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Waste Analysis In Delivery Process Using The Lean Distribution Method

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Abstract

In the current era of globalization, the existence of goods delivery service companies supports almost every area of human life. In the process of delivering goods, PT. X always strives to provide fast and precise service. However, the problem faced by the company is the long lead time for delivery of goods. This study employs a lean distribution approach, applying Value Stream Mapping and identifying waste using the 8 waste framework. The research findings revealed waiting recapitulation of 20%, excess processing of 18%, overproduction of 17%, defects of 13%, non-utilized talent of 10%, inventory of 9%, transportation of 7%, and motion of 6%. With proposed improvements, the delivery process time can be reduced from 8243 minutes to 5929 minutes.

A. Introduction

In the trade sector, what is necessary for producers is to meet the demands of consumers who always rely on goods delivery services via various modes of transportation such as land, sea and air [1]. In facing competition in the market, logistics companies must also have the ability to increase their competitiveness to ensure business sustainability [2]. This includes providing the best service by sending goods on time as agreed, maintaining the safety of goods so that they are not damaged, lost or reduced [3].

PT X is a firm engaged in the service sector, namely as a goods delivery service. The company makes deliveries using land and sea routes. In the process of delivering goods, PT X always strives to provide fast and precise service. However, the problem faced by the company is that the lead time for delivery of goods is long and there are often differences with the estimated delivery of goods given by the company to customers [4]. Differences in lead time can occur due to activities that require a long time and are not calculated in detail by the company [5]. This problem can result in delays in delivery and the goods being rejected by the recipient [6].

In operational practice, the lean approach is a collection of methods and tools to significantly improve process efficiency [7]. If lean principles are implemented well, they can provide concrete and measurable benefits, such as reducing waste levels, speeding up lead times, reducing rejection ratios, increasing customer satisfaction, and the like [8], [9]. From the problems that have been mentioned, they can be identified through the application of a lean distribution approach. The principles of this approach aim to reduce lead time, with the hope that a shorter lead time will reduce costs and improve service to consumers in the distribution system run by the company [10].

Value stream mapping (VSM) is a method utilized for visual representation activities in the form of flow diagrams, which are beneficial in detailing value-adding activities aimed at achieving lean processes [11]. Waste refers to activities without added value [12]. Meanwhile, according to Suhartono (2007) in research [13], the Toyota Production System (TPS) identifies eight categories of waste in the manufacturing process as outlined below:

1. Defects refer to damaged or non-compliant products. This leads to inefficient rework processes, high customer complaints, and increased inspection levels.
2. Overproduction, occurs when items are manufactured in excess of demand, resulting in waste.
3. Waiting is time wasted waiting for the next process. It occurs when operators are not engaged in value-adding activities due to waiting for products from the previous process.
4. Non-Utilized Talent involves not assigning people according to their abilities and them not directly participating in the production process.
5. Transportation, although crucial, does not contribute value to a product. It entails the transfer of materials or work-in-progress between different workstations.
6. Inventories are unnecessary stock. This means having excessive raw materials or work-in-process inventory between processes, requiring significant storage space.

7. Motion refers to unnecessary activities or movements by operators that do do not contribute to value addition and impede the progress, leading to longer lead times.
8. Excessive processing happens when work methods or sequences are considered ineffective or rigid. This can also happen when processes are not standardized, increasing the likelihood of defective products.

By conducting this research, it is hoped that PT X will be able to reduce waste in the goods delivery process. Furthermore, after knowing the level of waste that occurs, the company can make improvements according to the priority weight of the waste that occurs [14]. Thus, it is anticipated that the company will be able to implement the proposed improvements that have been analyzed. So that the company is able to compete with competitors and can provide effective and efficient services to customers [15]. Hence, it is anticipated that this research will enhance company performance.

B. Research Method

In this research, data collection in identifying waste in the goods delivery process at PT X used several sources, namely field studies and literature studies. Field studies were obtained through various methods such as interviews, observations, and questionnaires, while literature studies were derived from previous research that supported the research object. After collecting the data, the steps that will be taken are processing the data, so that the problems faced can be resolved. The following is the data processing method used in this research:

1. Creating current stream mapping, namely a basic view of existing processes where all processes in production are measured, and becomes a representation of all entities and operations in the value chain.
2. Next, create a Process Activity Mapping (PAM) to determine which activities are VA, NVA, or NNVA.
3. Identify 8 wastes that occur, namely: waste of defects, waste of overproduction, waste of waiting, waste of non-utilized talent, waste of transportation, waste of inventory, waste of motion and waste of excess processing.
4. Preparing and distributing questionnaires to related companies to determine the greatest waste.
5. Analyzing sources of waste using a fishbone diagram.
6. Designing improvement proposals to reduce the causes of waste using the 5W+1H principle.
7. Creating a Future state map represents a vision of how to see the condition of the value chain at one point in the future after improvements have been made.

