ISSN No:-2456-2165

Analysis of Improving Lead Time for Material Delivery from Hub Warehouse to Site Location in Heavy Equipment Company using Dmaic Method

Muhammad Ridwan, Muhamad Atho Rifaitulloh, Humiras Hadi Purba
Master of Industrial Engineering Program
Mercu Buana University, Jakarta - Indonesia

Abstract:- The DMAIC method is one of the Six Sigma tools that can be used to improve performance with a systematic level of analysis to eliminate non added value. This methode is usually applied in production process, but it can also be used for the supply chain sector. In the case of accuracy time of material procurement until its delivery to the site, corrective measures are performed using the Ishikawa diagram to determine the problem of the process stage. The improvements are focused on consistency in making the Shipping List and scheduling delivery time to the site warehouse.The results of this research were increase in accuracy from 34% to 71% after improvements were made

Keywords:- *DMAIC, Six Sigma, Value Added, Supply Chain System, Ishikawa Diagram.*

I. INTRODUCTION

Supply chain management have a huge role in doing business, both in retail (consumer goods) and in the manufacturing and services industries. Companies with a good supply chain system will be able to compete better compared to competitors in relate to the cost, since 70-80% of production costs come from the cost of materials. In addition to the cost, the supply chain system's success also has implications for completing product (delivery) so that it can arrive at the customer on time.

This research is conducted in a company engaged in the manufacture of heavy equipment as well as heavy equipment repair services on sites adjacent to the location of heavy equipment owner's. One of the problems is the length of procurement time of consumable material. Start from material requisition from the site, ordering process to the vendor, receiving material by the warehouse hub in Jakarta then delivering it to the site location. Timing of actual turnaround time can not be achieved or exceeded time targeted by team in site location. This resulted in material delays in site locations in Kalimantan and Papua, so the target of completion of work was also disturbed.

One way that can be applied to make improvements and control the procurement process is the implementation of Lean Six Sigma by using the DMAIC (Define-Measure-Analyze-Improve-Control) method. The DMAIC method can improve the level of rejection (Manohar & Balakrishna, 2015), which is this research the quality parameters is the process of late material procurement.

II. LITERATURE REVIEW

The DMAIC methodology is a tool of Six Sigma, which has been used to realize a more systematic lean concept to increase productivity generated across multiple companies. Its implementation includes using a range of quality and lean manufacturing equipment that produce better operations such as value-added flow diagrams, cause & effect diagrams (Ishikawa diagram), and Pareto diagrams. (Arafeh, 2015). Not only in the production process, DMAIC can also be applied for supply chain systems to reduce non value-added processes and also improve flow and physical information systems (Elbermawy et al, 2014).

Implementation of DMAIC method consists of 5 steps in accordance with the abbreviation named:

- *Define*

At the first stage, the identification of the problems encountered, determines the scope of the project and the collection of information related to the process (Manohar & Balakrishna, 2015). At this stage also determines the team involved in this project (Purwani, 2015).

- *Measure*

At this stage, current performance is measured to evaluate deviations that occur against the target set by the company (Kholil & Pambudi, 2014).

- *Analyze*

The purpose of this stage is to identify, verify and select the primary cause of the cases faced so that root causes can be eliminated. Ishikawa diagram has been developed to identify potential causes that have a significant effect and then show what can be eliminated to improve the process (Manurung, 2014).

- *Improve*

After analyzing the problem, improvements were made from known dominant factors. The results are identified to determine the factors that cause deviations that occur so that appropriate corrective actions are obtained (Kholil & Pambudi, 2014).

➢ *Control*

Corrective action should be monitored to see the effectiveness of this action and also ensure the stability of the process is maintained. The effectiveness of corrective action can be seen by comparing the performance of the process before and after the repair is carried out (Elbermawy et al, 2014).

If the organization has been consistent in implementing the DMAIC approach, then Six Sigma can be implemented to determine the organization's sigma value (Purwani, 2015).

III. RESEARCH METHODOLOGY

This research is carried out using the DMAIC method to determine the source of the problem, i.e the length of time the material is obtained from the material demand from the site to the material to be sent to the site. The flow chart of this research process is illustrated in Figure 1.

