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Implementation of LEAN Warehousing to Reduce Waste in Warehouse CV.X

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***Abstract*— CV. X is a company engaged in the manufacturing of various types of clothing. CV. X produces various types of clothing such as shirts, jackets, pants, and accessories. The warehouse at CV. X shows an increase when storing warehouse goods. There is waste in the form of waiting caused by goods waiting for operators to move them. There is another indication of waste in the form of a high level of transportation activities in the warehouse. This research aims to help the company minimize waste in the warehouse process. This research uses the Lean Warehousing method, and improvement proposals involve implementing the 5S methodology. From the waste in the warehouse process at CV. X, the highest type of waste is waiting, with an average weighting score of 4.4, followed by excess inventories with an average weighting score of 4, and transportation with an average weighting score of 3.6. One improvement proposal suggested is to clean and rearrange the items stored in the warehouse.**

Keywords: **Warehouse, Lean warehousing, 5s.**

I. INTRODUCTION

In today's modern and highly competitive industry, there is tight competition that leads to an increased role of warehousing functions in production activities, especially in planning and managing warehouse systems. Warehousing has a crucial function, namely storing products(Rizkya et al., 2021), anticipating fluctuating demand patterns(Nurhasril et al., 2023), maintaining price stability(Wang & Wang, 2019), preserving product quality (Kamali et al., 2019), ensuring product securities, especially for food(Prananingtyas & Zulaekhah, 2021; Van Geest et al., 2021), and serving as a place for consolidation among buyers(Ding & Kaminsky, 2020; Lin et al., 2020). One of the actions that companies can take is to analyze and minimize waste that occurs in the warehouse (Purba et al., 2021).

A warehouse is a place designed to store goods, typically raw materials going through production activities or finished products ready to be distributed to consumers(Saputra & Sihombing, 2020).

CV. X is a manufacturing company that produces various types of clothing, such as shirts, jackets, pants, and accessories. CV. X has a brand named "Lee Conti," usually marketed in stores like Ramayana, Matahari, and several other clothing outlets. The warehouse at CV. X involves several activities. The first activity is product receiving, where newly arrived goods are accepted. The second activity is product inspection, where specifications, quantity, and the condition of the goods are checked. Following that is the product storage process, where goods are stored in the warehouse. Next is the order fulfillment process, where orders needed by the production division are fulfilled. Finally, there is the delivery process, which involves shipping ordered goods from the production division to respective workstations.

The warehouse at CV. X shows an increase in storage activities, including storing unnecessary items in the warehouse. This leads to a full warehouse and makes it difficult for warehouse operators to find space for newly arrived goods. There is waste in the form of waiting, caused by goods waiting for operators to move them. Waiting for waste also occurs when goods are waiting for warehouse operators to find available space in the warehouse for storage.

Another indication of waste is the high level of transportation activities in the warehouse. One issue is related to manual material handling performed by operators. The

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movement of goods is done without using tools, requiring more time and energy. By conducting Lean Warehousing analysis at the warehouse in CV. X, it is hoped that the company can minimize waste. Lean warehousing is a concept aimed at minimizing waste in the upstream or downstream supply chain (Prasetyo et al., 2021).

II. METHODOLOGY

There are several stages to be conducted in the Lean Warehouse method, including:

A. Data Collection

The data collected in this research includes information related to types of waste and can be seen in Table 1.

Table 1 Types of waste

Types of waste	Respondent					Average	Ranking
	1	2	3	4	5		
Waiting	5	4	4	5	4	4,4	1
Excess Inventories	4	4	5	4	3	4	2
Transportation	4	4	3	3	4	3,6	3
Excess Processing	4	4	3	3	3	3,4	4
Unnecessary Motion	3	2	3	4	3	3	5
Defect	3	3	3	2	3	2,8	6
Overproduction	2	3	3	3	2	2,6	7

B. Preparation of Initial Big Picture Mapping

Big Picture Mapping serves to visually illustrate production activities and the flow of information within the company (Hafiz & Budiawan, 2019). Initial big picture mapping in CV. X's warehouse can be seen in Figure 1 below

