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Inventory System Improvement At Pt Furniture Using The Dmaic Method

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Abstract

PT Furniture is a company engaged in the distribution of goods located in Bandung, West Java. The company itself sells various products, in the field of home interiors. In the current system, the database owned by the company does not actually describe the number of goods owned by the company. The method used by the company to overcome this problem is the DMAIC method. In the DMAIC method, there are five stages carried out to solve the problem, namely define, measure, analyze, improve, and control. At the measure stage that has been carried out, it was found that the company had problems in the business process of purchasing goods, selling goods, and borrowing goods. From the business process owned by the company, ten root causes of failure were identified at the analyze stage. In the problems that occurred in the company, a proposal for improvement was made for the problematic business process. The proposed improvements are estimated to reduce the possibility of problems occurring in the company.

INTRODUCTION

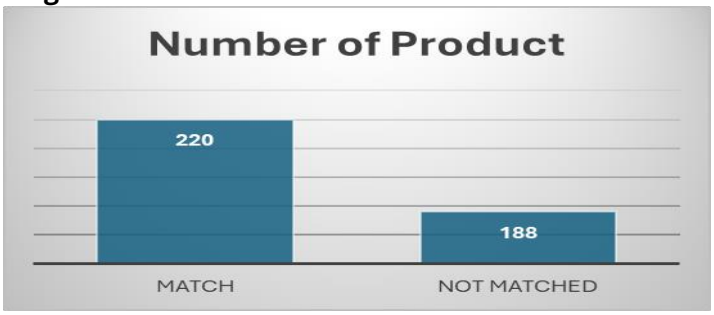
As time goes by, the population in Indonesia is growing. According to the Central Bureau of Statistics (BPS), Indonesia's population in 2023 will reach approximately 273 million, marking a consistent annual growth rate of more than 1% (BPS, 2023). This significant increase in population has led to an increased need for adequate housing, a trend that is expected to continue as the country continues to urbanize and develop (World Bank, 2021).

With the increasing number of housing needs in Indonesia, of course, the need for basic materials to decorate houses is also increasing. The needs of these basic materials include PVC Ceiling, PVC Panel, UV Panel, Vinyl & SPC Flooring, PU Panel, Bamboo Veneer, and various other decorations for residences. The Indonesian Ministry of Industry has highlighted the importance of these materials in supporting the national housing sector, noting that the market for home furnishing and decoration has grown significantly along with the construction industry (Indonesian Ministry of Industry, 2022). Increased residential construction activity, coupled with the growing desire of the middle class for aesthetically pleasing interiors, has further driven demand for these materials (Euromonitor International, 2022).

This furniture company has the goal of maximizing profits. In addition, this company also pays attention to the services provided to customers, so that customers will buy again at this company. For this reason, this Furniture Company does various ways to meet customer satisfaction, namely by providing goods quickly to customers. According to Supply Chain Management Review, the ability to manage inventory efficiently is directly related to a company's overall operational success and its capacity to respond quickly to market changes (Christopher, 2016). The way to provide goods to customers quickly is by providing inventory for goods to be sold. From interviews that have been conducted with the company, namely to the main manager and staff from the company, in providing inventory for goods to be sold to customers, the company often faces obstacles in the process. The obstacle that is often experienced by the company every month is the discrepancy between the number of goods in the warehouse and the database owned by the company. This is said directly by staff from the company, where when there is a purchase from a customer, in the database there are goods stored in the warehouse, but when they want to ship goods, the goods are not available in the warehouse. The difference in the number of goods in the warehouse and the database owned by the company can result in goods that should not have run out in the warehouse experiencing stockouts when sales are made. This happens in the company every month.

In addition to the inconsistency of the data on the number of goods in the warehouse and the company database, the company also experienced problems in recording the entry and exit of goods in the warehouse. For each item that leaves and enters the warehouse, a record is made by the company's staff, which is then entered into the database. However, there are differences in the results between the stored database and the recapitulation of the records made by the company.