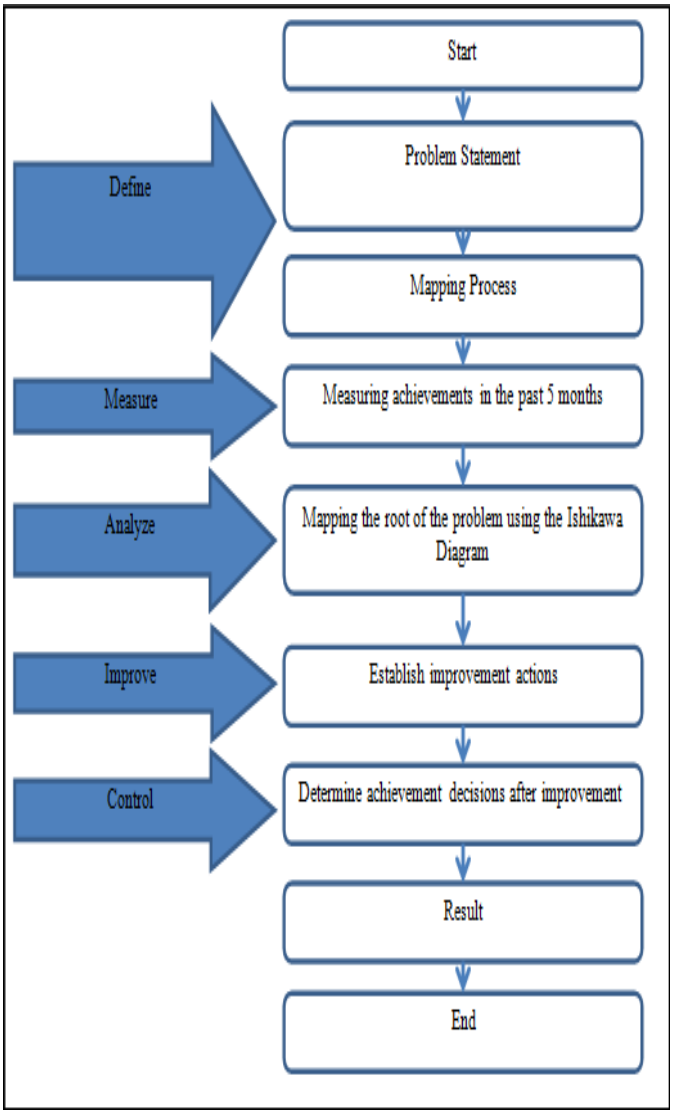

Fig 1:- Research flow chart

IV. RESEARCH RESULT

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

➢ *Define*

The problem statement in Six Sigma is formulated using Equation (1):

$$Y = F(X) \quad (1)$$

with Y is the desired result and X is the factor that affects the result.

In this study, the variables X and Y are as follows:

Y = Improve the timeliness of material procurement until it's delivery to the project site

X = Cause of delays in procurement and delivery of material

From the observation of the actual process performed, it is illustrated by the SIPOC diagram in Figure 2.

Supplier S	Input I	Proses P	Output O	Customer C
Inventory Site	Stock Transfer Order by SAP System	Check stock availability in HUB Warehouse	Purchase Request	Purchasing
Inventory Control Hub	Purchase request	Create Purchase Order	Purchase order released	Supplier
Supplier	Material	Incoming material	Good receipt in SAP System	Inventory Control Hub
Hub Warehouse	Data stock	Create Packing List	Packing List	Hub Warehouse
Hub warehouse	Material	Picking & packing material	*Package* material	Logistic hub
Logistic hub	Final *Packing list*	Delivery material to site	Material delivered to site	Inventory Site

Fig 2:- SIPOC material flow

➢ *Measure*

To determine the state of the process during the time, data collection was carried out during the procurement period of the previous 5 months (October 2016 - February 2017) based on the number of material requests from the project site. The KPI of procurement time determined by the company start from date of demand issue (Stock Transfer Order) from project site until delivery date from Warehouse Hub, the total lead time is 33 days. Therefore, if the lead time more than 33 days that called defect. In Table 1, it can be seen that the average DPMO in the last 5 months is 663,529, very far from the DMPO target of 150,000.

