

# Application of the Six Sigma Method to Overcome Stock Warehouse Difference at PT United Tractors

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## ABSTRACT

*PT. United Tractors has a warehouse to support its business activities, storing goods in the warehouse. Problems that often occur in warehouses are stock differences, actual goods not matching the system. The aim of this research is to find the cause of the problem and overcome it.*

*Six Sigma method with DMAIC, Define, Measure, Analyze, Improve, Control and Evaluation stages. Used to overcome warehouse stock discrepancy problems. The subject of this research is a case study at PT. United Tractors East Jakarta. The dependent variable in this research is the Six Sigma method, and the independent variable is the difference in warehouse stock. The data used in the research are field studies and observations, observations carried out in the PT warehouse. United Tractors East Jakarta.*

*The results of this research use the Six Sigma method to determine inventory control over stock discrepancy problems by going through stages. obtained results of 4 causes of stock discrepancy problems, the measurement stage looked for the highest percentage of values causing stock problems, from the high percentage results then analyzed the factors causing stock discrepancy problems, then proposals for improvements were made that could have a good impact, and a monitoring stage was made of the factors causing stock discrepancy problems.*

## 1. INTRODUCTION

Warehouse is one of the most important parts of warehouse logistics activities as a place to store goods [1]. The warehouse functions to store goods for production or production results in certain quantities and time periods which are then distributed to the intended location based on demand [2]. Inventory management is an important thing in the warehouse to achieve optimal inventory [3].

PT. United Tractors is a company engaged in the distribution of heavy equipment spare parts. PT. United Tractors has a warehouse to support its business activities and store spare parts before delivery to branches or to consumers. Optimal spare parts stock can provide capacity, delivery process, costs, consumer contact and company image [4].

The problems experienced by PT. United Tractors related to inventory that is still not optimal is the stock difference. Businesses that are overstocked will experience increased workload, storage costs, risk of damage, and out-of-date goods [5]. Meanwhile, businesses experiencing inventory shortages will have fewer sales because they don't have enough materials to sell [5]–[7]. Therefore, inventory management must improve inventory problems in order to obtain optimal inventory levels, in designing improvements to warehouse stock differences that can minimize the company's loss costs and can provide goods to consumers optimally[3].

Seeing the importance of inventory for companies, this research uses the Six Sigma method with the DMAIC stages (Define, Measure, Analyze, Improve, Control) [8]. The goal of the DMAIC stage cycle is to move from finding the problem, identifying the cause of the problem, to finally finding a solution to fix it [8]. The aim of this research is to find out how to overcome warehouse stock differences using the Six Sigma method at PT. United Tractors.



## Causes of PT United Tractors Warehouse Stock Differences

Based on reason data from the results of Stock Taking and Housecleaning at PT. United Tractors, resulting in the causes of stock differences, namely: (1) Passing the Quality Control process, (2) Passing the Quality Inspection process, (3) Incorrect stock data input, (4) Goods not matching location.

## 2. METHOD

The method used in this research uses a quantitative approach [9]. Data collection techniques use observation and field studies. The analysis technique used is the Six Sigma method with DMAIC stages. This method uses structured steps based on existing data, at each stage DMAIC has different goals and tools. The following is the data analysis at the Six Sigma stage in this research [10]:

### 2.1. Define

Define is an important step to identify problems, identify customer needs, determine goals, and identify process areas to be improved . The define stage is to predict current company problems using the SIPOC diagram.

#### SIPOC

SIPOC analysis is used to provide a glimpse of work flow starting from suppliers, input, process, output, customers .

### 2.2. Measure

Measure is validating the problem, and measuring the problem from existing data. The measure stage is a continuation of the define stage by collecting data to qualify and map the roots of problems that arise using the Pareto diagram.

#### Pareto Chart

The Pareto diagram is a tool for finding out a statistical picture of the causes of problems that must be resolved first. The Pareto diagram is included on the inspection sheet to clarify the most important factors from several existing factors, the biggest factors will then stand out.