Figure 1 Number Of Product Match And Not Match



From the historical data owned by the company, it was found that there were 188 types of goods that had differences between the recorded transaction data and the database owned by the company from a total of 408 types of goods sold by the company in 2023. In other words, the company has around 46% of product types that have differences between the recorded transaction data and the database owned by the company. With this data difference, it makes it difficult for the company to know the exact number of goods from the company's database.

Although the company has a database that does not match the actual data on the inventory or transaction data recorded by the company, according to the company's managers and staff, stock taking is not carried out on the inventory owned by the company. By not conducting stock taking, the company that initially had an inaccurate database will find it difficult to fully trust it, so it must first ensure the number of goods available in the warehouse before selling them to consumers. This will take quite a long time to confirm the availability of goods to consumers and affect consumer satisfaction with the company.

From the problems that exist in the company, the company has constraints related to their inventory management. Therefore, it is necessary to create a system that can help to manage inventory in the company to minimize the occurrence of inconsistencies between the database

owned by the company and the actual inventory conditions in the company, as well as transaction recapitulation data owned by the company. For this reason, in this project an evaluation will be carried out for issues that arise in the company.

LITERATURE REVIEW

In this section, it is explained what theories are used by the author to conduct research related to improving inventory management in the company. The theory used by the author in improving inventory management in the company includes using the DMAIC method. The following is an explanation of the theory for the DMAIC method used in this study.

DMAIC

The DMAIC method is a structured problem-solving procedure that is widely used in quality and process improvement. The DMAIC method is a structured problem-solving procedure commonly used in Six Sigma to improve processes. It consists of five stages: Define, Measure, Analyze, Improve, and Control (Pyzdek & Keller, 2014).

Define

The define stage is the first stage in the DMAIC method. The define stage is the stage that will be the basis of the improvement process of a project. This stage focuses on identifying and defining a clear and specific problem to be addressed. To do this, what is done at this define stage is to identify all the processes involved that are related to the problem to be solved.

In the define stage itself, to identify and define the problem, according to George (2003), graphical tools such as flow charts, value stream maps, and SIPOC diagrams are very important in the Define stage because they help visualize the process and determine the areas that need to be improved. Flow charts themselves are used to provide details of a process being handled. Meanwhile, the SIPOC diagram contains the Supplier, Input, Process, Output, and Customers involved in the process.

Apart from identifying and defining a clear problem, the define stage identifies the Critical to Quality (CTQ) that must be met which can affect the project. These CTQs are quality characteristics that must be present in a product or service to meet customer needs. The identification of these CTQs helps the team establish clear and structured quality specifications to guide the project (Montgomery, 2009).

Measure

The next stage carried out in the DMAIC method is the measure stage. In this stage, accurate and relevant data is collected to evaluate the current process performance. As stated by Evans and Lindsay (2014), data collection methods such as sampling, surveys, interviews, and focus group discussions are very important in this stage. This stage is also carried out by identifying the performance of the process based on the Critical to Quality that has been identified at the define stage. In collecting data to evaluate and determine the current process performance, data collection can be done in various ways. The most common way to collect data is by sampling. However, for qualitative data, data collection can be done using survey methods, interviews, or by conducting focus group discussions.

Analyze

The third stage in the DMIAC method is the Analyze stage. This analyze stage is carried out with the aim of determining the cause-and-effect relationship in the process and understanding the various sources that can lead to failures in the process using the data collected at the measure stage. According to Pande, Neuman, and Cavanagh (2000), tools such as cause-and-effect diagrams and failure mode and effect analysis (FMEA) are commonly used to uncover

underlying problems that contribute to process variability and defects. In this analyze stage, detailed identification is done to find the root causes of failures that occur in a process. In addition to identifying each root cause, actions are also taken to deal with each identified root cause, which will be applied at the improve stage.

Improve

The fourth stage in the DMAIC method is the Improve stage. At this stage, thinking about specific changes that can be made to the process and other things that can be done to reduce the negative impact that occurs in the process. With the changes made, it is expected that the changes can have a positive impact on the existing process.The purpose of the improve stage itself is to develop various solutions to the problem and also test the solutions provided. According to Harry and Schroeder (2000), this stage often involves repeated experiments to refine and validate the proposed solution. The aim is to implement changes that lead to measurable improvements in the process. The iterative nature of this stage ensures that the resulting solution is robust and effective in achieving the project objectives.