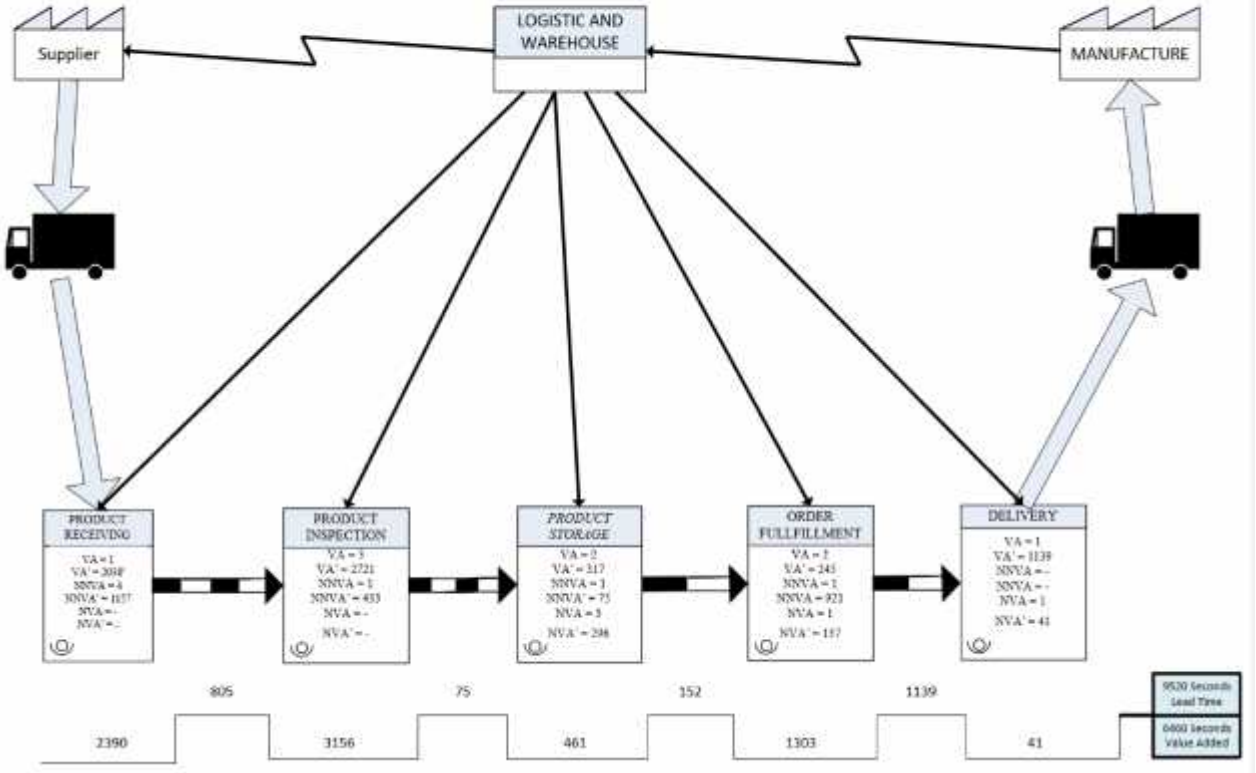

Figure 1. Initial Big Picture Mapping

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C. Data Processing Using VALSAT

Value Stream Analysis Tools (VALSAT) is a tool designed to select tools from the identification of process flow maps that will be used as a reference for identifying waste (Ariska & Aryanny, 2023).

D. Preparation of Process Activity Mapping (PAM)

Process Activity Mapping (PAM) is a tool used to identify the stages of a process, enabling the identification and minimization of waste (Pogowonto & Amrina, 2020).

E. Creation of Fishbone Diagram

A cause-and-effect diagram or fishbone diagram is a tool used for analyzing factors causing a problem to occur (Armyanto et al., 2020).

F. Improvement proposal using5S

5S is a method designed to organize the workplace by policies and standards, while improving discipline levels (Aulia, 2021).

III. RESULT AND DISCUSSION

A. Data Processing Using VALSAT

Table 2 shows the results of the Valsat score calculation that has been conducted.

Table 2 Valsat score calculation

Types of waste	Weight	VALSAD						
		PAM	SCRM	PVF	QFM	DAM	DPA	PS
Defect	2,8	2,8	-	-	25,2	-	-	-
Overproduction	2,6	2,6	7,8	-	3	7,8	7,8	-
Waiting	4,4	39,6	39,6	4,4	-	13,2	13,2	-
Transportation	3,6	32,4	-	-	-	-	-	3,6
Unnecessary inventory	4	12	36	12	-	36	12	4
Unnecessary motion	3	27	3	-	-	-	-	-
Overprocessing	3,4	30,6	-	10,2	3,4	-	3,4	-
Total		147	86,4	26,6	31,6	57	36,4	7,6

B. Preparation of Process Activity Mapping (PAM)

The PAM result can be seen in Table 3 and the mapping of activity categories can be observed in Table 4.

