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Reducing Stock Opname Mismatches between Actual Goods and Inventory System Using the DMAIC Method

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Abstract:- Stock-taking is generally carried out by most large manufacturing companies to calculate the suitability of the actual quantity of goods with the inventory system. A mismatch in stock-taking results between the actual quantity of goods and the data in the inventory system will certainly be very detrimental to the company. If the actual quantity of goods is more than the inventory system data, there will be a buildup of goods in the warehouse, and capital turnover will be disrupted. Otherwise, if the actual quantity of goods is less than the quantity in the inventory system, it will result in customer stop lines, and the company will get a penalty for reimbursement of stop line costs incurred to customers. This study aims to minimize the occurrence of mismatches between the actual quantity of goods and data in the inventory system when stock-taking is carried out. This research uses the Define, Measure, Analyze, Improve, Control (DMAIC) method to determine the cause of the mismatch between the actual quantity of goods and data in the inventory system during stock-taking. The data taken for this study were four months before the improvement, and three months after the improvement. The results of this study can reduce the mismatch between the actual quantity of items and the data in the inventory with an average per month from 964 pcs to 20 pcs per month.

Keywords:- *Stock Opname, Define, Measure, Analyze, Improve, Control.*

I. INTRODUCTION

Inventory management activities for raw materials and finished goods in a manufacturing company include procedures from the beginning of recording and handling from procurement, storage, to distribution. In some manufacturing companies, data collection inventory of goods and raw materials by taking stock of the actual data of goods in the warehouse is still being carried out manually by employees. The process requires employees to record the name of the goods and the quantity of goods, both raw materials and finished goods. The quantity is recorded on the inventory tag, which is a small sheet of paper attached to the box/packaging of raw materials and finished goods, then the data will be inputted by the inventory admin. Then, the inventory admin will check whether the quantity between the actual goods and the data in the inventory system is correct or not.

Mismatches in recording when stock-taking will have a negative impact on the smooth operation of the company, because it can cause various problems, such as the mismatch of actual raw material inventory with the inventory system so that it can disrupt production. Surely this will not happen if the company records and manages inventory properly.

One of the main causes of inventory data mismatches is the human error factor that often occurs in manual processes. Errors can occur at the initial recording stage by the operator, physical counting of goods, or during the data input process by the inventory admin. The use of inventory tags in the form of paper sheets also has the risk of being lost, damaged, or switched, which can increase the possibility of mismatches between the actual quantity of goods and the data recorded in the system. This condition can have a significant impact on the smooth operation of the company, such as disruptions in production planning due to inaccurate information on raw material inventory.

In addition, the complexity of inventory management in manufacturing companies with a large number of items and a high frequency of transactions is also a challenge for the company. Manual processes often take a long time to ensure data accuracy, which can cause delays in updating inventory information. This condition not only affects operational efficiency, but also interferes with decision-making that relies on the accuracy of inventory data.

To fix this problem, this research uses the Define, Measure, Analyze, Improve, and Control (DMAIC) approach. DMAIC is a structured framework in Lean Six Sigma designed to identify root causes of problems, measure their impact, analyze root causes, design solutions, and control the sustainability of improvements that have been implemented. With this method, it is expected to improve the accuracy of inventory data, minimize recording errors, and support the smooth operation of the company overall.

II. LITERATURE STUDY

- *Warehouse Management System (WMS)*

Warehouse Management System (WMS) is a major part of the Enterprise Resource Planning (ERP) module in supply chain management, which is conducted by a company. The main purpose of a WMS is to control the processes that occur in the warehouse overall, starting from the process of receiving, storing, and shipping. WMS is generally designed

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with facilities that make it easy for companies to get information about the storage of goods based on the quantity and type of goods, so that the storage area in the warehouse can be used optimally.

➢ *Stock Opname*

Stock opname (stock-taking) is an activity of calculating the physical inventory of raw materials, work-in-process, and finished goods in a warehouse or in a factory. This activity is carried out to determine the actual suitability of goods with records/data in the inventory system. Usually, stock-taking is carried out at the end of each month, or there are some companies that do it once every three months, once every six months, or at the end of the year.

