

Minimization of Return Product by Implementing Deming Cycle and Quality Loss Function

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Abstract. The rapid development of the industry requires every company to make efforts to control and reduce the number of product returns, so that the company does not suffer losses continuously. In this study, problems were identified according to the company's business process flow, calculating losses using the Quality Loss Function (QLF) approach, implementing the deming cycle as an effort to reduce product returns by providing SOPs, work instructions, and checking forms in the section associated with the source. the occurrence of product returns, as well as calculating losses after implementation using Quality Loss Function (QLF). From the results of monitoring after implementation, there is a decrease in the number of return products. Before the implementation of the average product return of 4.19% per month, the lowest rate of return occurred in December 2020, which was 1.96% with a loss of Rp. 383.543.63. After the implementation, there was a decrease in the percentage of the number of return products to 1.63% with a loss of Rp. 195.685.50.

INTRODUCTION

Background

Currently the development of the industry in Indonesia is growing so rapidly along with the company's competition to be able to meet consumer demand. The company must be competitive in thinking creatively and able to innovate in carrying out strategies that can compete against its competitors by producing good quality products, low prices, and fast service. Product quality has an important role in the reputation of manufacturing companies to create consumer confidence, in addition, aspects of product quality produced can also be used as a standard for the company's readiness to compete with similar competitors[1].

The company studied is one of the manufacturing industries in Bandung Regency engaged in textile with products produced in the form of fabric dye powder. The company manufactures dyes according to demand from fixed consumers and other consumers according to demand. To maintain the quality of its products, the company has established a product inspection system in the production section by conducting two inspection stages, namely, the first stage of conducting color concentration checks using rapid machines during the production process. The examination technique at this stage is carried out with technical sampling techniques. The second stage is inspection of the packaging process, at this stage is done only with visual techniques seen from the feasibility of the case.

Consumer demand for fabric dye powder products fluctuated each period, recorded an average demand in February 2020 to January 2021 as much as 9,308.75 kg or 372.35 box per month. During this period there has been an average monthly product development of 389.58 kg. It can be calculated that the percentage of return of defective products that occur is 4.19% per month or equivalent to 15.58 box. Based on the report recorded, the return of the product caused by a torn packaging seal, products contaminated with metal or foreign objects, clumping products, and the exchange of color concentration labels on the packaging. While the company's management has set a product return limit of 5 box per month. The high return of the product has an impact on the company's losses, because the company

has to reimburse the cost of the failed product. For that, efforts need to be made that can reduce the number of return products.

Problems

One of the manufacturing industry companies engaged in textiles in Bandung Regency has problems regarding the high number of return products. This is because the company has not established a sustainable quality control system all parts of the organization. It can be known that the four types of defects stem from the absence of quality control systems in the ware house and logistics (delivery), therefore the company needs a quality management plan in each section in order to reduce the number of product returns each month.

Research objectives

Based on the explanation outlined in the previous section, this study will be carried out efforts to apply the Deming cycle to the part associated with the type of defect in the company so that it is expected to reduce the return of the product that occurs.

METHODOLOGY

Total Quality Management (TQM) is defined as a way to improve continuous performance improvement in all parts of the organization using all available human resources [2]. As for the benefits of TQM's implementation with deming cycle approach for the company, one of which is to avoid quality deviations generated in the company's business process flow, the resulting products will be in accordance with standards, eliminate rework, improve work time, reduce machine work, and save material use. While Quality Loss Function (QLF) is a mathematical approach used to see the large losses experienced by companies due to defective products [3].