### 2.3. Analyze

Analyze is a step to examine and analyze every activity obtained (Widowati 2021). At this stage, several things are done, including prioritizing improvements, identifying the sources and root causes of failure in a process. There is a tool to use in the analysis stage, namely the fishbone diagram.

#### Fishbone Diagram

The fishbone diagram is a tool for describing data regarding causal factors and analyzing the causes of problems that have a significant influence. The causal factors in the fishbone diagram are categorized as 5M1E, namely (1) Machine, (2) Method, (3) Material/raw material, (4) Man Power/labor, (5) Measurement/measurement, (6) Environment/environment.

### 2.4. Improve

Improve is a proposed action plan to make continuous improvements after knowing the root cause of the problem. Steps in repair using the 5W+1H method technique.

#### 5W+1H

The 5W+1H concept is useful for overcoming every root problem. The 5W+1H concept describes a fact by asking includes (1) who, (2) what, (3) where, (4) when, (5) why, and (6) how.

### 2.5. Control

The control stage is a step to carry out control and supervision of the proposed improvements that have been determined so that they can achieve process standards that are in accordance with work guidelines. At this stage, standard guidelines are created, as well as ownership and responsibility for the

process to ensure the quality of the product or service has reached process standards in accordance with the improved work guidelines.

**2.6. Evaluation**

Evaluation is a process that is carried out regularly and systematically by comparing predetermined standards and criteria with the results obtained (Mayasari 2021). Through the results of this comparison, conclusions and suggestions are then prepared for each activity in the program.

**3. RESULT AND DISCUSSION**

Based on data from the results of data collection, various data processing and analysis were carried out. The following are the results and discussion related to the results of the data processing that has been carried out.

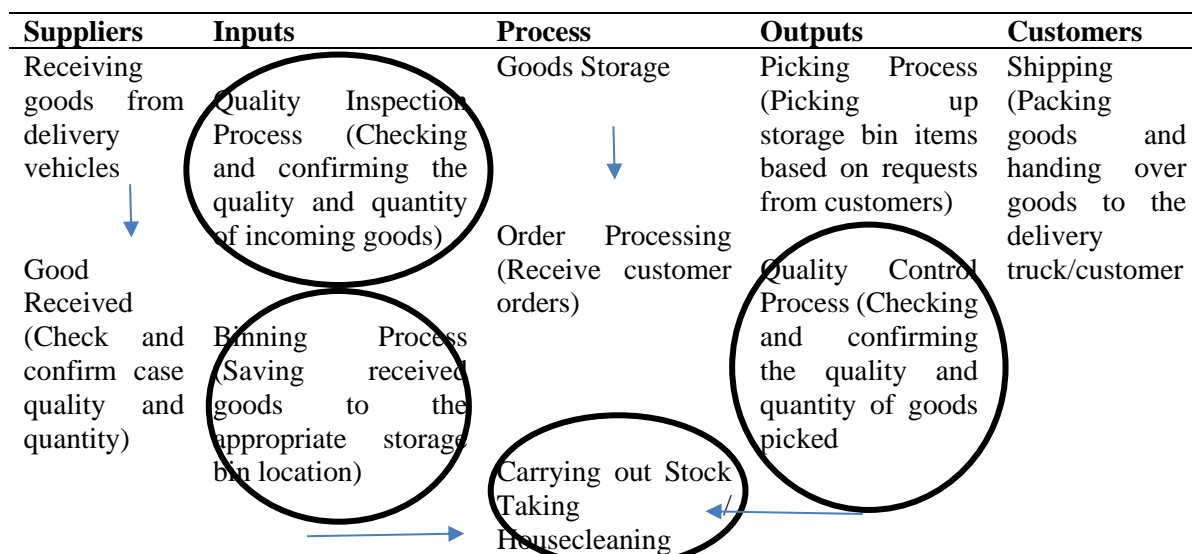
**3.1. Define**

The define stage is the stage of defining the problem of stock differences in the Warehouse, at this stage there are 4 causes of stock differences, namely (1) less thorough checking of the quantity of outgoing goods, (2) less thorough checking of the quantity of incoming goods (Incoming), (3) placing goods in inappropriate locations, (4) incorrect input of stock data.

