THE IMPROVEMENT OF STOCK ALLOCATION LEAD TIME BY USING LEAN SIX SIGMA

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ABSTRACT

In the high level of competition in the market, customer satisfaction is very important for many companies to respond to the customer requirement such as on-time delivery. The current stock allocation process of company is inefficient to respond to on-time delivery and achieve customer requirement. The purpose of this research was to improve the stock allocation process of company by reducing sales order lines adjustment and lead time process. DMAIC model was applied to find activities that should be improved. The redesign process was created and implemented by eliminating the three adjustment reasons. After the implementation, the lead time of stock allocation process was reduced from 11 hours to 4 hours, and the sales order lines adjustment percentage was reduced from 58% to 16% in the first month of implementation, 13% in the second month, and 12% in the third month.

Keywords: *Stock allocation, process improvement, DMAIC, customer satisfaction*

บทคัดย่อ

ท่ามกลางการแข่งขันสูงในตลาด ความพึงพอใจของลูกค้าเป็นสิ่งสำคัญที่บริษัทต้องตอบสนองเพื่อให้ส่งของได้ตรงเวลา อย่างไรก็ตามในปัจจุบันกระบวนการจัดสรรสินค้าของบริษัทที่ใช้เป็นกรณีศึกษายังไม่มีประสิทธิภาพมากพอที่จะตอบสนองต่อความต้องการของลูกค้า งานวิจัยนี้มีจุดประสงค์เพื่อปรับปรุงกระบวนการจัดสรรสินค้าของบริษัท เพื่อลดการแก้ไขรายการขายและเวลาที่ใช้ในกระบวนการ โดยการนำเครื่องมือ DMAIC มาใช้เพื่อหากิจกรรมที่ควรปรับปรุง รวมถึงออกแบบกระบวนการใหม่เพื่อกำจัดสาเหตุในการเปลี่ยนแปลงรายการขาย ทั้งนี้กระบวนการใหม่ช่วยลดเวลาที่ใช้ในกระบวนการจัดสรรสินค้าลงจาก 11 ชั่วโมง เป็น 4 ชั่วโมง และการแก้ไขรายการขายลดลงจาก 58% เป็น 16% ในเดือนแรกของการเริ่มใช้งาน 13% ในเดือนที่สอง และ 12% ในเดือนที่สาม

คำสำคัญ: การจัดสรรสินค้า การปรับปรุงกระบวนการ DMAIC ความพึงพอใจของลูกค้า

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INTRODUCTION

In the stock allocation process, the warehouse team requires 5.5 hours to proceed for picking, packing, invoicing, and reserving the transportation to ship the product to the customer. As agreed between the customer service team and the warehouse team, the former must send the loading plan before noon to the warehouse team in order to arrange the shipment within the regular working hours of 8.5 hours per day, and all loading plans will be sent to all distribution centers on time.

However, the customer service team spent a long time in the loading of the workbench plan process, which was almost 5.5 hours in stock allocation, sales order adjustment including creating the loading plan. The loading plan was sent very late to the warehouse team, which has an impact on the remaining activities. After the warehouse team has done the activities, the researcher found that the total process lead time consumed was 11 hours, which is over the regular working hours. The researcher would like to improve the stock allocation process to reduce process lead time by reducing the number of sales order adjustment. DMAIC method was applied in this research to define the problem of this process; measure the process and create data collection plan, analyze data by using tools of Lean Six Sigma; improve and redesign the process; and control the new process to monitor the redesign process that is in control.

REVIEW OF RELATED LITERATURE

DMAIC Model

The DMAIC model concentrates to find out and eliminate the variation. In the Define step, the problems are identified based on customer needs and feedback to achieve business objective. In the Measure step, it is determined how to measure its performance and the process that creates defect or variation relative to the process. In the Analyze step, to find causes of defects are determined. The key variables that are most likely to generate process variation are identified in this step to understand why defects are generated. The Improve step focuses on eliminating the cause of defects and key variations; identifying the maximum acceptance range of key variables; and redesigning the process to stay within an acceptance range. The last step is Control that determines how to maintain the improvement by putting the tools to ensure that the key variables remain in the acceptance range.