To solve the problem in this study will be carried out systematic steps, the description of the methodological steps can be seen in the following description:

1. Identify the company's business process, this step is done to trace or identify defects found to come from which part of the process in the company. Identifying the company's business process is done to find out the production flow that starts from the beginning of the purchase of raw materials to the end until the product is accepted by consumers and can know the problems that occur in the company thoroughly in each part.
2. Identify the cause of disability on the part of the company, after knowing the process in each part with the company's business process, then the next stage is to identify the problems that occur in the part that causes the defect to occur. This stage is carried out to find out the root cause of the types of defects that occur in the company. To find out the root of the problems that occurred in this study using 5W + 1H tools.
3. Proposed application of Deming cycle, Deming cycle consists of stages Plan, Do, Check, Action involving all resources power in improving the quality of a product produced and carried out in a sustainable manner [4]. The application of deming cycle is done on the part that causes the return of product in the company. Plan, carried out the preparation of a quality plan on the part that has been identified the problem has a relationship with the type of defect that occurs. Do at this stage carry out improvement proposal activities in accordance with the results of the quality management plan in the company's business process using the Deming cycle principle, this principle is used as a framework that directs the organization to improve its performance in a sustainable manner (continuous improvement). Check after the implementation of the Deming cycle in the environment for 1 month, the next stage will be recalculated the percentage of the number of product returns that occur at the time after implementation. This examination process is carried out to prove whether the planning and implementation process that has been carried out in accordance with the target or purpose of this research in reducing the number of product returns. Action, adjustment actions are carried out based on the analysis of results at the check stage. The adjustment process can be in the form of setting new standardization in the company environment in accordance with the results of the Dostage. If the implementation phase of the Deming cycle in the company environment can reduce product returns and reduce losses then the establishment of new standardization needs to be applied by the company. These stages are carried out to maintain or avoid the onset of the same problem repeated, and is done as a new target for the next improvement [5].
4. Analysis, at this stage is done to see if with the application of deming cycle in the company environment can reduce the amount of product return. At this stage of analysis will be done a percentage of the amount of product

return and the amount of losses due to return on conditions before and after the Deming cycle is applied. The results of this analysis are expected to provide an over view to the company of the importance of making quality improvements based on the Deming cycle and can help over come the company's hopes in controlling the quality of its products.

RESULTS AND DISCUSSIONS

Research Results

In this section explained about the results of the research conducted, the results of the study consisted of identifying the company's business process, identifying the cause of disability on the part of the company, and proposing the application of siklus Deming. The results of the study can be seen in the following description.

Identify the Company's Business Process

Identifying the company's business process is done to find out the production flow that starts from the beginning of the purchase of raw materials to the end until the product is accepted by consumers and can know the problems that occur in the company thoroughly in each part. For the results of the company's business process identification can be seen in Figure 1.