Table 3 PAM Result

Activity	Freq	Percentage	Time (s)	Percentage
Operation	9	45%	3.323	34,91%
Transportation	4	20%	2.171	22,8%
Inspection	3	15%	3.642	38,26%
Storage	1	5%	165	1,73%
Delay	3	15%	219	2,3%
Total	20	100%	9.520	100%

Table 4 Activity percentage

Types of act.	Freq	Percentage	Time (s)	Percentage
VA	8	40%	6.460	67,86%
NVA	5	25%	428	4,5%
NNVA	7	35%	2.632	27,64%
Total	20	100%	9.520	100%

C. Creation of Fishbone Diagram

The fishbone diagram for the three highest waste can be seen in Figure 2-4.

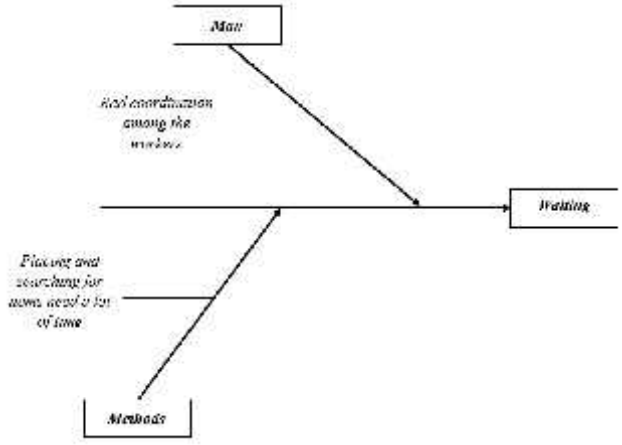

Figure 2. Fishbone for waste Fishbone Diagram for Transportation

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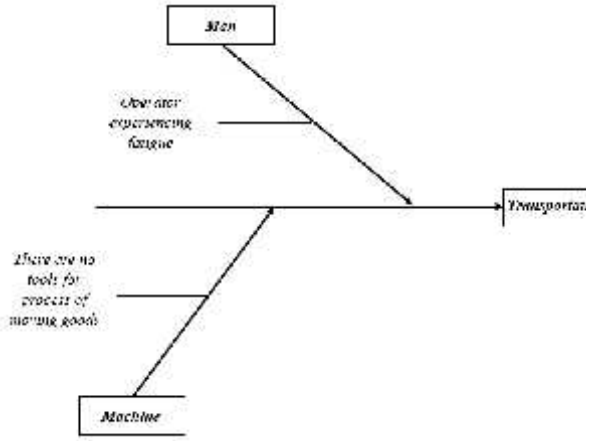

Figure 3. Fishbone for transportation

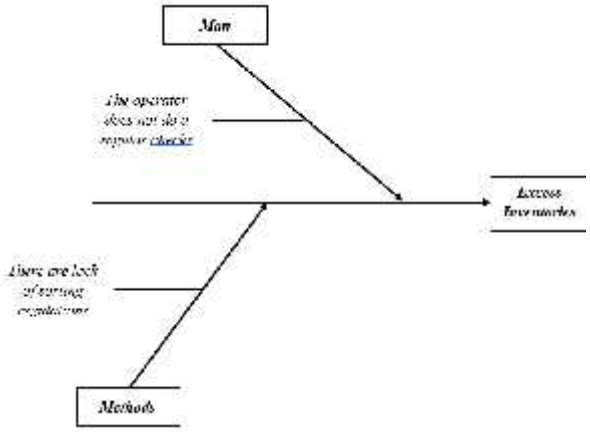

Figure 4. Fishbone for excess inventory

D. Improvement proposal using5S

The improvement proposals provided using the 5S method can be seen as follows:

1) Seiri (Sorting) Activities can be divided into several stages. In the first stage, a thorough cleaning is performed in the warehouse area. In the second stage, stratification management is conducted to identify the importance of each item. In the third stage, red labeling is applied.
2) Seiso (Sweeping) In Seiso (sweeping), macro-cleaning or comprehensive cleaning of the warehouse area is carried out, as well as micro-cleaning, which involves cleaning the stored items in the warehouse.
3) Seiton (Systematic Arrangement) In Seiton (systematic arrangement), the classification of item usage frequency is performed, storage locations are determined, and labels are applied to the items.
4) Seiketsu (Standardization) In Seiketsu (standardization), the creation of standardization in the warehouse area is undertaken, and daily inspections are conducted to ensure the previous 3S are functioning well.
5) Shitsuke (Sustaining) In Shitsuke (sustaining), the creation of visual displays, the development of 5S checklists, and training for the implementation of 5S are carried out.