Controls

The last stage in the DMAIC method is the control stage. This stage has the aim of completing the work of the project being carried out to provide the process owner with an improved process control plan and other procedures needed to ensure that the project has been successfully carried out. This stage contains the design of the application that can be done by the company to implement the improvements that have been made. Thus, this stage ensures that there are benefits that can be gained by the process owner if improvements are implemented in the process.In addition to using the DMAIC method in conducting research, concepts related to inventory management are also used. The inventory management concept used is related to the ABC analysis method. The following is the inventory management concept used in this research.

Inventory

Inventory is a collection of goods that are overwritten by an organization / business entity in carrying out the organization's activities. The items stored by the organization are usually items used in the production process or finished goods that are ready for sale. Inventory usually consists of raw materials, goods in process (WIP), and finished goods (Vollmann, Berry, Whybark, & Jacobs, 2005). In the inventory itself, a system is definitely needed to control the items in it. According to Wild (2002), stock-taking is essential to verify that inventory records match the actual physical inventory. Controlling items in inventory is useful to ensure that the flow in inventory can run as well as possible. One of the things done in controlling the goods is stock taking. Stock taking is the process of calculating and recording the amount of goods or raw materials in inventory in a company. The purpose of this stock taking is to ensure that the number of items recorded in the inventory system matches the actual physical quantity in the warehouse. This process is important to ensure the accuracy of inventory data, and can also identify the remaining stock owned, and can help manage inventory more effectively.

In recording the stock taking process, of course, all types of goods stored in the inventory need to be checked. This check is carried out at regular periods. However, many companies have many items stored in their inventory. Due to the large number of items, companies usually do not carry out an overall check for the types of goods owned by the company. Therefore, it is necessary to classify the types of items owned by the company when conducting stock taking. One of the grouping methods that can be done is by using ABC analysis.

ABC Analysis

ABC analysis is an inventory control system, which aims to categorize each item. The categorization is done depending on the level of importance of each item in the inventory. The

calculation for the level of importance of each item in the inventory can be used in the following equation.

$$Total\ value = Price\ per\ Unit \times Number\ of\ Units$$

$$Total\ Contribution = \frac{Total\ Value_n}{\sum_{n=1}^{405} Total\ Value_n}$$

From the total value generated in the calculation, grouping is then carried out according to the existing categories. ABC analysis categorizes inventory items into three groups: A (high value items), B (medium value items), and C (low value items) (Silver, Pyke, & Peterson, 1998), namely:

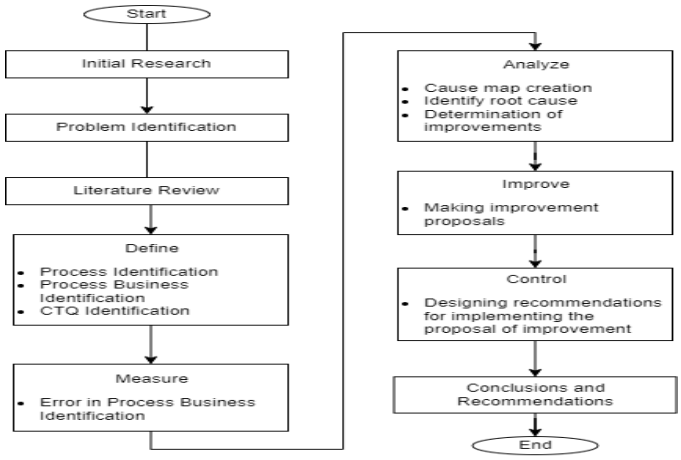
1. Category A
   In this category, items usually comprise 10-20% of the total number of items, but account for around 70-80% of the overall inventory utilization. In category A, the items are usually fast-moving items in the inventory, which have more frequent purchases and high risk.
2. Category B
   In this category, the items usually comprise 15-25% of the total items in the inventory with around 15-40% of the total items. Items managed in this category do not require high intensity as in category A, but still require good supervision.
3. Category C
   In this category, items usually cover 60-70% of the total items in the inventory, but only account for about 5-10% of the total items in the inventory. Items in this category are minimally managed, as they have low value and low risk.