Month	Delivery Demand	On Time Delivery	Defect	DPO	DPMO	Sigma-L
Oct-16	172	46	126	0.732558	732558	0.879432
Nov-16	124	58	66	0.532258	532258	1.419053
Dec-16	208	66	142	0.682692	682692	1.024759
Jan-17	173	63	110	0.635838	635838	1.152644
Feb-17	173	53	120	0.693642	693642	0.993801
Total	850	286	564	0.663529	663529	1.077885

Table 1:- Current State Condition

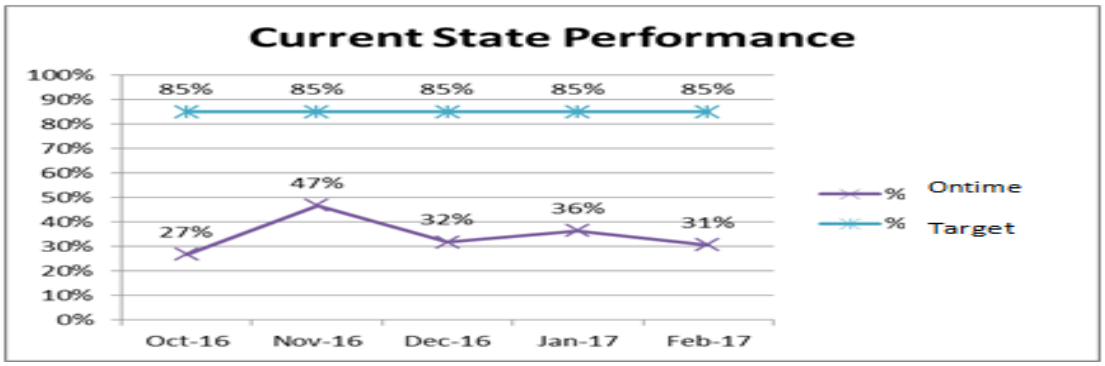

Fig 3:- Line Chart of Current State vs Company Target

In Figure 3, we can see the deviations that must be corrected so that the company's targets can be achieved.

➢ *Analyze*

Then, analysis of the causes of the problem is done by using the brainstorming method to find the root cause (X) so the target is not reached (Y). The result can be seen in Figure 4.

