

PRODUCT DEFECT REDUCTION USING QUALITY PLANNING IN FURNITURE MANUFACTURING

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Abstract

The purpose of this study is to find out the most common defect in the company production, the effect of defect to the company's financial performance, and understand the cause of the defect to find out the proper solution to minimize the defect. This study interprets quality planning management and implements five steps of DMAIC for Six Sigma to find the root cause. Several methods were used for collecting data interviews, observation, and surveys. The study found that different group of customer has different sensitiveness towards defect, and it turns out their customers from non-corporate project is more sensitive towards defect than corporate project customer. An unprecise door, fracture, unfulfilling finishing, unsymmetric closing level, unergonomic product, unfitted with the site, untidy stitches, and last a varied pattern direction in one product are the type of defects that frequently arise. The cause of the defect is because the company has no project evaluation. They don't have evaluation to measure and standards for their products quality, so defects keep happening. The recommendation for minimizing defects is, a control chart to track the progress, standard generate guiding principles and training methods for workers to develop an eye for detail.

Keywords: Defect Product, Quality Planning, Project evaluation, Furniture Manufacturing, DMAIC.

Introduction

The competition among furniture manufacturers becoming more intense, as the value of furniture and home furnishings in Indonesia is steadily increasing and number of. In addition, furniture SME's should develop and implement strategies that lead to superior performance relative to competitors in the same industry and provide greater customer value. In accordance with the findings of (Maryono et al. 2021) on the woodcraft industry research, the furniture industry in Indonesia has a great deal of growth and development potential over the long term (Bell & Waters, 2018).

PT XYZ is one of the SME furniture manufacturers in Jakarta that has recently received numerous product defect complaints, which has a negative impact on the company's profit (Kaymaz, Birinci, & Kızıllan, 2022). The company declared the situation a crisis after one of its regular customers expressed dissatisfaction with the quality decline and expressed concern that they would be unable to accept a new project if the quality could not be improved (Mittal & Gupta, 2021). In the furniture industry, to maintain customers and acquire new customers, a company must meet customer expectations and maintain performance by establishing long-term relationships with existing customers in order to increase demand (Paulus & Hermanto, 2022). Since

2021, the company experience a decreasing profit while its revenue is increasing smoothly, following that they start to receive a complaint from their customer due to its defective products. From the financial data, it is predicted they can lose around 5% of profit each year due to this problem. To survive, a study on improving their quality is needed, this study research will dip into the issue to find the root cause and find its solution. The company needs to find the reason why these defects are happening to prevent more losses in the future.

Methods

This study research implements five steps of DMAIC for Six Sigma (Guerrero, Leavengood, Gutiérrez-Pulido, Fuentes-Talavera, & Silva-Guzmán, 2017). The first process is define. In this process, activities are carried out identifying the problems, defining the requirements, and process map that includes the process inputs and outputs (Selvi & Majumdar, 2014). Next, measure the aim of this phase is to quantify and better understand the primary quality issues that need to be solved. Then, the Analysis process, the root cause of the problem addressed was identified in this phase. Afterward is Improve phase, once the root cause is known, the improve phase will be focused on finding a solution to the problem. Finally, the last step, Control to establishing standard measures to maintain performance and correct the problem as needed. This step will result in a control plan (De Mast, 2004).

In this study research, the methods that are being used for collecting data are interviews, observation, and surveys. This study research will use semi-structured interviews to gather information from the customer and the company itself (Kaushik, n.d.). For this study research on site observations was held in three weeks. For data analysis, this study uses several methods consists of stakeholder analysis, SIPOC Diagram, Pareto Chart, Eight Waste of Lean Manufacturing, Current Reality Tree and AHP.

Results and Discussion

DEFINE STEP

The company serves numerous customize projects from residential, office, school, commercial, public space, or even outdoor furniture for individuals, private companies, or government companies. Thus, the type of customer ss divided into two groups based on the project type, which are corporate projects customer and non-corporate projects.

Studying their financial data, their operational cost was increasing because of the added cost in the non-corporate projects. **Figure 1 of Pareto Chart Toward Operational Added Cost** shows that their non-coporate projects are more sensitive toward defects and must repair to get their satisfaction. The defect itself is usually found when the product has already been delivered to the site, roughly can be said that the company doesn't check the product quality before they send it to the customer.