METHODS

Research Design

In this section, the research design of the study is explained. The research design serves as a blueprint for conducting research, outlining the strategies and methods used to collect, analyze, and interpret data (Creswell, 2014). In this study, the research design carried out has eight stages, namely initial research design, probelm identification, literature review, and the DMAIC (Define, Measure, Analyze, Improve, Control) stage, which is widely recognized for its effectiveness in quality and process improvement (Pyzdek & Keller, 2014).

Figure 2 Research Design



Initial Research

At the initial research stage, a search for companies that have problems in it is carried out. After searching for the company, then a request for permission to conduct research at the company was made, starting from making a letter for research permission, until permission was

given by the company. After permission was granted by the company, the research began. This systematic approach ensures that the research is conducted in an appropriate and relevant context (Saunders, Lewis, & Thornhill, 2015).

Problem Identification

At the problem identification stage, qualitative data collection is carried out by conducting brief interviews with company managers and company staff. This interview aims to understand the current condition of the company and identify recurring problems (Patton, 2002). In addition, historical data collection is also carried out by the company to find out whether there are problems that exist and occur in the company.

RESULTS

Define

The first stage carried out in this research is the define stage. At the define stage, identification is carried out for existing processes in the company. The identification carried out is assisted by using flowcharts to describe the processes that occur in the company. In addition to making flow charts. After that, Critical to Quality (CTQ) is also made to find out what failures occur in the process carried out by the company.

Flowchart

Making a flowchart is done to describe the inventory management process carried out by the company in outline. In making this flowchart, a mapping of the processes carried out by the company is carried out starting from purchasing goods until the goods are sent to consumers. The following is a flowchart made to describe the inventory management system owned by the company.

Figure 3 The Inventory Management Process At The Company

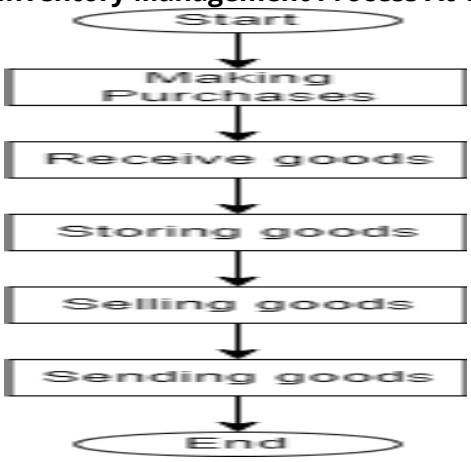


Figure 3 is a flowchart for the processes carried out by the company. In general, there are five processes carried out by the company, namely making purchases, receiving goods, storing goods, selling goods, sending goods. The following is an explanation of each process in the company.

1. Making purchases
   In the making purchases process, products are purchased from suppliers. Purchasing this product is done by checking which items are low in stock in the warehouse. After determining the product to be ordered, an order is then placed with the supplier for the product ordered.
2. Receive goods
   The next process carried out is the receive goods process. In this process, products that have been ordered from suppliers previously will be received at the warehouse. In this process, the

type of goods received by the warehouse is checked against the travel document provided by the sender. After that, a report is made to the office regarding the goods received, and after they match the order, payment is made.

3. Storing goods
   After receiving the goods, the next process carried out is storing the goods. In this process, the goods that have been received will be stored on the shelves according to the item code. If a new type of item is received, a place will be provided for that type of item, a new item code will be written, and the item will then be stored.
4. Selling goods
   In the Selling goods process, goods are offered to consumers. In this process, negotiations are carried out between the office and consumers for the goods offered by the company. After a sales agreement is reached, the goods are then checked to find out the amount of stock in the warehouse. If stock is insufficient, the office tries to find additional stock by borrowing goods from other companies, and paying a higher price for the goods borrowed. If the goods are not available, the office will hold discussions with the buyer regarding the goods ordered.
5. Sending goods
   After the goods ordered have been confirmed and payment has been made by the buyer, then the sending goods process is carried out. In this process, goods are sent from the warehouse to consumers according to consumer orders. The ordered goods will be picked up at the warehouse using the FIFO (First in First Out) system, and then a travel document will be made. After that, the goods delivery process is carried out.