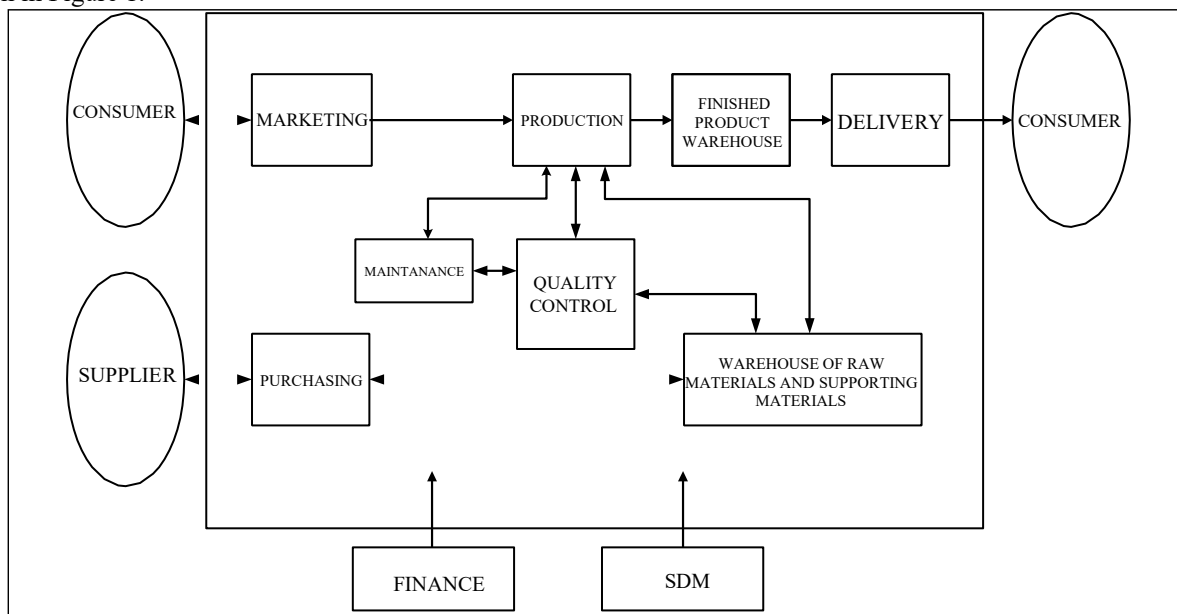


Figure 1. Enterprise Business Process

Based on the results of the company's business process identification, the process flow can be traced to the source of the problem that occurs in the company, the results of the process description associated with problems in the type of defect that occurred can be seen in Table 1.

Identify the Cause of Disability on the Company's Part

Based on data on the type of defect that occurred, namely the defect of the torn packaging seal, contaminated products of foreign objects, clumping products, and the exchange of packaging labels, the 5W + 1H tool was used n n to find out the root of the problems that occurred in the company environment. For the results of identifying the source of the problem associated with the type of defect that occurred can be seen in Table 2 through Table 5.

TABLE 1 Identification of Process Description In Part Associated with Types of Defects

No	Division	Process Description
1	Delivery	Employee delivery in the process of transferring the finished product is carried out in arbitrary or rough and do not do the process of checking the condition of the feasibility of the transport car. The condition of the transport car is not feasible one of them can cause potential product defects such as water seepage when it rains and the tearing of plastic seals.
2	Finished Product warehouse	The finished product warehouse only conducts the packaging process and checks the feasibility of the case and does not check again when the production operator provides a report of the production results that will go into the warehouse for packing.
3	Maintenance	The process of activities carried out only performs repairs when the machine is already said to be damaged and there has been no preventive action to prevent engine damage. When repairing the machine in the middle of the production process, the condition of raw materials is still in the machine, thus allowing the contamination of products with foreign objects during the repair process.

TABLE 2 Results of Identification of Problems Due to Types of Torn Packaging Seal Defects

No	Aspects	Description
1	Why	The process of transferring the finished product to a transport car is done roughly and has not added a check of the feasibility of the transport car.
2	Where	Problems occur in the delivery section.
3	When	A problem occurs in the last year.
4	Who	Employee delivery.
5	How	The problem is solved by providing Standard Operating Procedure and construction of the feasibility work of transport cars (with Add pallets).

TABLE 3 Results of Identification of Problems Due to Types of Defects in Foreign Contaminated Products

No	Aspects	Description
1	What	Products are contaminated with metals/foreign bodies (box).
2	Why	1. The packaging process is done arbitrarily so that it allows the product to be contaminated 2. The process of repairing machinery carried out by maintenance employees is carried out during the production process by not removing products in the machine.
3	Where	1. Problems occur in the packaging. 2. The problem occurs in the maintenance section
4	When	A problem occurred in the last year.
5	Who	1. Employee packaging. 2. Maintenance employees.

TABLE 3 Results of Identification of Problems Due to Types of Defects in Foreign Contaminated Products (continue)

No	Aspects	Description
6	How	1. The problem is solved by providing proposed standard operating procedures and work instructions in the process packaging.
		2. The problem is solved by providing a proposed standard operating procedure and proposed preventive repair schedule of the average engine replacement period.

TABLE 4 Results of Identification of Problems Due to Types of Clumping Product Defects

No	Aspects	Description
1	What	Clumping products (box).
2	Why	The process of delivery is not safe, delivery is done without the use of a cover to protect the product.
3	Where	The problem occurs in the delivery section
4	When	A problem occurs in the last year.
5	Who	Employee delivery.
6	How	The problem is solved by providing Standard Operating Procedure and receipt of the feasibility of the transport car (by adding a tarp as a product cover during the delivery process).