**SIPOC Diagram**

To make the depiction easier, a table is presented that explains the process flow in the warehouse. The following is a SIPOC diagram of the supplier's incoming goods process and the outgoing goods process at PT. United Tractors.

**Table 1.** SIPOC Warehouse PT United Tractors



Source: Data Processing Results, 2023

Based on Table 1 above, it can be seen that the stock taking or housecleaning process is carried out after the Input and Output processes. As a result of stock taking, a stock discrepancy occurred, which caused the availability of goods to not match the data in the system. The following is data on stock discrepancies in the PT warehouse. United Tractors in 2022.

**Table 2.** Causes of Stock Differences

No.	Different Stock Factor
1	Passed the Quality Control Process (Outgoing)
2	Passed the Quality Inspection Process (Incoming)
3	Incorrect stock data input
4	Items Not Suitable for Storagebin (Location)

Source: Data Processing Results, 2023

### 3.2. Measure

Measure or measurement stage, before making a Pareto diagram, calculate the level of the problem.

#### Pareto Chart

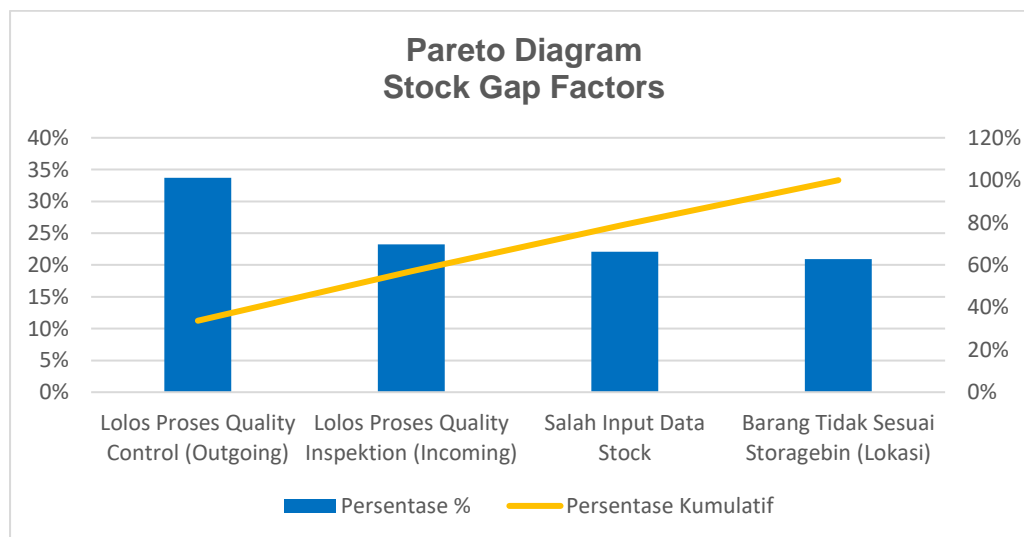
Data taken from PT. United Tractors during the Stock Taking and Housecleaning process, namely the process of passing QC, passing QI process, inputting stock data incorrectly, placing goods at inappropriate locations. Measurements are carried out by calculating the percentage of factors causing stock differences and calculating the cumulative percentage. The following is a table of problem level calculation results.

**Table 3.** Percentage of Causes of Stock Difference

No.	Different Factor	Stock	Frequency	Percentage %	Cumulative Frequency	Cumulative Percentage
1	Passed the Control (Outgoing)	Quality Process	29	34%	29	34%
2	Passed the Inspection (Incoming)	Quality Process	20	23%	49	57%
3	Incorrect stock data input		19	22%	68	79%
4	Items Not Suitable for Storagebin (Location)		18	21%	86	100%
<b>TOTAL</b>			<b>86</b>			

Source: Data Processing Results, 2023

Based on Table 3 above, a Pareto diagram can be made, below is a picture of the Pareto diagram of the causes of stock differences.



**Fig 1.** Stock Differences Factor Pareto Diagram

The results from Figure 1 show that the factor causing the highest stock discrepancy is passing the Quality Control (Outgoing) process at 34%, so this cause must be minimized or resolved first. The second cause is passing the Quality Inspection (Incoming) process at 23%, then incorrect data input at 22% and goods not matching the location at 21%.