Critical to Quality

In this section we will discuss Critical to Quality that companies must have when carrying out inventory management. This CTQ is needed by companies to identify the criteria that must be achieved by the company in carrying out inventory management. If the company's CTQ is not fulfilled, then the failures that will arise from not fulfilling the CTQ are also analyzed. The following are the CTQs, and failures owned by the company.

Table 1 Critical to Quality (CTQ)

No	CTQ	Failure
1	the number of goods that matches the actual inventory	The number of goods that does not match the actual inventory

From the table above, the company has one CTQ, and there is also one failure that can occur if the CTQ is not met. The CTQ in the company is the number of goods that matches the actual inventory. In this CTQ, if it is not met, it will cause a failure in the form of several goods that do not match the actual inventory. This failure can be fatal, because the number of goods in the database does not reflect the exact number of goods owned by the company in inventory. With this mismatch, a condition can occur where the number of goods in the database is still available, but there are no goods in the inventory.

Measure

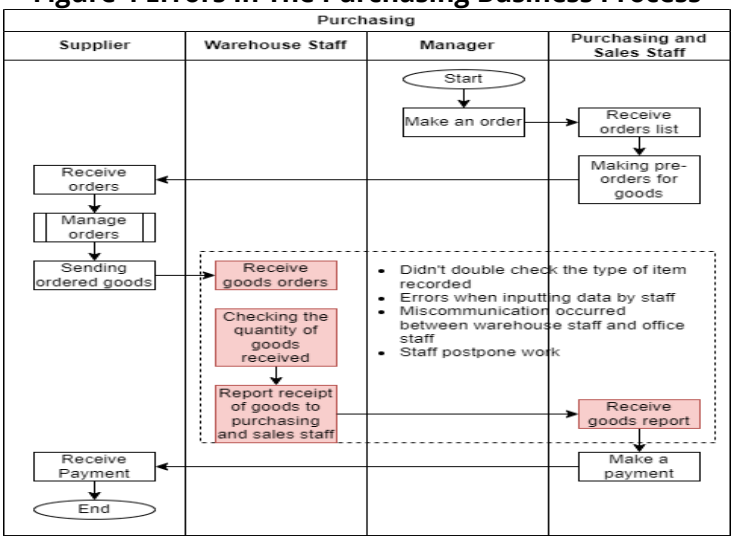
The next stage after the define stage is the measure stage. At this stage, mapping is carried out regarding the current problem conditions in the company. This mapping is carried out with the aim of being able to find out what problems are currently occurring in the company.

Purchasing Process

The first business process reviewed is the purchasing business process. In this process, there are four processes that experience problems, namely receiving goods orders, checking the

quantity of goods received, reporting receipt of goods to purchasing and sales staff by warehouse staff, and receiving report goods by purchasing and sales staff. The problems that occur in this process cause failures that have been defined in the define stage.