Product Defect Reduction Using Quality Planning in Furniture Manufacturing

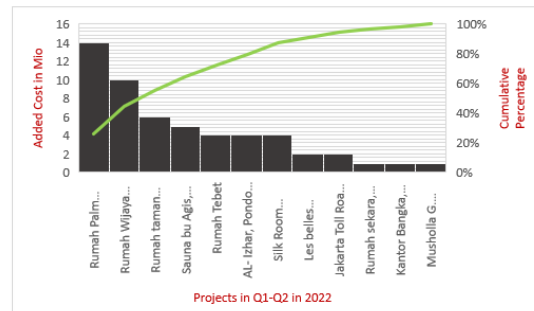


Figure 1 Pareto Chart Toward Operational Added Cost

MEASURE PHASE

To measure how bad the issue, The current performance will be measured with defects per unit (DPU). DPU reflect the average number of defects of all type over the total number of units sampled. This case will be calculated with the DPU of non-corporate projects in the first semester of 2022. Its found that the DPU of the performance was nearly 0.2, which indicates a probability that one in five units will have a defect. From the interview and data its found there are eight types that usually found, unprecise door, fracture, unfulfilling finishing, unsymmetric closing level, unergonomic product, unfitted with the site, untidy stitches, and last a varied pattern direction in one product. An interview with the customer was held, to find which defect irritates them the most, so the company can more aware of the defects. It reveals a defect on the unprecise door cabinet, unfitted with the site, varied pattern direction in one product, fracture, and unfulfilling finishing have bothered them.

ANALYSIS PHASE

In order to determine the underlying cause of the five defects problem, the finding was analyzed using the eight waste of lean manufacturing tools and the current reality tree to find the cause. The data were obtained by observation and interview with the stakeholder within the company who has a duty related to the production process.

Table 1 Possible Cause Defect

Defect Source	Waste	Cause
Drawing check	Excess processing	must redraw customer shop drawings because they lack detail or cannot be read.
	Waiting	Shop drawings changes from customer
Material preparation	Defect	lack of quality control when purchasing the raw material
Cutting	Waiting	no weekly work plan, so workers (craftsmen) need instruction before
	Motion	Shop drawings are difficult to see. So, workers must double-check with the operational head.
	Excess processing	Not enough information regarding customer needs, so sometimes if there's an unusual standard they keep working
Finishing	Motion	when it's in full pack, the area of finishing is full
	Waiting	drying time uncontrollable
	Non utilizing talent	rushed workers

From an interview with the internal stakeholder, the five defects are possibly source from drawing check, material preparation, cutting, and finishing. There are five waste that founded in the production process, excess processing, waiting, defect, motion, and not utilizing talent, five of them are caused by unclear customer needs, lack of process control, poor production planning, failure to involve people in design which means clients with people in the production, and poor automation. More deep analysis to discover the system core driver, an analysis using the current reality tree is used. The causes in **Table 1 Possible Causes of Defect** above are considered as the company's undesirable effects (UDEs), all the UDEs listed will be linked to make a relationship between them into a current reality tree diagram as seen in **figure 2 Current Reality Tree**.

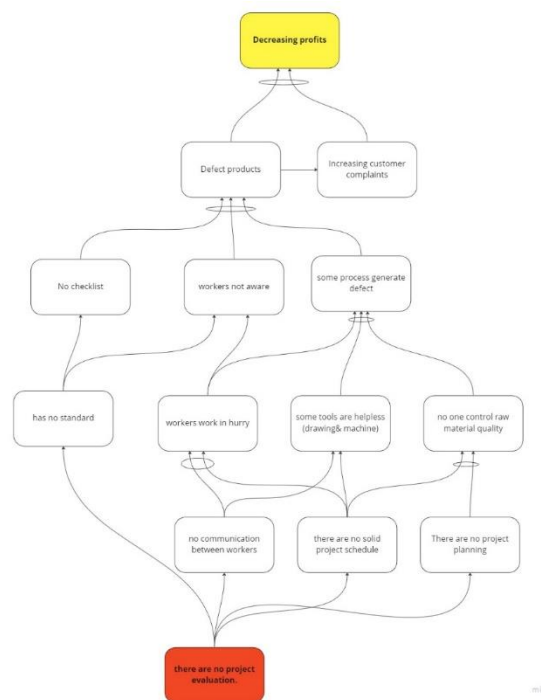


Figure 2 **Current Reality Tree**.