### 3.3. Analyze

In this stage, information is obtained regarding the main causes of stock differences in the PT United Tractors Warehouse caused the first problem, namely passing quality control (Outgoing).

**Fishbone Diagram**

In the first stage of analysis, look for the 5M1E matrix, then create a fishbone diagram to make it easier to describe the causes of stock differences because they pass the quality control process. The following is a matrix of causes of stock differences:

**Table 4.** 5M1E Factors Causes of Passing Quality Control (Outgoing)

Problem	Factor	Cause of Problem		
		Cause 1	Cause 2	Cause 3
Passed the Quality Control Process (Outgoing)	Man	Lack of accuracy of warehouse personnel	Low workforce capability	
	Machine	Use of PDT (Scanner)	PDT is not used when operating the warehouse	Insufficient PDT signal infracture
	Method	Inventory control knowledge	Lack of instructions in warehouse operations	Lack of supervision of warehouse operations
	Material	The quantity of material items is large	Materials are difficult to quantify	
	Measurements	Data input error	Incorrect quantity calculation	Lack of concentration while working
	Environment	The environment and surrounding conditions during the warehouse operation process	Insufficient lighting	Hot air temperature

Source: Data Processing Results, 2023

After creating a matrix of causes of stock differences passing the quality control process (Outgoing) then create a fishbone diagram, the following is a fishbone diagram image using the 5M1E concept:

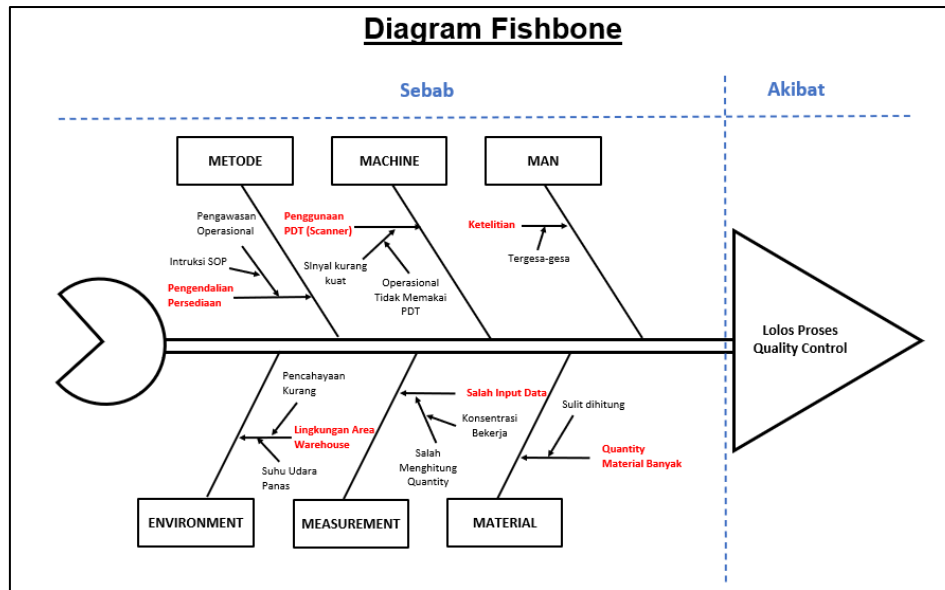


Fig 2. Fishbone Diagram 5M1E

### 3.4. Improve

Efforts to minimize stock differences that cause passing 76 quality control processes by carrying out continuous improvement action proposals using the 5W+1H concept method.

#### 5W+1H Concept Analysis

The following is an explanation of the proposed analysis results using the 5W+1H method based on the root of the problem in the Fishbone diagram.