Figure 4 Errors In The Purchasing Business Process

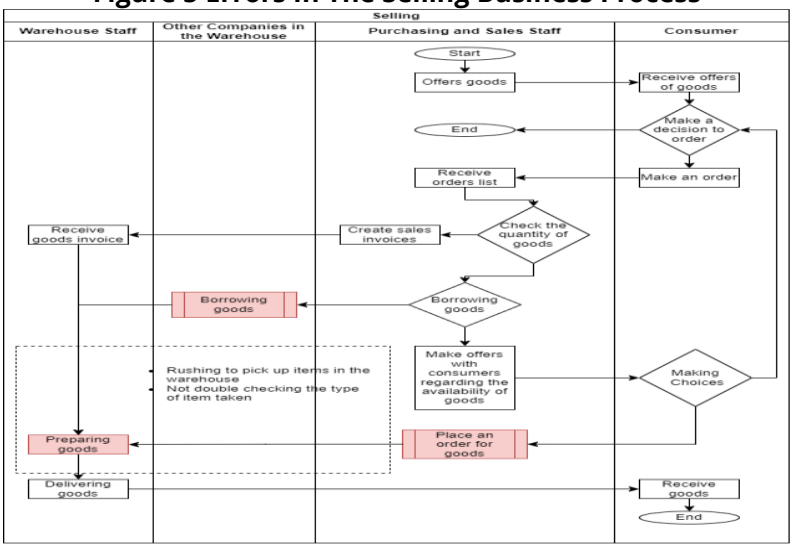


The problematic process is starting from the process of receiving goods order, checking the quantity of goods received, the process of reporting receipt of goods to purchasing and sales staff carried out by warehouse staff and receiving goods report by purchasing and sales staff. In this process, there is no written SOP that is carried out for the reporting that is carried out, so there is a possibility of errors when checking goods that come into the warehouse and when inputting data into the database. With this error, it will result in the failure of the number of goods in the database not being in accordance with the actual inventory.

Selling Process

The next business process that can cause failure is the selling business process. In this business process, there are three processes that can cause failure, namely the process of borrowing goods, placing an order for goods, and preparing goods. The process of borrowing goods and placing an order for goods will be explained in a separate section.

Figure 5 Errors In The Selling Business Process

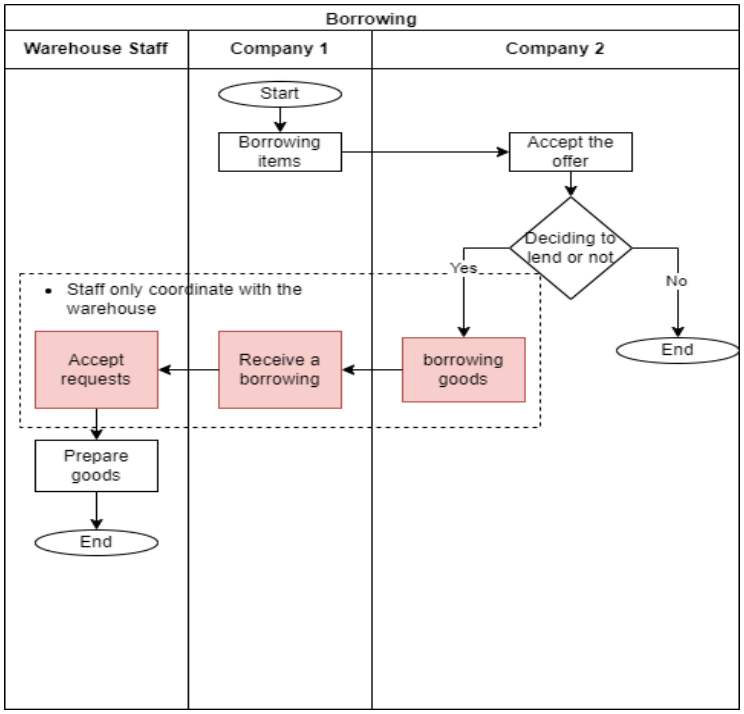


The process of preparing goods has the possibility of causing failure. An error that often occurs in the process of preparing goods is the wrong item being picked up by the warehouse staff because the warehouse staff only picks up the goods and does not pay attention to the item code written in the warehouse. Apart from that, the warehouse staff did not check again regarding the goods sent, resulting in differences in the database and actual inventory.

Borrowing Goods

The next business process that causes failure is the borrowing business process. In this business process, there are three processes that can cause failure, namely the process of lending goods, receiving a borrowing, and receiving a request. These three processes can cause failure in the company's inventory system.

Figure 6 Errors In The Borrowing Business Process



The failure that occurred in these three processes was due to not recording the goods to be borrowed by the company, giving rise to negative numbers in the company's database. With data with negative values, the company starts to find out what errors have occurred, and only then realizes that other companies have borrowed goods because they forgot to record the borrowing of goods. This happens because there is no clear SOP in the process of borrowing goods.