Table 5 Results of Identification of Problems Due to Types of Defects Changed Color Concentration Label

No	Aspects	Description
1	What	The color concentration label (box)
2	Why	Lack of thoroughness when the process of inserting the finished product into box, resulting in the inclusion of packaging labels sent to the consumer
3	Where	The problem occurs in the packaging section
4	When	A problem occurs in the last year
5	Who	Employee packaging
6	How	The problem is solved by providing satandard operating procedure and work instruction in carrying out the process packaging

Based on the analysis of 5W + 1H above can be known the cause of disability experienced by the company.

Proposed Implementation of Deming Cycle

Deming cycle proposal is done to reduce the number of product returns by applying an approach where quality is continuous. The Deming cycle consists of plan, do, check, and action stages. The following proposed application explanation can be seen in the description below.

1. Plan, this stage will be given a quality planning proposal in the delivery, warehouse, and maintenance sections. The proposal plan given one of them in the delivery section in the form of the application of Standard Operating Procedure and work instructions, to support performance on its part is also given a checking form. This is given because the company has not fully carried out the quality management process in an ongoing manner and there has been no record of established standards.
2. Do, the proposal process in all parts of di is done or implemented in the company environment for one month. Due to time constraints in the research process, at this stage, the implementation is only 1 month, namely in June 2021. The proposals given are expected to be implemented continuously by the company in the future.
3. Check, the process of monitoring from the previous stage, seen the conformity of the results with the purpose of this study. This stage calculates the amount of decrease in product return caused by each way and performs the calculation process after the implementation of deming cycle implementation in the company environment.
4. Action, provides new standardization by implementing Standard Operating Procedures (SOP) and work instruction in the company environment. One of the proposals made new standardization by the company is in the employee delivery section. The proposal can be seen in Figure 2 through Figure 4.

DISCUSSION

Based on the results described in the previous section, by applying the Deming cycle to the part related to the type of defect that occurred, there was a decrease in the number of return products. The time before implementation has an average value of product return in one year of 4.19% or equivalent to 15.58 box per month. The smallest product return value was in February 2020 of 1.96% or equivalent to 7 box. After implementing the Deming cycle, the return of products in June 2021 to 1.63% or equivalent to 5 box. The implementation of quality management onan ongoing basis by implementing the Deming (plan-do-check-action) cycle in the company environment can have a very significant impact, especially in reducing the amount of product returns and losses of the company. To measure the extent of the reduction in losses experienced by the company, it can be calculated using the Quality Loss Function formula. Delivery employee instruction can be seen in Figure 2

Work Instructions for Handling and Transfer of Finished Products to Transport Cars	
	<ul style="list-style-type: none"> • Prepare a handtruck that will be used to move the finished product into the transport car. • Fill in the form for checking the feasibility of the transport car. • Clean all sides of the tailgate to avoid foreign objects. • Install the pallet on the base of the car. • Move the finished product in the warehouse into a transport car using a handtruck. • Carry out the process of stacking finished products in the car body with a maximum limit of 3 piles. • Cover the pile of finished products in the tailgate using a tarp. • Glue and tie the tarp using a rope to the side of the tailgate.

Figure 2. Delivery Employee Work Instructions

Standar operating procedure employee can be seen in Figure 3

Standard Operating Procedure (SOP) Process of Handling and Transferring Finished Products to Transport Cars		No. Document : - Date of Enactment : June 10, 2021 Revision to : - Revised Date : - Page : 1	
<p>▼</p> <p>1. Purpose Ensuring the process of handling and transferring the finished product into the transport car is maintained in quality and</p> <p>▼</p> <p>2. Equipment used a. Handtruck . b. Pallet .</p> <p>▼</p> <p>3. Parties involved a. Finished Product Warehouse Division(warehouse). b. Employee Delivery.</p> <p>▼</p> <p>4. Documents used a. Report the number of finished products. b. Work instructions for handling and transferring the finished product to a transport car c. Form checking the feasibility of the transport car.</p> <p>▼</p> <p>5. Implementation procedures a. Receive a report on the number of finished products from the warehouse. b. Check the feasibility of the transport car using the checking form that has been provided. c. Move the finished product from the warehouse to the transport car in accordance with the direction of the work instructions given. d. Send the finished product to the consumer.</p>			
Disposition	Name	Position	Signature
Proposed by			
By			
Approved by			

