Available online at JDR Website: http://journal.unublitar.ac.id/jdr

Journal Of Development Research, 7 (2), November 2023, Pages 208-213

DOI: https://doi.org/10.28926/jdr.v7i2.364

Integration of The Lean Six Sigma Model in The Distribution of Goods to Minimize Delivery Delays at PT. AMA

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Received: 1 November 2023; Revised: 24 November 2023; Accepted: 28 November 2023

Abstract

PT. AMA is a company operating in the goods distribution industry (cement-non-cement). A problem that is the focus of research at PT. AMA is a delay in delivery by the company's fleet. In this research, the method used is the integration of the Lean Six Sigma model which combines the philosophy of waste reduction from Lean and the high-level quality control approach from Six Sigma where with the help of research using Visual Stream Mapping to visualize the company's operational processes to identify in more depth the root of the problems that cause there is a delay in the delivery of goods. Which results in a total lead time of 770 minutes and value-added time of 420 minutes with an error rate of 22% and a Six Sigma value of 2.29. Proposed improvements to the new goods distribution operational system using the 5W-1H method analysis. The results of the research that has been carried out show that the integration of the Lean Six Sigma model significantly reduces waste, optimizes a distribution process and increases on-time delivery.

Keywords: Delay in Delivery, DMAI, Lean Six Sigma, Root Cause Analysis, Value Stream Mapping

Introduction

PT. AMA is a well-known subsidiary company engaged in the goods distribution logistics industry (Cement - Non-Cement). Where this company consists of an Operational work unit which is fully tasked with the logistics distribution process starting from forecasting-executing sales orders, checking and monitoring the smoothness of the fleet work process. Logistics distribution plays a central role in maintaining a smooth and efficient flow of goods in a company's supply chain. especially in archipelagic countries like Indonesia, logistics distribution is not only a crucial business strategy but also a determinant of success in satisfying consumer needs with timely delivery (Hambajawa, Handoko, & Kiswandono, 2020).

Service quality has a significant impact on sustainability or progress in company development. Satisfaction is a form of assessment result that arises from a comparison between performance or results and expectations (Somadi, 2020). Companies that provide high quality services to meet their customers' needs have a greater advantage over their competitors (Sakti, & Mahfudz, 2018). Inadequate quality in the supply chain system can result in various types of defects appearing in its operations (Ramadhan, Syarif, & Ariani, 2022). On time delivery has a positive and significant effect on customer satisfaction (Aminah, Rafani, & Hariyani, 2017). A series of obstacles resulting in delays in product delivery give rise to significant loss elements in terms of time, effort and costs (Siregar, & Ayu, 2019). Waste refers to all activities that do not provide added value in converting input into output. In the product distribution process, deviations often occur from the scheduled time, in other words there are often delays in the delivery process (Kusmayadi, & Vikaliana, 2021). The lean approach is focused on reducing operational or processing time and production quantities significantly in order to reduce complexity and dependence on predictions and planning that are not yet ideal (Siregar, & Puar, 2018).

Lean Six Sigma uses the DMAIC phase which is similar to six sigma which focuses on eliminating waste aspects and critical to quality

characteristics (Gaspersz, 2005). In implementing the Six Sigma concept, there are 6 (six) important elements that must be considered, including: 1) Identifying customer needs, 2) Understanding in depth about products/services and production requirements that are tailored to customer desires, 3) Defining a process by clear, 4) Minimize errors and waste, 5) Increase the level of success of the process continuously towards the desired standard (Supriyanto, 2018)

The Lean six sigma approach model was chosen because it has the concept of measurable improvement starting from performance values and also has an in-depth and continuous control process (Hudori, 2016). The solution to achieve effective and efficient results that meet expectations is the need for support from optimal work processes to produce maximum results and in accordance with the targets set by the company (Gaspersz, 2001). This research is focused on identifying problems in the company's operational processes which cause delays in the distribution or delivery of goods through the integration of the Lean Six Sigma model method with the DMAI (Define, Measure, Analyze and Improve) treatment phases which are intended or expected to be able to provide a strategy for solving the root of problems that arise as well as proposed improvement plans to reduce and minimize problems experienced by the company, especially aspects of logistics delivery delays (Maulana, & Wahyuni, 2021).