DISCUSSION

Analyze

The next stage carried out in the DMAIC method is the Analyze stage. At this stage, a search is carried out for the root of the problem that causes the problems that occur in the company. Searching for the root of this problem is carried out with the aim of finding out exactly what causes this problem to occur in the system that has been implemented by the company so far. To find the root of the problem that occurs, a cause map is created to identify every root problem of failure in the company.

After creating a cause map to identify the root of the problem for each problem that occurs in the company, then a recap is carried out for each root of the problem and the problems that occur in the company. The following is a recap of the root causes and problems that occurred in the company

Table 2 Root Causes Summarize

No	Root Causes	Solution
1	Didn't double check the type of item recorded	Improve purchasing business processes
2	Errors when inputting data by staff	Improve purchasing business processes
3	Miscommunication occurred between warehouse staff and office staff	Improve purchasing business processes
4	Rushing to pick up items in the warehouse	Improve sales business processes
5	Not double checking the type of item taken	Improve sales business processes
6	Staff only coordinate with the warehouse	Improve borrowing business process
7	Staff postpone work	Improve purchasing and borrowing business processes
8	Too many types of goods	Categorizing items with ABC analysis
9	Don't know what types of items to inventory	Categorizing items with ABC analysis
10	There are no regulations for conducting stock taking	Create a new business process, namely stock taking

In the table, there are 10 root causes that cause failure in the amount of inventory that is different between the actual and the database owned by the company. The root causes obtained in this table come from the cause map that has been created previously. These root causes will be used to determine the improvements made by the company to fix the system, so that the problems that occur can be minimized.

Improve

The next stage carried out in the DMAIC method is the improvement stage. At this stage, improvements are made for each root problem identified in the previous stage, namely analyze. At this stage, the 10 root problems identified in the analyze stage, proposals for improvement will be made to minimize the emergence of these root problems.

Control

The next stage carried out after the improve stage is the control stage. At this stage, a design is carried out for the implementation of the improvements that have been made at the improve stage. The design of the implementation of this improvement aims to show how the company can implement the results of the recommended improvements, so that it can improve the existing system in the company.

Table 3 Improvement Planning

Activity		Period								PIC
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Preparation	Evaluation Of Improvement Proposal									Manager /CEO, Office staff
	SOP Design									Manager /CEO, Office staff
Training And Testing	SOP Trial									Office staff, Warehouse staff
	Training For Office Employees									Office staff, Warehouse staff
	Training For Warehouse Employees									Office staff, Warehouse staff
Implementation	Implementation For Office Employees									Manager /CEO, Office staff, Warehouse staff
	Implementation For Warehouse Employees									Manager /CEO, Office staff, Warehouse staff
	Supervision Conducted by Manager									Manager /CEO, Office staff, Warehouse staff
Evaluation And Monitoring	Monitoring Of New System									Manager /CEO
	Evaluation Of New System									Manager /CEO, Office staff

CONCLUSION

1. Furniture companies have main processes carried out in their inventory management process, namely the process of making purchases, receiving goods, storing goods, selling goods, and sending goods. The five processes are divided into three business processes in them, namely the purchasing business process, the sales business process, and the borrowing business process. From the processes running in the company, there are failures that arise in them, namely the failure of the number of goods not in accordance with the actual inventory.
2. From the processes in the Furniture company, there are several root problems in the processes running that cause failures to occur. The root causes of failure include not double checking the type of item recorded, errors when inputting data by staff, miscommunication occurred between warehouse staff and office staff, rushing to pick up items in the warehouse, not double checking the type of item taken, staff only coordinate with the warehouse, staff

postpone work, too many types of goods, don't know what types of items to inventory, and there are no regulations for conducting stock taking.
3. To solve the problems that occur in the Furniture company, there are several actions that need to be taken. The recommended corrective actions are to improve the purchasing business process, improve the sales business process, improve the borrowing business process, and create a stock taking business process and categorize the types of items using the ABC analysis method. The improvements made can be seen in Improve.

SUGGESTION

1. Companies can make system improvements according to the improvements given in Improve to improve problematic systems in the company.
2. Companies can make improvements with a timeline according to the Gantt chart that has been made in Control to improve problematic systems in the company.
3. In the future, research can be continued using the second cycle DMAIC method for companies.

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