Figure 3. Standard Operating Procedure Employee Delivery

Form checking for cars feasibility can be seen in Figure 4.

TRANSPORT CAR FEASIBILITY CHECKING FORM

Driver Name

Day/Date

Freight Car Feasibility		Condition of Transport Car	
		Standard	Fit in the field
Car equipment			
Sheeting		Available	
Tarpaulin Condition		Not Leaking	
Pallet		Available	
Pallet Condition		Not broken	
STNK		There and Still Happens	
KIR Book		There and Still Happens	
Driver's License		There and Still Happens	
The condition of the car <i>pickup</i>			
Cleanliness (floor and side of cover)		Clean	
Containers free of nails and loose tonnes of bolts		Not Last	
The vehicle tub is not hollow		Not hollow	
Vehicle Safety Equipment			
Tire Condition		Thick and has contours	
Brake Condition		Bold Canvas	
Tire Pressure		Tidak Kempes (>35 psi)	
RearView Mirror (2 pieces)		Function	
Lights (near and far)		Function	
Penny Lamp		Function	
Horn		Function	
Spare Tire (1buah)		Available	
Safety <i>Hazard Sign</i>		Available	
First aid box		Available	
Proposed by	Checked and Approved by		
Head of Warehouse & Expedition			

Approval Date :/ / 2021

St

Accepted
Rejected

Figure 4. Form Checking the Feasibility of Transport Cars

Examples of Quality Loss Function calculations before and after applying the Deming cycle are as follows.

Calculate constant value $K = \frac{A}{\Delta^2}$ (1)

$$K = \text{Rp. } \frac{1.900.000,00}{(15,58^2)}$$

$$K = \text{Rp. } 7.827,42$$

- a) Calculation of Quality Loss function before applying deming cycle from the average number of defects in February 2020 – January 2021:

Loss $= K \times (y^2)$ (2)

Loss $= \text{Rp. } 7.827,42 \times (24^2)$

Loss $= \text{Rp. } 4.508.594,51$

Average loss $= \frac{\text{1st month loss} + \dots + \text{12st month loss}}{12}$

$$= \frac{383.543,63 + \dots + 4.508.594,51}{12}$$

$$= \text{Rp. } 2.391.929,41$$

- b) Calculation of Quality Loss function before applying the Deming cycle of the smallest number of defects occurred in February 2020:

Loss $= K \times (y^2)$

Loss $= \text{Rp. } 7.827,42 \times (7^2)$

Loss $= \text{Rp. } 383.543,63$

- c) Calculation of Quality Loss function after the implementation of deming cycle in June 2021:

Loss $= K \times (y^2)$

Loss $= \text{Rp. } 7.827,42 \times (5^2)$

Loss $= \text{Rp. } 195.685,50$

CONCLUSION

Based on the results of research proposed the application of deming cycles in the company environment, the conclusions were obtained, namely:

1. Of the four types of defects that occur, proposed Standard Operating Procedure (SOP), work instructions, and checking forms in the packaging, maintenance and delivery sections to reduce the number of product returns.
2. The result of the process of implementing quality management on an ongoing basis with the implementation of deming cycles in the company environment decreased the number of company returns to 1.63%.
3. The results of the loss calculation after implementing the Deming cycle in the company environment with a Quality Loss Function approach of Rp. 195,685.50. There was a decrease in losses of Rp. 187.858.08 or 48.98%.

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