Materials and Method

Research carried out by the company's operational units to identify solutions to problems experienced by the company is using a quantitative approach using the Lean Six Sigma method with the DMAIC phases, the description of the phases is as follows:

1. Define Phase
   The Define phase is the initial phase intended to identify a problem that occurs in a company. The Define phase describes in general a process as follows:
   a. Creating a SIPOC diagram (Supplier, Input, Process, Output, Customer)
   b. Process visualization depiction with Value Stream Mapping
   c. Activity classification with Process Activity Mapping
2. Measure Phase
   The Measure phase is a phase intended to identify waste that has the most influence on problems that arise by measuring capabilities related to all processes carried out, including:
   a. Calculating of Defect per million opportunities
   b. Calculating of Six sigma value capabilities
   c. Control chart
3. Analyze Phase
   The Analyze phase is a phase of the analysis process where an in-depth process of identifying the root causes of problems is carried out in order to explore data to produce mapping steps and determine critical factors that influence the results of a process with the help of a Fishbone diagram for determining and classifying Critical To Quality.
4. Improve Phase
   The Improve phase is a proposed phase that will be carried out in order using 5W+1H analysis tools to minimize the causes of waste by determining action plans. The action plan is intended to outline the allocation of resources, priority scale and delineation of alternatives that will later be considered in implementation.
5. Control Phase
   After the improvement stage has been carried out by brainstorming with all elements of the company, the control stage is carried out as a sustainable effort to see and measure the effectiveness of the agreed development plan. Where companies must be able to align problems that occur with the development of company SOPs and carry out regular audits using 5R.

Results and Discussion

Data obtained from observations are in the form of fleet operational release data, delivery delay data, data on types and types of operational activities. The following is research data obtained in October 2022.

In the Table 1 identification results from collecting data regarding waste (Delay in Delivery) with Lean Six Sigma integration resulted in:

1. Define Phase
   Following is the identification of the problem with several process steps carried out at the define phase:
   a. SIPOC Diagram show on Figure 1.
   b. Value Stream Mapping show on Figure 2.
   c. Process Activity Mapping show on Table 2.
2. Measure Phase

Table 1. Fleet Operational Recap Data

Date	Daily Release	Number Of Delays
1 October 2022	110	23
2 October 2022	157	35
3 October 2022	155	29
4 October 2022	153	33
5 October 2022	159	38
6 October 2022	148	26
7 October 2022	138	25
8 October 2022	120	21
9 October 2022	157	34
10 October 2022	159	39
11 October 2022	170	48
12 October 2022	156	36
13 October 2022	154	37
14 October 2022	140	24
15 October 2022	136	23
16 October 2022	160	41
17 October 2022	167	42
18 October 2022	158	35
19 October 2022	151	35
20 October 2022	143	28
21 October 2022	149	24
Total	**3140**	**676**

Table 2. Process Activity Mapping

Number	Activity	Time (Minutes)	? TK	Activity Type					Category
				O	T	I	S	D	
1	Sec. Matching check SO data	7	1	O					NNVA
2	Data checking fleet availability	17	1	O					NNVA
3	Checking unloading capacity data- load DO	6	1	O					NNVA
4	Sec. Monitoring recap daily data	20	1	O					NNVA
5	Checking fleet status information	12	1			I			NNVA
6	Making data updates- confirmation Vendors	13	1	O					NNVA
7	Planning Team coordinating fleet readiness	30	1	O					NNVA
8	Making daily plans order execution	28	1	O					NNVA
9	Information reporting data update- Vendor confirmation	7	1	O					NNVA
10	Sec. Matching order execution- Vendor confirmation	35	1	O					NNVA
11	Checking fleet readiness (SOP K3 Company)	10	1			I			NNVA
12	Driver waits for SPJ printing from the Operator	13	1					D	NVA
13	Driver picks up SPJ to Operator	1	1	O					NNVA
14	Confirmation fleet readiness	1	1	O					NNVA
15	The fleet is heading DO stated	420	1		T				VA
16	Driver submits evidence SPJ	1	1	O					NNVA
17	SPJ checking by DO Operator	2	1			I			NNVA
18	Drivers wait SPJ confirmation is validated	13	1					D	NVA
19	Drivers carry out the queuing process unloading	20	1	O					NNVA
20	Fleet carry out the unloading process	95	1	O					NNVA
21	Data checking & matching demolition	20	1			I			NNVA
	Total	**770 Minutes**		**14**	**1**	**3**	**0**	**0**	