➢ *DMAIC*

DMAIC (Define, Measure, Analyze, Improve, Control) is a systematic, data-driven approach used to improve quality and efficiency in manufacturing processes. In the DMAIC method there are five stages used to identify problems, find solutions to those problems, and implement continuous improvement.

Define is the first step to clearly identify the problem you are dealing with. Define aims to identify the product or process to be improved and determine what resources are needed in the implementation of a project. In define, SIPOC (Suppliers, Inputs, Process, Outputs, Customers) is used to help understand and define the overall process more clearly. SIPOC can help identify the key elements of a process, so the project team can understand in detail how the process works, and who is involved.

Suppliers are parties or entities that provide inputs or resources to the process. Suppliers can be external vendors, other divisions within the company, or internal resources.

Inputs are the materials, information, or resources required to run the process. Inputs can be raw materials, data, instructions, or equipment used in the process.

Process is the main activity or stages that occur in the process from start to finish.

Outputs are the products or results of a completed process. Outputs can be finished goods, processed data, or services provided.

Customers are the parties that receive the output of the process. Customers can be external customers (buyers), or internal customers (other divisions that use the output for the next process).

Measure is the data collection activity needed to understand the extent to which the identified problem is occurring. This data collection includes measuring the actual process performance performed at present (baseline) using relevant metrics.

Analyze is the stage of analyzing the data that has been collected to identify the root cause of the problem that is happening. In this research, Pareto diagrams are used to validate hypotheses and find the main causal factors that affect process performance.

Pareto diagrams are bar charts combined with line diagrams sorted from largest to smallest frequency. Pareto diagrams are usually included on inspection sheets to clarify the most important factors from several factors, so that the largest factors will be visible.

Improve is the stage that develops and implements solutions to address root causes. These solutions are tested, monitored, and adjusted to produce significant improvements to process performance.

Control is the stage of ensuring that improvements have been made through continuous performance monitoring.

Fishbone diagrams are used to show the sources and root causes of problems. Fishbone diagrams will identify various potential causes of an effect or problem and analyze the problem.

III. RESEARCH METHODS

Data collection carried out in this study includes research variables (stock-taking, tags, inventory systems used, actual quantity of raw materials, calculation differences, and targets), stock-taking process flow, and data on stock-taking calculation mismatches for the period January 2024 to June 2024. The flow of the stock-taking process is as below:

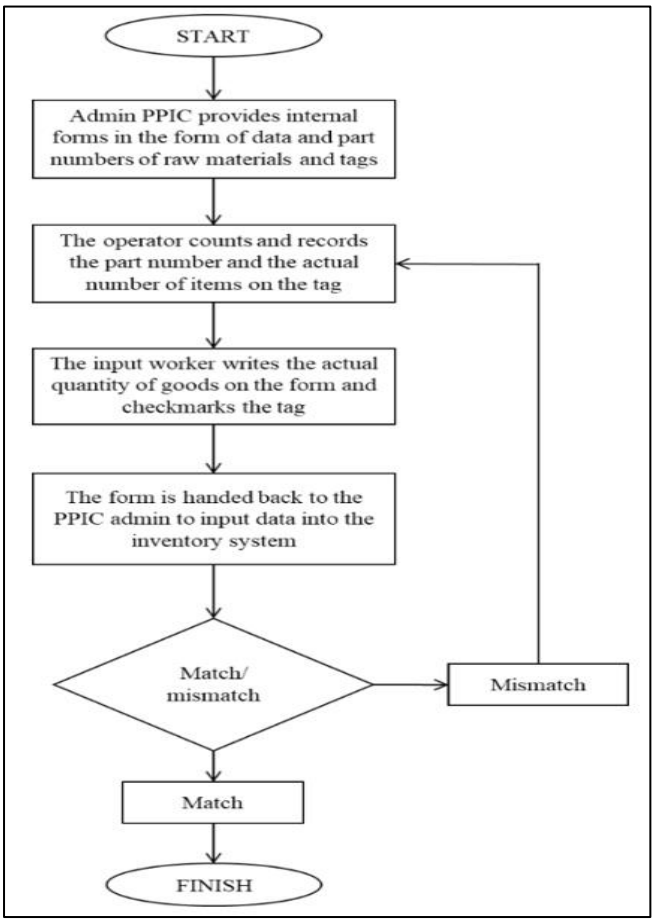

Fig 1 Stock-taking Process Flow

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➢ *The Data Processing Techniques carried out in this Study are as follows:*

- *Define Stage*

In this research, the define stage is used to identify the problem of stock-taking mismatches using the SIPOC diagram tool, to show every activity related to recording raw material inventory, starting from the receipt of goods, up to the finished product.