C. Result and Discussion

The data that has been collected is the basis for making Current Stream Mapping. Identification is carried out by mapping the goods delivery process through Value Stream Mapping. The mapping contains information on the process flow, category and time for each group of activities, namely value added, non-value added, and naccessary non-value added, the number of activities in each activity

group, the total time for each activity group, and the total time for all activities mapped as follows.

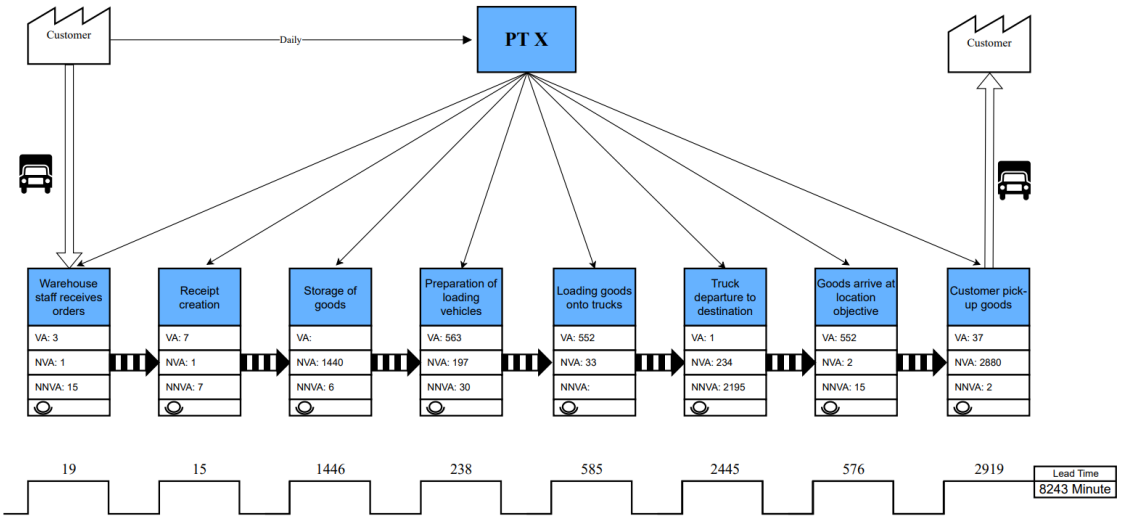

Figure 1. Current Stream Mapping Delivery of Goods

Next, a Process Activity Mapping is created to categorize activities into Value Added (VA), Non-Value Added (NVA), or Necessary but Non-Value Added (NNVA) [16]. Apart from that, process activities are also grouped into 5 types, namely Operation (O), Transportation (T), Inspection (I), Storage (S), and Delay (D). Process Activity Mapping (PAM) of the goods delivery process can be seen as follows.

Table 1. Process Activity Mapping

No	Activity	Category			Type					Time (Minute)
		VA	NVA	NNVA	O	T	I	S	D	
1	Warehouse staff receive customer goods	VA			O					1
2	Warehouse staff record customer order data	VA			O					2
3	Warehouse staff provides order data to the helper to pick up the shipment		NVA			T				1
4	The helper unloads the customer's order			NNVA		T				15
5	Warehouse staff calculates the weight of goods	VA					I			6
6	Warehouse staff reports the weight of goods to admin		NVA			T				1
7	Admin creates a receipt			NNVA	O					5
8	Customers make payments according to orders			NNVA	O					2
9	Admin gives a receipt to the customer	VA			O					1
10	The helper moves the goods to the destination city grouping			NNVA		T				6