The finding shows, because there are no project evaluations it led to the company don't have proper communication among stakeholder, scheduling project, planning, and standard operation, so the mistake is continuously happen (Ali, Yousof, Khan, & Masood, 2011).

IMPROVE PHASE

High quality and productivity are key to a manufacturing company's production rate. (Ali et al., 2011) state that Establishing a quality culture environment is an important key factor in achieving a higher rate of production. No business, organization or manager can dream of higher productivity without total commitment, without

adhering two facts "To be quality conscious and productivity conscious". According to (Singh, Ramdeo, Singh, & Ramdeo, 2020), to motivate workers and achieve higher rates of production, organization must first establish a team of quality and productivity-oriented line managers who work on the production line. Team quality and productivity can be measured with an evaluation. To improve, some solutions was suggested:

First suggestion: Control Chart to track the progress.

The system is formed of certain inputs and steps, like labor, supervision, raw materials, machines, and operations. To make the system better, the company must change these things. Firm management oversees making these changes and has the power to do so. Workers can't change the system on their own. Since workers can't be responsible for the system, managers need to be able to tell the difference between abnormal and normal variation, so they know when and how to change the process. Statistical signals from control charts are the only sure way to tell the difference between the two sources of variation in a process. In this case, A control chart is needed. Control charts help to identify changes over time. A system control chart has a middle line that shows the average of the process and two control limits, one at the top and one at the bottom (Kent, 2016).

Second Suggestion: Standards to generate guiding principles

A standard operating procedure (SOP) is a set of written instructions that describe how to complete a task or activity. They are detailed rules that anyone can follow and should leave very little ambiguity about what needs to be done. By then a suggestion regarding the SOP needs to be made in the production process, especially in the defect main source, cutting area and finishing section.

Third Suggestion: A training method for workers to develop an eye for detail.

A suggestion about employee training is aimed at helping the employee improve their work quality on things that generate defects in the production line so with training all workers are more aware of product quality. Training is a set of activities to transfer knowledge (Edition, 2018).

A three alternative has been selected, to choose which one properly fits with the firm, an analysis was done using the Analytic Hierarchy Process (AHP) method. The data was collected using interviews with questionnaires to two people in the firm and their decision very affecting the firm, the president director and the production head. As for the criteria, four aspects were selected: Impact, Easiness, and Cost. The first criterion is impact, which will measure the speed solution to solve the problem, the easiness is about the degree of faculty for workers to adapt, and the last cost is how much money is needed to implement the suggestion. AHP analysis is began by structuring the hierarchy tree that helps to illustrate the relationship between alternatives and criteria. Each criterion will be compared to find the rate of the same criteria and the decision itself. Then the top two management and the production process with total 16 people from the firm were interviewed to judge which suggestion need to prioritize first.

Table 2 AHP Calculation Result

Criteria	Weight	Alternatives	Score
Impact	0,573	Control Chart	0,589
Easiness	0,326	SOP	0,281
Cost	0,101	Training	0,107

Source: Personal Analysis

The survey questions are analyzed using spreadsheets to produce the AHP and the results are shown in **Table 2 AHP Result**. Both shareholders agree that the most important factor they had to consider was an impact, and at the end of the analysis, Control Chart is selected as the most preferable suggestion to reduce defects by the stakeholder with a score of 0,58.

CONTROL PHASE

To control, the author worked together with the production head to plan a schedule for implementing each solution. All the schedule was projected base timeline so it will be easier to know whether the result is effective or not. However to present the impact of implementing of three solutions need to be studied in future study.

Conclusion

PT XYZ is a furniture manufacturing in Jakarta. In the past three years the company face decreasing profits as the number of complaints of product defects increase. It found their product frequently has unprecise doors, fractures, unfulfilling finishing, unsymmetric closure level, unergonomic product, unfitted with the site, messy stitching, and a varied pattern direction in one product. The root cause of the defect was because they don't have project evaluation after finishing each batch of project. So, to work the next project they don't make any changes so the mistake is repeatable. This continuous defect product costs the organization extra money to fix until the customer accepts the project. Quality management planning found three solutions: control chart to track progress, standards to create guiding principles, and training for staff to build an eye for detail. This study used AHP analysis using three factors—impact, ease, and cost—to choose solutions. Control conversation has a stronger impact with 0.58 points. The organization will first create a control chart, then SOP, then training to eliminate product defect.

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