- *Measure Stage*

In the measure stage, a pareto diagram is used to determine the cause of the mismatch between the actual data of goods and the inventory system that has been occured. By using a pareto diagram, the problems that cause mismatches in the frequency of occurrence can be charted clearly.

- *Analyze Stage*

Analyze the causes of mismatches when stock-taking is carried out. Especially when recording the actual quantity of goods into the inventory tags that have been provided.

- *Improve Stage*

Corrective actions for recording when stock-taking is carried out after knowing the causes of the mismatch between the actual number of goods and the inventory system.

- *Control Stage*

The monitoring stage of the corrective actions that have been taken, related to the mismatch between the actual quantity of goods and the inventory system.

IV. RESULT AND DISCUSSION

A. Early Identification

The early identification results showed that there were mismatches between the actual quantity of goods and the data recorded in the inventory system during the stock-taking process. These mismatches were found in several categories of goods, both raw materials and finished goods, which showed a difference in stock shortages. Based on observations, this mismatch is assumed to be caused by several factors, such as errors in the process of counting goods by operators, inaccurate manual recording, and delays in updating data by the inventory admin. These findings provided the baseline for further analyzing the root causes of the problem and designing effective improvement solutions.

The following is a table of mismatches between actual goods quantity and stock-taking reports for the last four months from May 2024 to August 2024:

Table 1 Data for the Period May to August 2024

Month	Total Items	Inventory Systems (Qty)	Actual Goods (Qty)	Difference
May	223	1.441.789	1.441.306	(483)
June	223	1.408.267	1.405.813	(2454)
July	223	1.471.225	1.470.961	(264)
August	223	1.392.779	1.392.123	(656)

Based on table 1, the highest four-month raw material inventory mismatch data in June 2024 was 2454 pcs. If the data is described in detail, the raw materials that have the highest difference in June 2024 are as follows:

Table 2 Mismatch Data for the Number of Items in June 2024

Month	Item Description	Inventory Systems (Qty)	Actual Goods (Qty)	Difference
June 2024	ANTENNA, ASSY AMPLIFIER (PLATINUM WHITE)	1284	732	552
	ANTENNA, ASSY AMPLIFIER (PURPLISH SILVER)	612	300	312
	CABLE, ANTENNA	1250	500	750
	CABLE, ANTENNA	1252	724	528
	ANTENNA, ASSY AMPLIFIER (GREY ME)	444	228	216
	ANTENNA, ASSY AMPLIFIER (BLACK ME)	300	204	96
TOTAL		5142	2688	2454

Based on the data from table 2 above, actual raw material inventory mismatches can cause many losses to the company, especially in terms of the quality of procurement of goods and their quantity.

B. DMAIC Implementation

➢ *Define Stage*

The define stage is carried out using the SIPOC diagram to identify the problem of stock-taking calculation mismatches. SIPOC is used to show all activities related to the stock-taking process at the company in this study. To describe all activities involved in the stock-taking process, it can be seen from table 3 below:

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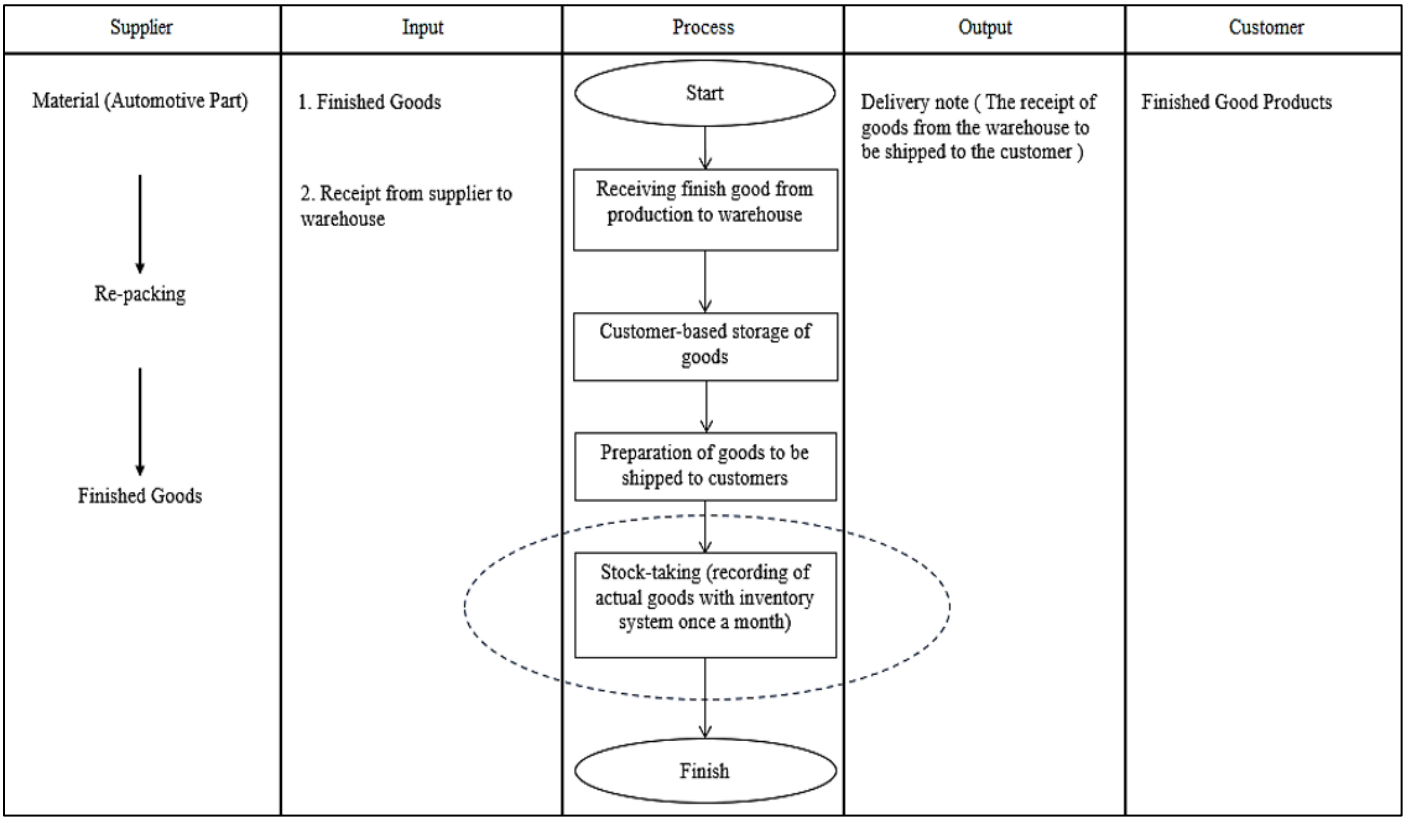
Table 3 SIPOC Flow Chart



In the SIPOC workflow, the focus is on recording goods when stock-taking is carried out as in the table above. The flow of recording goods consists of processes such as:

- Supplier is a company located overseas. The company makes orders to suppliers based on inventory data contained in the inventory system.
- Input is input in the form of goods handover data from the receiving department to the warehouse department to be stored in the inventory warehouse. Physical documents in the form of evidence of goods handover will be stored, and the item data in the form of part name, part number, and quantity will be recorded in the inventory system.
- In the process stage, the warehouse department records incoming goods, storage, then conducts stock-taking activities once a month to ensure that the actual quantity of goods matches the quantity of goods in the inventory system.
- Output is the process of shipping goods from the inventory storage warehouse to be delivered to the customer. In the shipping process, a delivery note will be made as evidence of a transaction that results in a change in the quantity of goods.
- Customers are goods that are delivered to customers, which will later be used in the assembly of products at the customer's site.