11	Storage of goods in the warehouse		NVA					S	1440
12	Warehouse staff calculates the total goods to be transported			NNVA			I		25
13	Determining the number of vehicles to be used			NNVA			I		5
14	Warehouse staff contacted the driver	VA				T			11
15	Waiting for the truck to arrive		NVA					D	180
16	Check the condition of the truck		NVA				I		17
17	Loading goods onto trucks	VA			O				552
18	Admin creates shipping documents			NNVA	O				31
19	Hand over delivery documents to the driver			NNVA		T			2
20	Departure of trucks to the port			NNVA		T			15
21	Waiting for the ship's departure		NVA					D	120
22	Departure of the ship to the port of destination			NNVA		T			2160
23	Waiting in line to exit the ship		NVA					D	15
24	Waiting in line to leave the port		NVA					D	5
25	Drivers are waiting for branch admin confirmation		NVA					D	94
26	Truck trip to branch office			NNVA		T			35
27	The truck arrives at the branch office	VA			O				1
28	Admin records data on arriving goods		NVA		O				5
29	Admin provides item data to the helper to unload the shipment		NVA				I		2
30	Helper unloads goods from the truck	VA			O				552
31	The helper reports that the goods have been unloaded to the warehouse staff			NNVA			I		1
32	Warehouse staff checks the condition of the truck		NVA				I		2
33	Admin checks the amount of data according to the document			NNVA			I		12
34	Admin confirms with head office admin			NNVA	O				1
35	The admin confirms to the warehouse staff that the ordered goods have been unloaded			NNVA	O				1
36	Warehouse staff	VA			O				7

	contacts customers									
37	Waiting for customer arrival		NVA						D	2880
38	Admin provides billing information			NNVA		T				2
39	The customer pays the bill in full	VA			O					3
40	Goods transported by customers	VA			O					27
	Total	11	13	16	15	10	8	1	6	8243

Based on the number of types of activities and activity times in Table 1, the total processing time for goods delivery is 8243 minutes, with the frequency and time of the types and categories of activities as follows.

Table 2. Frequency and Time Percentage

Type	Frequency	Percentage	Time	Percentage
Operation	15	37.5%	1191	14%
Transportation	10	25%	2248	27%
Inspection	8	20%	70	1%
Storage	1	2.5%	1440	17%
Delay	6	15%	3294	40%
VA	11	27.5%	1163	14%
NVA	13	32.5%	4762	58%
NNVA	16	40%	2318	28%

After being identified from the results of making PAM, then waste identification was carried out using 8 wastes including waste of defects, waste of overproduction, waste of waiting, waste of non-utilized talent, waste of transportation, waste of inventory, waste of motion and waste of excess processing. Then critical waste was determined by distributing a questionnaire involving 10 correspondents. directly involved in the goods delivery process. The following is a recapitulation of the questionnaire results.

Table 3. Critical Waste Ranking

Type of Waste	Respondents										Score	Weight	Rank
	1	2	3	4	5	6	7	8	9	10			
Defects	3	3	3	4	3	2	3	2	1	2	26	0.13	4
Overproduction	4	4	3	4	3	4	4	3	3	3	35	0.17	3
Waiting	5	4	4	4	3	5	4	4	5	4	42	0.20	1
Non Utilized Talent	3	2	1	3	1	2	2	2	2	2	20	0.10	5
Transportation	2	2	1	2	1	1	2	1	1	1	14	0.07	7
Inventory	2	2	1	2	1	3	3	2	1	2	19	0.09	6
Motion	1	1	2	1	2	1	1	1	2	1	13	0.06	8
Excess Processing	3	3	3	4	4	3	4	4	4	4	36	0.18	2
Total											205	1	

After knowing which waste has the greatest value that influences product delivery activities to consumers, the next stage is to find the root causes of waste waiting.