Table 3. Process Activity Mapping Recap Result

Category	Number of Activities	Time (Minutes)	Percentage
Value Added (VA)	1	420	55%
Necessary Non-Value Added (NNVA)	18	334	45%
Non-Value Added (NVA)	2	16	2%
Total	21	770	100%

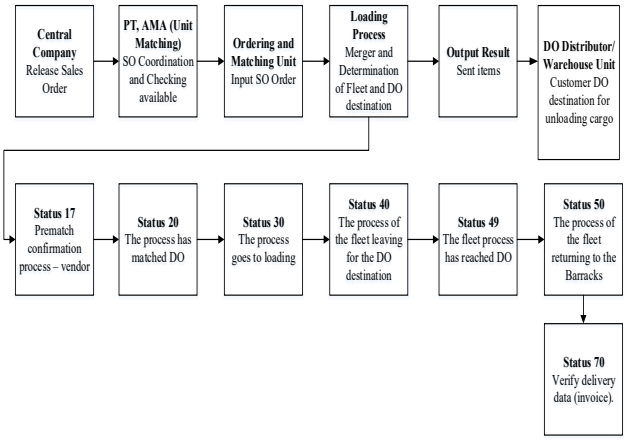

Figure 1. SIPOC Diagram

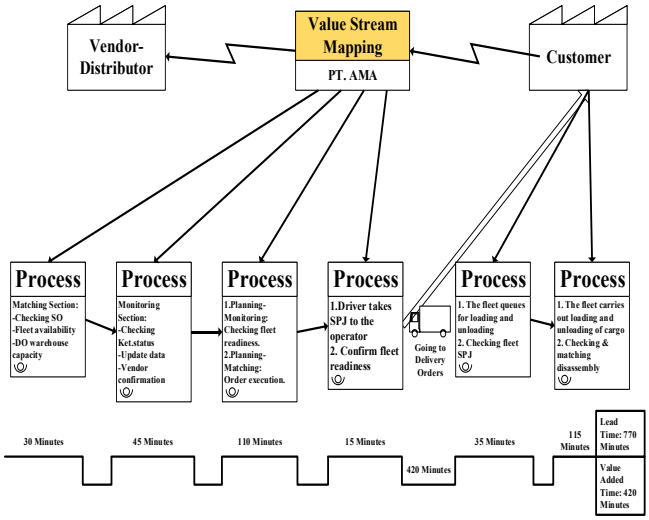

Figure 2. Value Stream Mapping

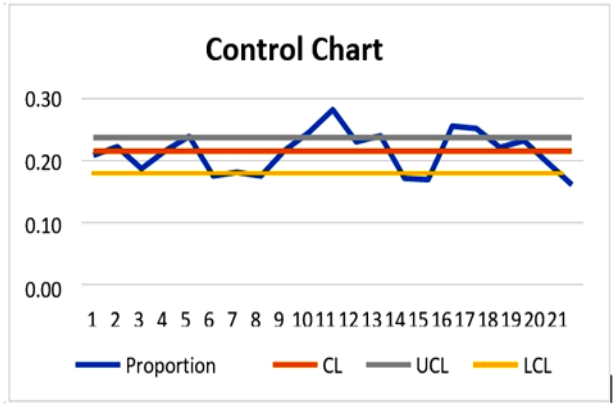

Figure 3. Control Chart Six Sigma

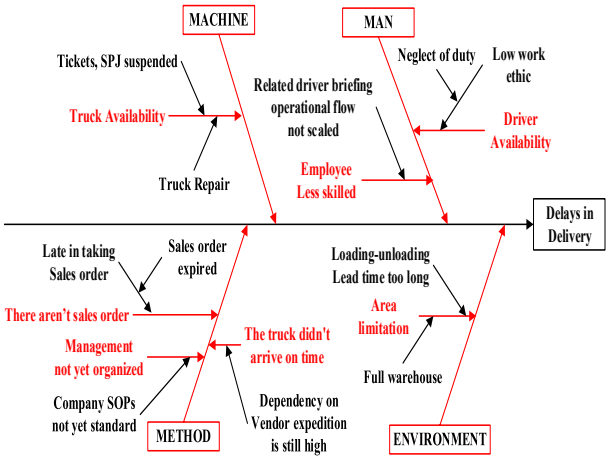

Figure 4. Fishbone Diagram

The following is an analysis of the calculations with several process steps carried out at the Measure phase:

a. Calculation of Defect per Million Opportunities

DPMO = DPO * 1.000.000

DPMO = 215286,624 (**215287**)

b. Calculation of Six Sigma Value Capabilities

NORMSINV (1 – DPMO ÷ 1.000.000) + 1.5

Six Sigma Value = 2.2882 (**2.29**)

c. Control Chart

In the Figure 3, it shows that the defect per million opportunities (DPMO) is 100,000 times, with delays in delivery of goods is 676 times out of a total of 3140 deliveries. So it produces a Six Sigma value of (2.29).

3. Analyze Phase

The following is a calculation analysis with several process steps carried out at the analyze phase:

From the Figure 4 description of the fishbone diagram above, it can be seen that the causes of problems are caused by several factors, including factors Man, Method, Machine & Environment. With the following explanation:

a. Human Factors, with the variable that the work ethic of employees is still low, drivers are less competent in carrying out the company's operational SOPs. The proposed improvement is to provide drivers and vendors with targeting in work operations as assessment/evaluation material on a scale to improve work ethic and professional

Table 4. Improvement suggestions

Factors	Analysis	Explanation
Low work ethic results in negligence regarding duties and the availability of drivers who are not ready	What	Low Ethos Work
	Why	To improve performance and enthusiasm in optimizing service effectiveness and productivity distribution of goods.
	Where	Assembly point drivers.
	When	On the final day of work effectiveness can be seen from the realization of daily releases and rest hours excessive.
	Who	Ka. Seksi Operational Transportation area, Vendors.
	How	Given a challenge / continuing success target with bonuses for each individual driver / vendor to increase the ethos spirit work.
Fleet drivers are incompetent in following the company's operational SOPs resulting in delivery delays	What	Drivers don't competent.
	Why	To increase knowledge and understanding of the relevant drivers process flow implementation operational fleet and system as well minimize flow procession less effective.
	Where	In the Operating time, in the DO Warehoused
	When	During fleet operations.
	Who	Unit Monitoring, Ka. Seksi Operational Transportation area, Vendors.