➢ *Measure Stage*

To identify the causes of mismatches in the actual quantity of goods and inventory data when stock-taking is carried out, Pareto diagram was made during the research to simplify the analysis process. The following is table of factors causing mismatches in the actual quantity of goods and stock-taking inventory data for the period May 2024 to August 2024:

Table 4 Factors Causing the Mismatch

No	Factor of Cause	Frequencies	Cumulative Frequencies	Percentages (%)
1	Incorrectly calculating the total quantity of boxes on the tag	40	40	54%
2	Incorrect writing of the part number on the tag	20	60	27%
3	Double tag on actual goods	8	68	11%
4	Labels with actual goods are different	6	74	8%
Total		74		

Based on table 4 above, it can be concluded that the factor of mismatch in the quantity of goods during stock-taking is mostly due to the mistake when counting the total quantity of boxes on the tag with a total frequency of findings is 40 times. After collecting the data, Pareto diagram of the factors causing the mismatch between the actual quantity of goods and stock-taking inventory data is made as below:

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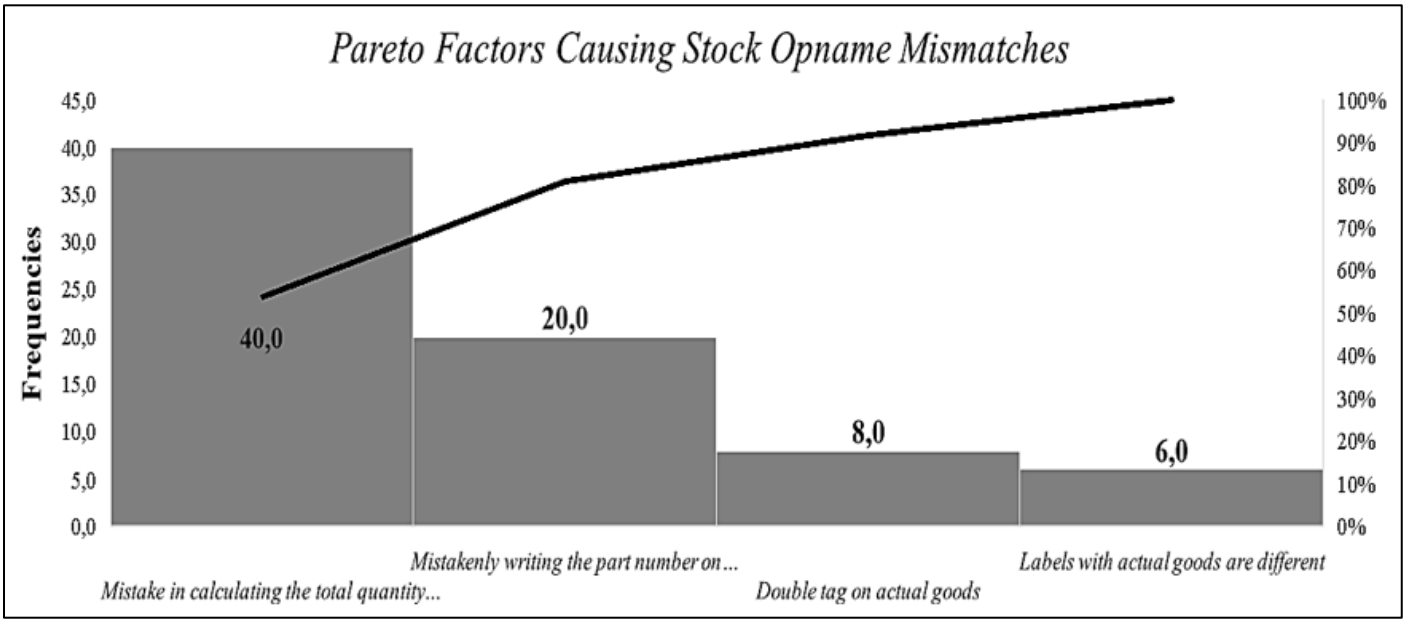

