and Infrastructure.



Check Sheet

A check sheet is a sheet for collecting and analyzing data presented in a table. The table contains production data and the number of products that do not meet specifications. Making a check sheet aims to facilitate data collection, analyze data, and find problems with the types of causes of problems (Devani, 2016). In addition, the inspection sheet is loaded in a table that contains communicative information. (Tasman, 2016).

Histogram

Histogram is a statistical tool used in organizing data for analysis. Histograms include a type of bar graph in which the data grouping is categorized based on a certain range (Rodiah, 2019). Meanwhile, according to Rani and Setiawan in (Kamal & Sugiyono, 2019) histogram graphs are data expressed in the form of images, also known as frequency distribution histograms.

Control Chart

Control charts are maps to observe changes in a process. The results of the control map graph can identify whether the process is running well or not. Control maps have characteristics in determining whether the process is good or not, namely by determining a pair of control limits, the collected data will find the trend of actual operating conditions (Ulkhaq, et al, 2017). The control map is defined as a useful tool to determine whether the process activities of a company are still under control or not. Control maps are used as a tool for quality control. The function of the control map is to assess production performance, determine product standards, and monitor controlled production (Widanti, 2017).

Pareto Diagram

A Pareto Chart is a bar graph put together with a line graph depicted in the form of data comparison. Pareto diagrams serve to define key issues regarding quality levels from largest to smallest. Using Pareto diagrams to show the main problems and focus on problems that occur frequently. Pareto diagrams work by showing which problems have a greater impact if improvements are made. Existing data is written into tabular form and then made into a graph on a pareto diagram (Hairiyah, et al, 2019). Pareto diagrams are useful as a tool to rank problems from the most important and focus on the most important problems to find the cause (Yuwono, 2015). Meanwhile, according to an Italian economist V. Pareto in (Kamal & Sugiyono, 2019) the pareto diagram is a diagram used to identify quality characteristics that need to be prioritized for improvement and control.

Fishbone Diagram

The advantage of a fishbone diagram is that it can describe what is happening and all those involved can provide suggestions. Meanwhile, the disadvantage of fishbone diagrams is that opinions depend on tools whose design is to visually describe the problem using the “why level” method. It is usually ranked to determine the most likely causes included in the chart (Murnawan, 2014). According to Purwati in Kamal & Sugiyono (2019) The cause and effect diagram (Fishbone Diagram) explores the possible causes of problems that occur, with the intention of finding the root cause of the problem.

METHOD

This research uses quantitative descriptive methods as a method used to find the root of the problem and evaluate the types of defects found in the object of research. According to (Kusumastuti, Khoiron, & Achmadi, 2020) Quantitative research methods are methods for testing certain theories by examining the relationship between variables. Variables are usually measured by research instruments so that data consisting of numbers can be analyzed. Meanwhile, according to (Roosinda, et al., 2021) Descriptive research is a type of research that aims to present a complete picture of the social setting or research conducted to explore and clarify a phenomenon or social event by describing the variables related to the problem under study of the phenomenon being tested.

The quantitative analysis method in this research is used to analyze product defects with the seven tools method, while the descriptive analysis method is used to analyze the flow of each production activity process in the company. The use of quantitative descriptive methods is able to provide research outputs that are expected to provide an overview to management of what happens in the production process.

This research was initiated because of the existence of defective products that exceed the tolerance limit for months. Based on the author's observations and data provided by the company, defective products per month always exceed the tolerance limits given by the company, therefore this research was conducted to analyze what are the causes of defective products with the seven tools method in the company where the author currently works.

Population is a set of objects or subjects with certain characteristics that have quality, which will then be studied by researchers (Sugiyono, 2016). The initial stage of this research is to collect data on the number of defective productions in 2022 - 2024, namely 290,024 pieces.

Meanwhile, the sample is part of the number and characteristics possessed by the population (Sugiyono, 2016). The sample in this study was selected using purposive sampling method criteria. The purposive sampling method is a sampling technique with consideration of certain criteria by researchers (Sugiyono, 2016). Researchers took the type of defective product pieces with a crack category of 113,138 pieces, because the number of defects in the crack category had the highest total defects.

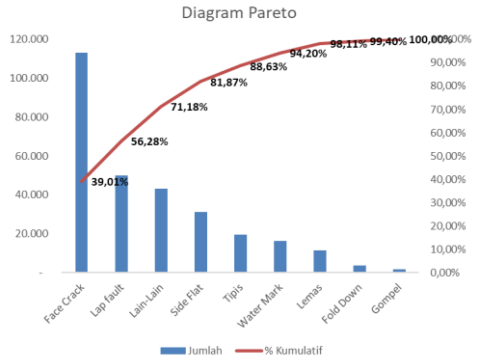
RESULTS AND DISCUSSION

Check Sheet

The results of the check sheet show that from March 2022 to August 2023 the type of face crack defect is very dominant compared to other types of defects. Meanwhile, from September 2023 to January 2024, lap faults were dominant while in February 2024, other defects were dominant.