Pareto Principle

Vilfredo Pareto observed that 20 percent of the population have 80 percent of the land in Italy. The remaining 20 percent of landowners were identified as 80 percent of 20 percent of population (Pareto, 1896). After that, in 1940s, Joseph Juran developed the principle and named it "Pareto" to be the principle of the vital few and trivial to many. Juran applied the Pareto principle to identify that few projects provide large improvement, and it is the top priority (Juran & Godfrey, 1998). The Pareto principle states that from many events, the 80 percent of the effects come from 20 percent of the cause. Zhu and Xiang (2016) used Pareto model to study the journals that were downloaded from the library and found that 20 percent of the frequently downloaded journals comprise 80 percent of the total downloaded journals. This analysis can be a database for subscriptions. If a librarian can decide for retaining the frequently downloaded journals, it will meet 80 percent of the users' demand who downloaded the full text and can save the budget for

other urgent resource. Nicholas et al. (2010) also found that the Pareto principle or 80/20 rule can be applied in a survey of Elsevier's ScienceDirect (SD) usages at British universities, which provided 5 percent of the journals, taking into account for a third to one-half of the total page views.

Process Map

Barbrow (2015) explained that process map is a visual form that shows and describes working and decision steps in the routine workflow. The flow of document, information, material contained in the workflow is tracked in the process map to clarify tasks, actions, and decision that are required at the point of time. Moreover, the process map characterizes the role of many stakeholders involved in the process. The main concepts of workflow that are analyzed are the Swim lane map and the value-added map, which are cross- functional maps. The role in the process is organized by cross-functional map, which is easy to see the tasks, activities, decisions, and information for which they are responsible. The use of a particular pattern of map depends on the company's needs and the processes they plan to map. The process map can visually highlight delays and breakdown in the process, which help managers make decision based on evidence because it shows information about workflows in a format that is easy to understand. The map explains a workflow without too many details and gives clear and enough information that is helpful for cross-departmental communication. The heart of business process map is flowcharts where the designed role shows a cross-functional or swim lane process map. The flowcharts contain shapes that represent different elements of a workflow.

METHODOLOGY

The DMAIC model was used to identify, eliminate, and improve the stock allocation process. Time consuming in stock allocation process caused delayed delivery from the manufacturer to the customer because the finished goods did not arrive to the customer as expected. The DMAIC methods and tools used in this research are shown in Table 1.

Table 1: Research Process

DMAIC	Tools
Define	Problem Statement Project Charter
Measure	Detail Process Mapping Muda (7 wastes) Data Collection Plan
Analyze	Pareto Analysis
Improve	Brainstorming
Control	Control Chart

Defining the Problem

The purpose of this phase is to define and explain the problem. The problem statement of this research was defined as the stock allocation process, taking more than 8.5 hours, which is greater than the normal working hours, starting from planning the allocated stock until the product was packed and ready to be shipped. In the eyes of the customer, the warehouse team should arrange the shipment to catch the truck of the third-party logistics company by following the time schedule and the finished goods should be delivered to the distribution center on time.

Measurement Phase

From the problem statement in Define phase, the stock allocation process takes around 11 hours from planning the allocated stock until the product is packed and ready for shipment. In this phase, the researcher tried to find out the delay activities of stock allocation process. To find the root cause and reason of sales order line adjustment, the author has developed a data collection plan. The data collected was the number of sales order lines adjusted based on the allocated quantities from the total sales order lines that the officer made for a stock allocation per week. Also, reasons for the sales order lines were adjusted. The reason for collecting the adjustment reason was to find the root cause of inefficient stock allocation process and its impact on the process productivity.

Analyze Phase

The author gathered data for the number of sales order lines that was adjusted based on allocated quantities and the reasons why the officer adjusted the allocation quantities from the total sales order lines that the officers allocated stock to customer. The researcher found six reasons why the officers adjusted the allocation quantities in sales order lines. Then, the researcher calculated the adjustment percentage of each reason by using number of sales order that was adjusted from each reason divided by total number of sales order. The adjustment percentage of each reason is shown in Table 2.