Table 5. Improvement Proposals Pass the 5W+1H Concept Quality Control Process

Factor	5W+1H concept	Description/ Action
Man	What	Accuracy of warehouse operations
	Why (Why)	Lack of workforce capabilities
	Where (Where)	Quality Control Area
	When (When)	When the outgoing process takes place
	Who (Who)	Quality Control Operators
	How	<b>Providing training to hone work skills</b>
Machine	What	Use of PDT (Portable Data Terminal) tools
	Why (Why)	PDT tools are not used during warehouse operations
	Where (Where)	PT. warehouse area. United Tractors
	When (When)	While operations are running
	Who (Who)	Warehouse Operator
	How	<b>Improve the Portable Data Terminal signal by adding wifi</b>
Method	What	Inventory control knowledge
	Why (Why)	Lack of SOP instructions in warehouse operations
	Where (Where)	Carried out in the warehouse of PT. United Tractors
	When (When)	When warehouse operations are running
	Who (Who)	Responsible for PIC warehouse operations
	How	<b>Conduct a briefing and read the Standard Operating Procedures before starting work</b>
Material	What	The quantity of material items is large
	Why (Why)	Materials are difficult to quantify

Factor	5W+1H concept	Description/ Action
Factor	Where (Where)	At the material storage location
	When (When)	When the outgoing process is running
	Who (Who)	Picking Operator and Quality Control Operator
	How	<b>Carrying out material repacking such as packing the quantity per 10 pcs, to make it easier when the outgoing process is running</b>
	What	Data input error
	Why (Why)	Incorrect quantity calculation
	Where (Where)	In the Outgoing warehouse area
	When (When)	When the material will be sent to the customer or branch
	Who (Who)	Picking Operator and Quality Control Operator
	How	<b>Motivate warehouse operational employees to work with concentration</b>
Measurements	What	Warehouse infrastructure is lacking
	Why (Why)	Insufficient lighting and hot air temperatures
	Where (Where)	Warehouse operational area
	When (When)	While operations are running
	Who (Who)	Responsibility is handed over to the operational management section
	How	<b>Add air ventilation such as fans and additional lighting</b>
Environment	What	Warehouse infrastructure is lacking
	Why (Why)	Insufficient lighting and hot air temperatures
	Where (Where)	Warehouse operational area
	When (When)	While operations are running
	Who (Who)	Responsibility is handed over to the operational management section
	How	<b>Add air ventilation such as fans and additional lighting</b>

Source: Data Processing Results, 2023

### 3.5. Controls

This control stage controls the proposed corrective actions that have been obtained so that they are carried out by PT warehouse operational employees. United Tractors on an ongoing basis. The control stages carried out are:

1. Create a regular audit system once a day by the internal audit team to ensure the warehouse is in good condition. Such as checking materials in real stock with the SAP inventory system, on materials affected by outgoing processing transactions.
2. Create a special report in the form of a checklist of points, checks carried out by the internal audit team who have carried out the 5W+1H concept in the warehouse area. Once every week with the aim of ensuring the warehouse condition is neat and operations run according to SOP.

### 3.6. Evaluation

At the Evaluation stage, ensure that the quality control (Outgoing) process improvement program is in accordance with the aim of reducing stock differences or not [11]–[13]. If the results of the repairs that pass the quality control process experience an increase in numbers then an iterative repair process will be carried out, if the results experience a decrease in impact then continue the process of repairing the cause of the stock discrepancy next [10], [14]. This research results inline with some previous research that DMAIC was able to detect some problems and encountered the problems [14], [15].

## 4. CONCLUSION

Based on the results of research on the application of the Six Sigma method to overcome warehouse stock differences at PT. United Tractors with the DMAIC (Define, Measure, Analyze, Improve, Control) stages obtained results from several factors causing the problem of stock discrepancies. The Pareto diagram shows that passing the quality control process has the highest value. Next, an analysis of the source of the problem was carried out using the fishbone method and improvements were carried out using the 5W+1H method, with improvement steps: (i) Man Factor by providing work skills training; (ii) Machine Factor with Portable Data Terminal signal rectification; (iii) Method Factor by conducting

routine briefings before starting work activities; (iv) Material Factors by repacking stock materials to facilitate the outgoing process; (v) Measurement factors by motivating operational employees to work with concentration and; (vi) Environmental factors increase air ventilation and additional lighting.

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