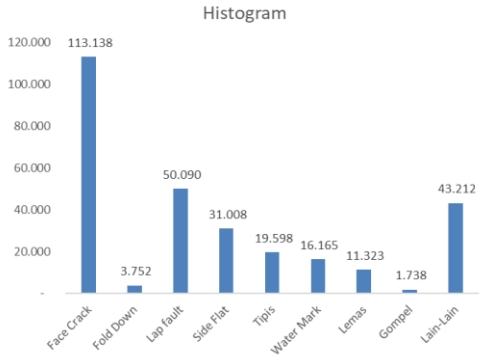
Pareto Diagram

The results of the pareto diagram can be seen that 56.15% of the damage that occurs during the production process there are 2 types of damage that are most dominant, namely: Face crack with a percentage of 39.01% and lap fault with a percentage of 17.30% of the total production. Repair can be focused on the type of damage to face crack because the damage is very dominant compared to other damage with a percentage of 39.01%.



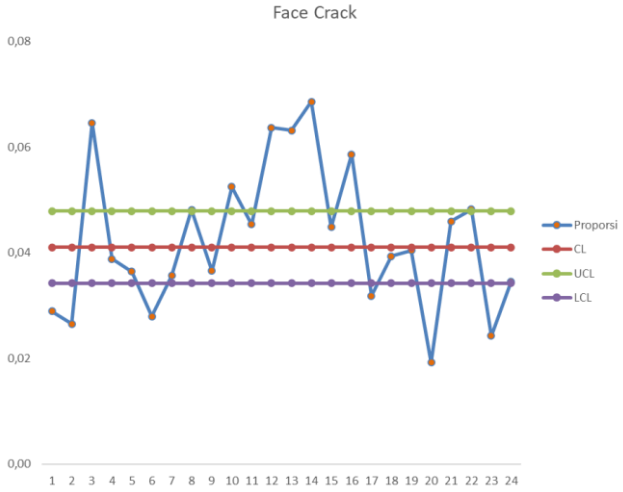
Histogram

The results of the histogram can be seen that the highest percentage of defects when totaled gets a score of 108.07% with a total of 113,138 product defects from total production with the face crack category. While the lowest defect with a percentage of 1.32% with a total product defect of 1,738.



Control Chart

In the control chart image, it can be concluded that the product defects found for 24 months with the type of face crack defect, the data is outside the control limits, so improvements need to be made.



Fishbone Diagram

In the fishbone diagram picture, it can be seen that there are human, machine, environmental and material factors that affect product defects as follows:

Human, Operators sometimes neglect to monitor the health of the machine, it was also found that there were operators who were not in place when the machine was printing products.

Machine, The lack of maintenance carried out by the engineering team as well as machine cleaning, makes the motor sometimes overheat so that the heating of raw materials becomes excessive and information is also obtained about the existence of cutting knives and sizes that are not suitable.

Environment, The environment is a factor in causing cracks in the product. The product is carried by a forklip to the drying place, the road to the drying place is uneven so that it shocks products that have not dried to the maximum, causing cracks, and the temperature of the environment when the raw material dough is prepared can affect the dryness or humidity of the raw material dough.

Material, Material composition is one of the most influencing factors, information is obtained that there are changes in the composition of raw materials and prices.

CONCLUSION

1. Based on the results of the study, it is concluded that there are a total of 290,024 pieces of defective products with different types of product defects during the roof tile manufacturing process at PT XYZ, which are dominated by face crack defects of 113,138 pieces followed by lap faults 50,090 pieces, side flats 31,008 pieces, thin 19,598 pieces, water marks 16,165 pieces, limp 11,323 pieces, fold down 3,752 pieces and gompel 1,738 pieces from the period March 2022 - February 2024.
2. Based on the analysis using the fishbone diagram, the factors that cause damage or product defects are as follows: Human Factors cause due to lack of supervision. Machine Factors cause due to lack of maintenance. Enviromental Factors caused by operational road conditions. Material factors cause due to changes in raw materials
3. Based on the analysis using 5W + 1H, the way to reduce the number of defects that occur so as not to exceed the percentage determined by the company is as follows:The operational team discusses the formula for raw materials, looking for options to use raw materials with higher grades and updating the formula to improve the product. And the latest formula for raw materials must be made so that it can compete with market prices and the goods sold are not easily damaged. The operational team should request the purchase of new machines to management and repair the old machines. The HRD team must be tightened more for socialization related to company regulations related to production operations, and superiors in the operational team must better monitor the work of employees under them. The operational team must make submissions to improve operational roads and request the manufacture or purchase of tools to support the operational process.

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