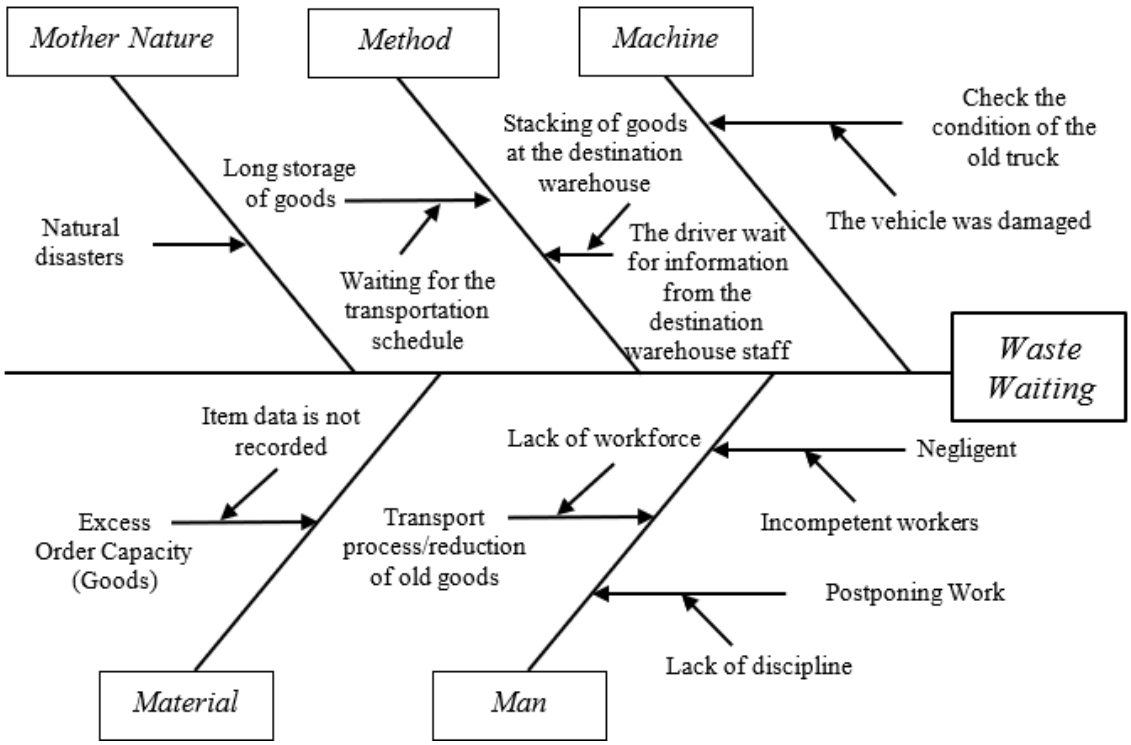

Figure 2. Waste Waiting Fishbone Diagram

The improvement proposal stage is a corrective solution to the problems that occur. Proposed improvements aim to resolve the root cause of the problem. Based on the results of identifying waste in critical waste, recommendations for improvements are then made to support the research results.

Table 4. Proposed Improvement Using 5W+1H

Aspects	Description
What	Conduct waste analysis in the goods delivery process using the lead distribution method which is beneficial for PT to reduce lead time and reduce waste that occurs, so as to improve the performance of the goods delivery process. Derived from the analysis outcomes presented in table 3, critical waste is obtained in the order of waste waiting, excess processing, overproduction, defects, non-utilized talent, inventory, transportation, and motion. The identification of waste has been analyzed, it was found that the causes of waste in waste waiting come from several factors, namely, man, machine, method, material and mother nature.
Why	Improvement plans need to be carried out to reduce waste, especially waste waiting which is the company's critical waste, so that the lead time for delivery of goods is more effective and efficient.
When	Improvement plans are carried out after knowing the results of identifying waste that occurs in the goods delivery process.
Where	Improvement plans need to be carried out throughout the goods delivery process, meaning when the goods enter the storage warehouse, travel, and arrive at the destination warehouse.
Who	Corrective action will be taken by all workers involved during the goods delivery process.
How	• Man Factors - Providing wages at a target time determined by the company, to reduce the activity of delaying work due to lack of discipline from the workforce. - Calculate the capacity of the goods being transported by looking at the frequency and weight of ordered goods to calculate the amount of labor required before

transporting the goods. So that the number of workers can be optimal with the given workload.
- Increase supervision and monitoring, enforce policies and procedures, and provide incentives to prevent negligent workers.

• Machine Factors
- Carry out regular machine scheduling by ensuring that checks are carried out regularly by trained technicians to identify potential problems and prevent damage.
- Establish long-term maintenance contracts with service providers to ensure trucks remain in optimal condition.

• Method Factors
- Optimize planning and scheduling between departure and receipt of orders, so that goods are not stored for too long, thereby reducing waiting time. If possible, increase the goods delivery schedule with a collaborative system with other companies.
- Carrying out effective communication between destination warehouse staff and customers, and destination warehouse staff and drivers. So there is no accumulation of goods, and there is no waiting time.

• Material Factors
- Create an appropriate inventory management system to calculate the suitability between the number of goods received and those to be sent according to vehicle capacity. Can also provide training to workers about the urgency of accurate recording.