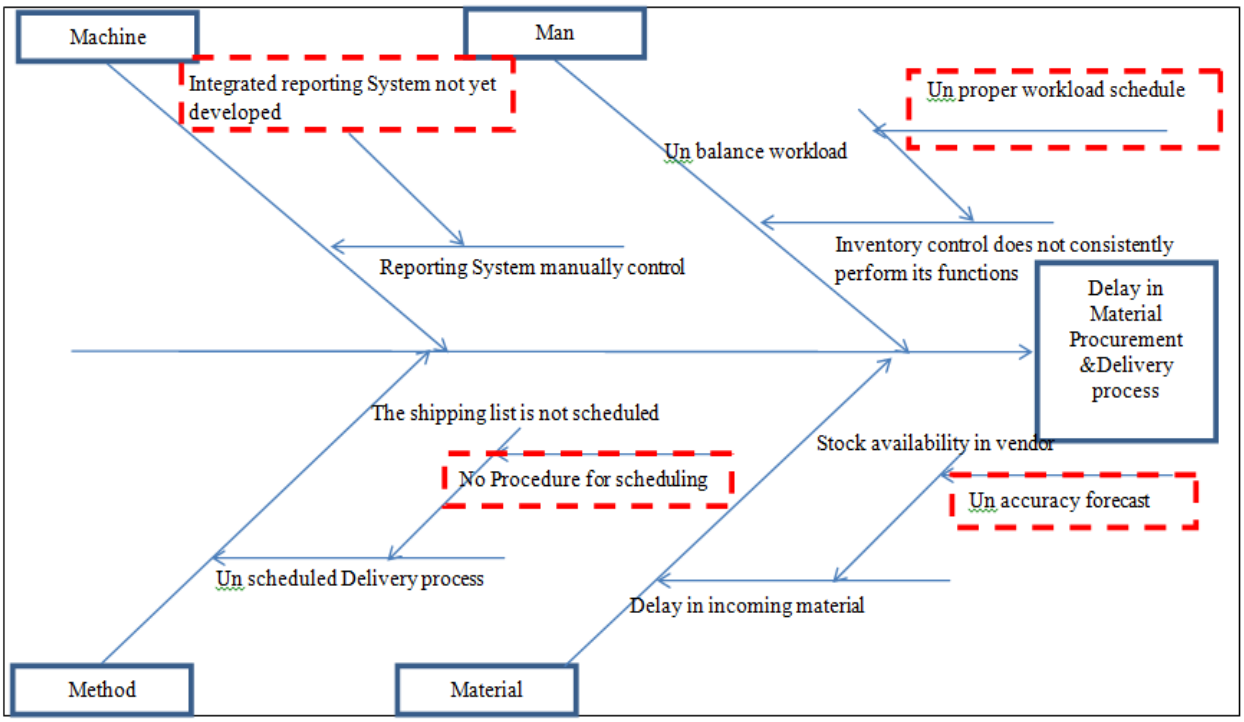

Fig 4:- *Ishikawa Diagram*

From the Ishikawa Diagram in Figure 4, there are at least 4 main reasons that result in delays in material procurement and delivery time. From the root cause of the boundary problem of the mapped process that can be controlled and cannot be controlled by the Hub Inventory control is obtained based on the result in Figure 5.

	High Impact	Low Impact
In Control	- Un Proper workload schedule	- No procedure for scheduling
Out Of Control	- Un accuracy forecast	- Integrated reporting system not yet developed

Fig 5:- Impact diagram vs. Control over the root of the problem

➢ *Improve*

Based on the results of root problem mapping in Figure 5, the problem to be resolved / eliminated is the scheduling process of inventory control to consistently submit the delivery order for the delivery process as well as the Standard Operational Procedure (SOP) that manages the delivery schedule of materials to the project site. From the brainstorming result with the team, it is agreed that the production of shipping data is made weekly with scheduled delivery to the site every 2 weeks.

➢ *Control*

After improvements in the improvement phase, decision control is carried out during the period of March to July 2017. Based on the graph in Figure 6, it can be seen that there was an increase in average time of procurement and delivery of 34% before the improvement process to an average of 71% after improvement and DPMO also increased from 663,529 to 293,083.

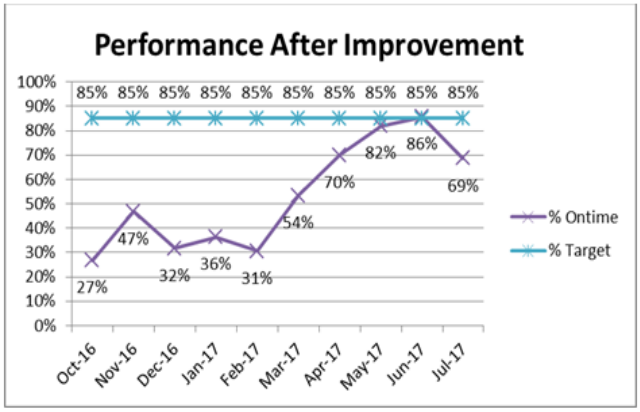

Fig 6:- Line chart after improvement

V. CONCLUSION

From the research, it was found that the analysis of time-enhancing analysis of the material until material delivery to the project site using the DMAIC method can be obtained significant change even though it has not been able to meet the targets set by the company. The increase in average results The turnover and submission is 34% before the 71% process by consistently making a List of Submissions and scheduling delivery time to the project site.

REFERENCES

[1]. Arafeh, M. (2015). Combining Lean Concepts & Tools with the DMAIC Framework to Improve Processes and Reduce Waste. American Journal of Operations Research, 5, 209-221

[2]. Elbermawy, M. F., Al Manhawy, A. A. & Ibrahim, H. E. A. (2014). Implementation of Lean six sigma For Improving Supply Chain processes in a Pharmaceutical Industry. International Journal of Scientific & Engineering Research, Volume 5, Issue 8, 519-529

[3]. Kholil, M. & Pambudi, T (2014).Implementasi Lean Six Sigma Salam Peningkatan Kualitas dengan Mengurangi Produk Cacat NG Drop di Mesin Final Test Produk HL 4.8 di PT. SSI. Jurnal PASTI Volume VIII No 1, 14 – 29

[4]. Manohar, C. & Balakrishna, A. (2015). Defect Analysis On Cast Wheel bu Six Sigma Methodology to Reduce Defect and Improve The Productivity in Wheel Production Plant. International Research Journal of Engineering and Technology (IRJET), Volume 2, Issue 3, 1659-1663

[5]. Manurung, S. (2014). Improvement Material Inventory Tracking for Maintenance and Project Through Lean Sigma Methodology. ICTOM 04 – The 4th International Conference on Technology and Operations Management, 519-530

[6]. Purwani, W. (2015). Usulan Perbaikan Kualitas Produk Kayu Manis di Industri Rempah-rempah dengan Metode DMAIC. Jurnal OE, Volume VII, 303-318.