Table 2: Reasons for Allocated Quantities Adjustment

Adjustment Reasons	% Adjustment	% Accumulative
Alignment of finished goods with tag stock of USA DC	30%	30%
Alignment of finished goods stock in RAF report	28%	58%
Rounding Volume	20%	78%
Order fulfillment percentage by customer	13%	91%
Quality issue	7%	98%
Inventories in the system and actual inventories do not match	2%	100%

The researcher used the 80/20 rule to prioritize and clarify the reason for adjustment. The Pareto chart was made to help to visualize the causes. The results show that there are three major reasons for the customer service officer to adjust the allocated quantities.

1. Alignment of finished goods with tag stock of USA DC
2. Alignment of finished goods stock in RAF report
3. Rounding volume

Improvement Phase

Three reasons that customer service officer adjusted allocated quantities in sales order lines were considered. The researcher used improvement process to find way to improve the stock allocation process and eliminate delayed activities. The researcher separated the improvement process into eight stages.

1. Set Working team

The researcher made a department list of working teams that is related to stock allocation process, and management team that has authorization for making decision. There were five departments that the researcher invited to join the brainstorm meeting: warehouse team, import and export team, scheduling team, production team, and customer service team. Then, the researcher invited the team members and set the meeting.

2. Provide background and define problem
In the meeting, the researcher explained the stock allocation process and provided the issue that made this process delayed from the analysis. There were three topics discussed in the meeting. The first was about the customer service staff who adjusted the allocated quantities in sales order lines because the system did not automatically allocate the stock to sales order lines because the rounding volume was set in the system. The second was about the customer service staff who adjusted the allocated quantities in sales order lines to align with the stock tagged by the warehouse team. The third was about the customer service officer who compared the stock between the total allocated quantities in sales order lines and the stock of inventories in RAF report. When the allocated quantities did not align with the stock of inventories in RAF report, they adjusted the allocated quantities in the sales order lines to align with the stock of inventories in RAF report.

3. Generate and select idea
After the working team understood the problem, the researcher separated the group by department and let them provide ideas in open environment. When they came up with the ideas they thought can solve the problem, the team member who took the minutes of the meeting wrote down the ideas in the whiteboard. Finally, all team members selected the best ideas that can help eliminate the problem in the process.

4. Create "To-Be" Process
After the working team has selected the best ideas to solve the problem, they re-visited the Detailed Process Map of loading plan workbench process to redesign the work procedure to eliminate delayed activities.

5. Implementation
The researcher explained to the customer service officer to understand the redesign process and some changes in the manner of working. To ensure that all staff have understood the redesign process, the researcher arranged a training and let the officer do all the activities for the stock allocation process with the researcher. After that, the customer service officer started to use the redesign process. The customer service officer recorded the number of sales order lines that was adjusted based on the allocated quantities.

6. Monitor and follow up
Every week, researcher arranged the meeting with the officers to check the number of sales order lines that was adjusted based on allocated quantities and discussed about their concerns.

Control phase
After the implementation of the redesign process. The officer collected the number of sales order lines adjusted to allocate quantities and the total number of sales order lines that was the allocated stock to customer by week, including the sales order lines adjustment percentage calculated from the number of sales order lines adjustment divided by the total sales order lines. Then, the researcher used the data to calculate the Upper Control Limit (UCL), Central Line (CL), Lower Control Limit (LCL) in the control chart to monitor the behavior of the process and ensure that this process is in the state of control.

CONCLUSION

The results of the implementation of Lean Six Sigma by using DMAIC concept and its tools have met the research objectives. Firstly, identifying activities should be improved which are activities that the customer service adjusted the allocated quantities in sales order lines. Secondly, clarifying the root cause of the allocated quantities adjustment from six reasons, which are rounding volume; alignment of finished goods with tag stock of USA DC; alignment of finished goods stock in RAF Report; order fulfillment percentage by customer; quality issue; and inventories in the system and actual inventories do not match. Thirdly, the redesign process was implemented to reduce the number of sales order lines adjustment and lead time of stock allocation process. From the results, the number of sales order lines adjustment has reduced nearly four times from 58% to 16% in the first month followed by 13% and 12% in the next two months. Moreover, the lead time process has reduced from 11 hours to 4 hours at 63.6% improvement.

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