E. Proposed Big Picture Mapping

After the improvement proposals were implemented using 5S, the creation of the proposed big-picture mapping was carried out to determine the total time savings obtained after minimizing the arising wastes.The proposedbig-picture mapping can be seen in Figure5 below. From the picture below we can conclude that the warehouse process lead time has decreased from the initial 9,520 seconds or 159 minutes to 8,878 seconds or 148 minutes.

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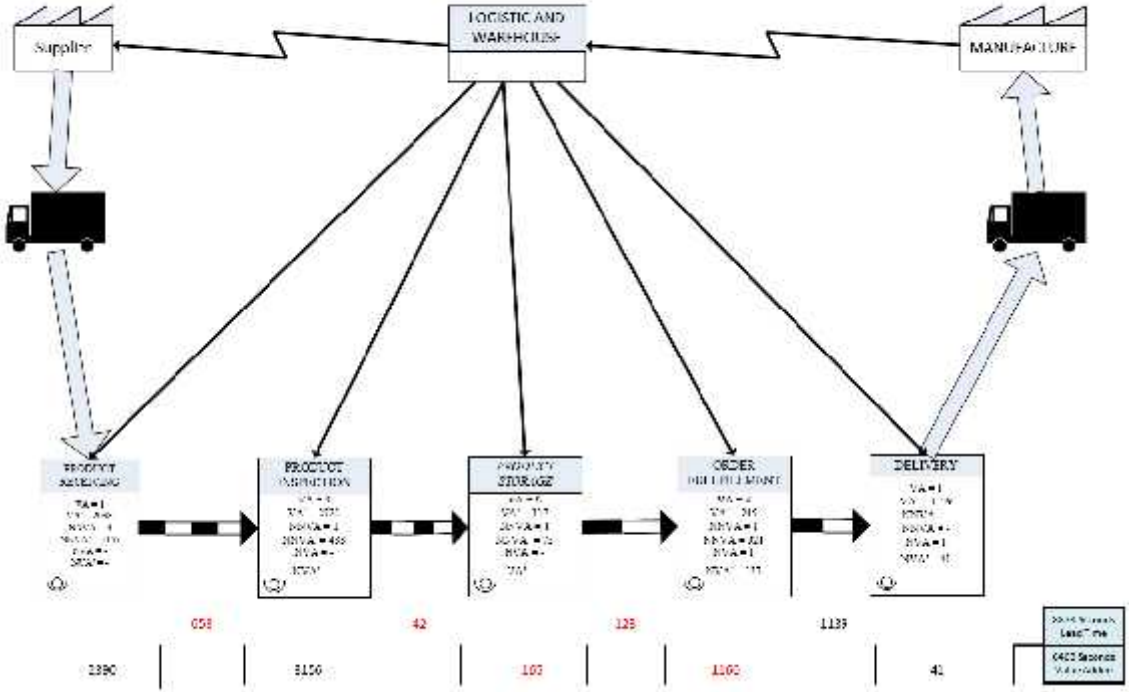

Figure 5. Proposed Big Picture Mapping

IV. CONCLUSION

From the waste in the warehouse process at CV. X, the highest type of waste is waiting with an average weighting score of 4.4, followed by excess inventories with an average weighting score of 4, and transportation with an average weighting score of 3.6.There is a reduction in the warehouse process time resulting in time savings of 6,9%. In the Seiri (Sorting) phase, a massive cleanup, stratification management, and red labeling were carried out. In the Seiso (Sweeping) phase, macro or comprehensive cleaning of the entire warehouse and micro-cleaning of items in the warehouse were performed. In the Seiton (Systematic Arrangement) phase, the classification of item usage frequency, determination of storage locations, and labeling of items were implemented. In the Seiketsu (Standardization) phase, the creation of standardization in the warehouse area and daily inspections to ensure the previous 3S (Seiri, Seiso, Seiton) were functioning well were conducted. In the Shitsuke (Sustaining) phase, visual displays, the development of 5S checklists, and training for the implementation of 5S was carried out.

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