Fig 2 Pareto Diagram of Factors causing Mismatches in Stock-taking Results

➢ *Analyze Stage*

The tool used to analyze this problem is a cause, and effect diagram or fishbone diagram. In this stage, information or statements relating to the causes of the mismatch in the actual quantity of goods and stock-taking inventory data that must be corrected are obtained. Generally, they are categorized into people, methods and environment. The machine and material categories were not included because stock-taking was still carried out manually and there were no issues related to materials. Interviews were also conducted with 34 operators who were directly involved in the stock-taking process to find out the cause of the problem. The following is a fishbone diagram of the mismatch of actual goods with stock-taking inventory data:

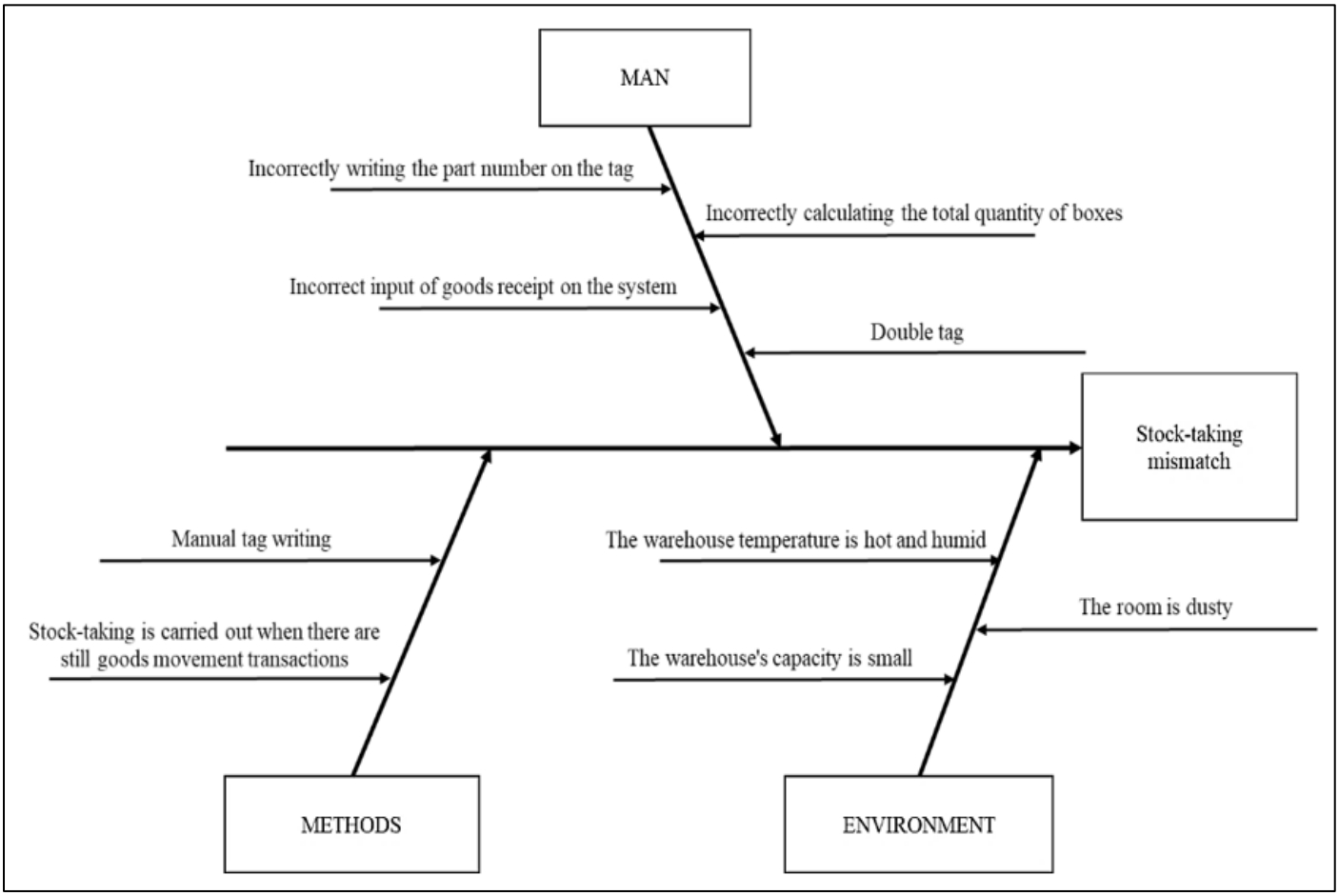

Fig 3 Fishbone diagram of stock-taking result mismatches

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➢ *Improve Stage*

The improve stage is a corrective action plan for the actual mismatch of goods and stock-taking inventory data that are generated after knowing the cause of the problem. In an effort to minimize the stock-taking mismatch that occurs, the following corrective actions are taken:

Table 5 Corrective Actions

Categories	Cause Factors	Why 1	Why 2	Corrective Action
Man	Incorrectly calculating the total quantity of boxes on the tag	Variation of quantity in each box	No clear identity on fraction box	Create custom labels on the fraction box
	Incorrectly writing the part number on the tag	Some of the part numbers look similar	Lack of clear guidance on the label	Create a label that contains the part name, part number, and part picture
Categories	Cause Factors	Why 1	Why 2	Corrective Action
Man	Goods that are ready for delivery are re-tagged (double tag)	Negligence in member's workflow	Not checking the box condition before tagging	Standardize where to place tags on boxes
	Box labels with actual goods are different	Lack of thoroughness in checking goods	Operators are in too much of a hurry when attaching labels	Review the working time required by operators
Methods	Manual tag writing	Not yet using a scanning system	Costs incurred are cheaper	Ensure part name, part number, and picture before tagging
	During stock-taking, in/out transactions are still ongoing	There's still shipping to customers and receiving from suppliers	Production process at the customer and supplier is still ongoing	Early schedule pulling to prevent stoplines
Environment	The warehouse temperature is hot and humid	Poor air circulation	The arrangement of goods blocks air circulation	Move items that block air circulation
	The room is dusty	5S is not implemented optimally	Many areas are difficult to reach and there is frequent forklift passing through	Using an assistive tool to clean hard-to-reach areas
	Small capacity of the warehouse	The layout of goods is less than optimal	There is still a possibility to change the layout of the goods so that the warehouse is more utilized	Change the layout for more warehouse capacity

From the improvements made in the table 5 above, then the stock-taking data is retaken after the improvement is implemented. The following is a table of mismatches between the actual quantity of goods and stock-taking inventory data after improvements have been made:

Table 6 Stock-taking Count Results after Improvement

Month	Total Items	Inventory System (Qty)	Actual Goods (Qty)	Difference
September	223	1.464.268	1.464.234	(34)
October	223	1.438.771	1.438.753	(18)
November	223	1.442.312	1.442.304	(8)

➢ *Control Stage*

The control stage is carried out as a monitoring of the improvements that have been made to the mismatch of the actual quantity of goods and stock-taking inventory data, so that it is carried out continuously. Control actions taken include as follows:

- Conduct regular weekly audits carried out by the internal audit team to ensure that the improvements that have been made are actually implemented, such as checking the special label on the fraction box, checking the place where the label is attached, checking the updated label, and 5S in the warehouse area.
- Create a 5S checksheet and 5S SOP to make it easier for operators to do 5S on a daily, weekly, and monthly schedule.

V. CONCLUSION

This research has identified the causes of the mismatch between the actual quantity of goods and the stock-taking inventory system data and provided suggestions and implementation of improvements to the company. Improvements were made by collecting data directly for 4 months before the suggestions were implemented and 3 months after the suggestions were implemented.

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The purpose of this research is to find out the causes of mismatches between actual goods and stock-taking inventory system data, provide corrective actions to minimize the occurrence of mismatches between actual goods and inventory system data during stock-taking.

The results indicated a significant decrease in the number of mismatches between the actual quantity of goods and the inventory system with an average before improvement of 964 pcs per month, to an average of 20 pcs per month. However, there is a more effective method to anticipate the mismatch of the stock-taking quantity, which is to replace the manual method with the scanner method. However, it was not applied in this research because it requires a large investment cost. So, another alternative was chosen to avoid this, by ensuring the part name, part number, and picture before attaching the tag. It is not expensive, but it takes a few seconds longer than using a scanner system.

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