	How	Driver provided a socialization gradual and deep scale give knowledge regarding SOPs operational company and application system as well as its importance K3 driving.
The arrival of a truck that is not in accordance with schedule that has been determined because the company still dependency with information Vendors	What	Delay in fleet arrival schedule
	Why	To eliminate waste time/delay in delivery
	Where	At the fleet barracks, at the delivery destination DO
	When	Delivery of cargo, completion of unloading
	Who	Company Management, Vendors.
	How	Create SOPs/policies for each line to work together appropriately so that operational productivity is more effective and efficient
Fleet availability/readiness is quite a problem due to it still being repaired by accidents or due to fines	What	Fleet availability and fleet readiness
	Why	In order to speed up the fleet conditioning process in the spare parts repair stage and managing other needs
	Where	In workshops, spare parts, fleet barracks, and on the road
	When	When it rains, there are sharp turns, the STNK period expires and is extended while the delivery operational process is running
	Who	Stroing Team, Unit Monitoring
	How	Make a periodic list by always updating information with all parties involved
The absence of a Sales Order is caused by an expired SO or a delay in collecting the SO	What	There are no sales orders
	Why	In order to speed up taking sales orders by considering fleet readiness by each vendor in a structured manner
	Where	Website System Unit Matching
	When	Towards the end of the month or non-effective day
	Who	Planner team, Ka. Seksi Operational Transportation area
	How	Carrying out data collection and shortening confirmation regarding SO data that has appeared in the system to parties Vendors.
Unorganized management is caused by the company's SOPs not being standardized or their implementation not being maximally firm	What	Management has not been organized properly Good.
	Why	To update a management and operational system to make it more structured and organized appropriate.
	Where	Operational staff, Vendors
	When	During the research due to system change.
	Who	Management Company, Ka. Seksi Operational Transportation area
	How	Updating the system massively and with integrity for each line so that good and precise communication is realized in order to optimize the effectiveness of distribution work goods.
Area limitations due to full warehouses and long lead times for the fleet loading and unloading process	What	Limited warehouse area
	Why	Because the lead time process for distributing goods to loading and unloading is long and the warehouse still full
	Where	Warehouse Delivery Order
	When	Early to mid month period
	Who	Management Company, Warehouse Delivery Order
	How	Shortening the process flow and rearranging facilities/facility layout to optimize it existing space