• Mother Nature Factors
- Develop a comprehensive emergency plan to overcome the impact of natural disasters on the goods delivery process.
- Conduct regular risk analysis and identify areas that are vulnerable to natural disasters, and implement appropriate mitigation measures.

Based on table 4, it can be seen that the proposed improvements can improve goods delivery using the lean distribution method. Furthermore, proposals for improvements were prepared to reduce goods delivery time by eliminating or reducing the time for several NVA activities, which can be seen in the table as follows.

Table 5. Proposed Improvements at Process Time

Activity	Time (Minute)	
	Real Time	Proposed Improvements
Waiting for the truck to arrive	180	0
Check the condition of the truck	17	0
Admin creates shipping documents	31	0
Driver waits for confirmation	94	0
Helper unloads goods from the truck	552	0
Waiting for customer arrival	2880	1440
Total	3754	1440

By using the lean distribution method, you can minimize the lead time of the goods delivery process by analyzing activities that can cause waste, such as waiting for the truck to arrive, checking the condition of the truck, admin creating delivery documents, drivers waiting for confirmation, helpers unloading goods from the truck, and waiting for customers to arrive. The proposed improvements that have been recommended will then be mapped by creating future stream mapping as follows.

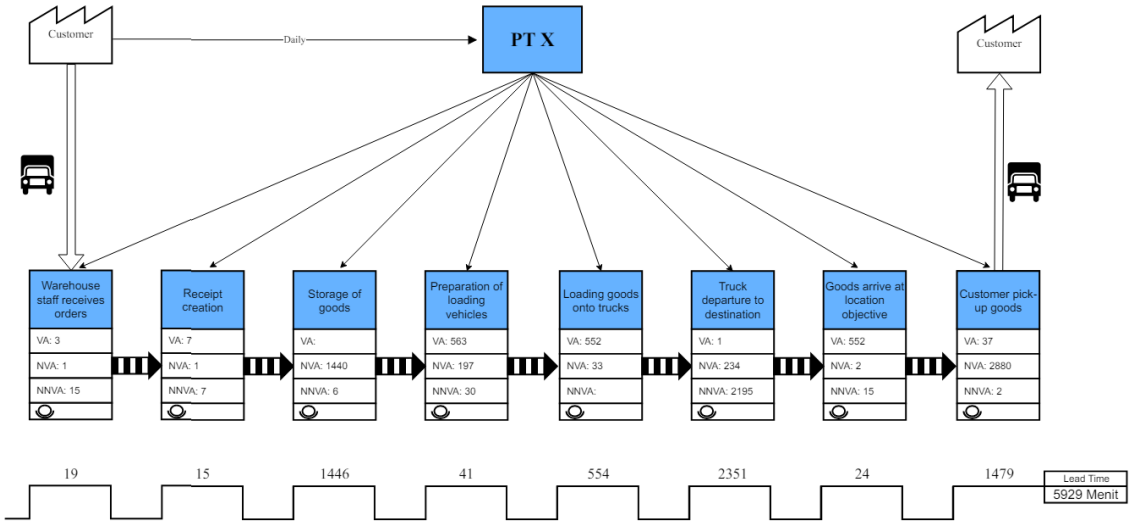

Figure 3. Future Stream Mapping Delivery of Goods

From the results of the proposed improvements, mapping was carried out by creating Future Stream Mapping, a comparison of the flow time of goods delivery activities from actual or real time conditions, namely 8243 minutes, to 5929 minutes from the results of the proposed improvements.

D. Conclusion

To determine the level of waste at PT X, a waste weighting calculation was carried out, the highest level of waste was obtained, namely waiting at 20%, excess processing at 18%, overproduction at 17%, defects at 13%, non-utilized talent by 10%, inventory by 9%, transportation by 7%, and motion by 6%. The proposed improvements in this research aim to reduce waste that occurs in the goods delivery process, including eliminating or reducing activities that result in waiting times such as waiting for the truck to arrive, checking the condition of the truck, admin creating delivery documents, drivers waiting for confirmation, helpers unloading goods from the truck, and waiting for customers to arrive. Because it can reduce the lead time for the goods delivery process, which was originally 8243 minutes, to 5929 minutes from the results of the proposed improvements. So, the lead time for delivery of goods becomes more efficient and can prevent delays resulting in goods being rejected by customers. So the lead distribution method has been proven to reduce lead time, with the hope that a shorter lead time will improve service to consumers in the distribution system run by the company.

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