Table 5. Control Phase

Factor	Before Improve	After Improve	What is reduce	Percentage
Waste (NNVA activity)	334 Minutes	260 Minutes	74 Minutes	22.16%
Defect (Delays in Order)	676 Times	214 Times	462 Times	68.05%

relationships between each element of the company's operations as well as providing outreach regarding detailed information regarding the company's SOPs.

b. Machine factor, where the fleet experiences damage/other problems (accidents, loss of spare parts, traffic tickets) causing the availability and readiness of the fleet and drivers for operations to decrease. Improvement proposals specifically for companies to create emergency service communication contacts focus on handling fleet conditions (accidents, damage, ticketing, etc.).
c. Method Factor, with the company's managerial records not being neatly arranged due to operational SOPs which are still not standard / their implementation is not carried out strictly and optimally. And also the absence of a Sales Order (SO) is caused by the SO having expired due to delays in collecting the SO from the company's operational units. The proposed improvements that are designed are addressed to the company in making Company SOPs which must be reviewed and determined and implemented firmly and clearly in order to create a professional operational environment.
d. Facilities / Environment factors, limited Delivery Order (DO) area caused by the warehouse being full, causing long queues for loading and unloading goods, resulting in longer fleet operational lead times. The proposed improvements aimed at expediting the delivery process are aimed at DO, namely the creation of a new system in the marketing process and the loading and unloading process so that fleet activities do not idle for too long so that the operational cycle runs in accordance with the system design that has been synergized and integrated from companies and vendors.

4. Improve Phase
The following is an analysis of the calculations with several process steps carried out at the improve phase show on Table 4 :
a. Control Phase

The subsequent section provides an examination of the computations conducted during the control phase, involving various procedural steps show on Table 5:

Conclusion

Based on the results of the research and data processing that has been carried out, it can be concluded that there are problems that occur in the operational process of logistics distribution using the Tronton (T) fleet from PT. AMA, namely delays in the delivery of goods, has an error rate of 22% with a six-sigma value of 2.29 where the root of the problems that occur are caused by several aspects and factors there in among there are human factors, machine factors, method factors, and environment factors. With brainstorming carried out with each operational element of the company, a conclusion was reached in developing operational processes for the sake of company sustainability with the result of reducing defects (delays in orders) by 68.05% and waste (NNVA activity) by 22.16%.

Suggestion

For further research, it can be combined with other methods such as regression analysis, the FMEA, AHP & ANP tools helps in validating appropriate and accurate waste weighting and can be used as a comparison for further research.

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