

LEAN WAREHOUSE APPROACH TO MINIMIZE THE WASTE IN THE RECEIVING PROCESS IN WAREHOUSE FINISHED GOODS OF PT. EMUDAH FULFILLMEN INDONESIA

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Abstract: PT Emudah Fulfillmen Indonesia is an e-commerce technology company, managed brands such as household needs, electronics, cosmetics, fashion, car accessories and other categories. The research was carried out in a finished goods warehouse with the aim of minimizing waste that occurs in the process of receiving goods. The results were taken from observation and communication about using the lean warehouse method. The tools used are Big Picture Mapping, Process Activity Mapping, Seven Wastes, Questionnaires and Fishbone Diagrams. It is found that the waste that occurred in the receiving process are extra processing, excessive transportation, waiting and unnecessary movement with reduced processing time by 115 minutes.

Keyword: Warehouse, Lean Warehouse, Big Picture Mapping, Process Activity Mapping, Seven Waste, Fishbone

Introduction

PT Emudah Fulfillmen Indonesia is an e-commerce technology company that focuses on the Indonesian market and the Southeast Asian region. PT Emudah Fulfillmen Indonesia is integrated with brand management, design, manufacturing, logistics, warehousing and fulfillment centers across the e-commerce industry and offline channels. Managed brands such as household needs, electronics, cosmetics, fashion, car accessories and other categories.

The business process at PT Emudah Fulfillmen Indonesia is related to activities in the warehouse in order to process the receipt of goods from suppliers before delivery to the buyer in accordance with the order via e-commerce and offline channels. This activity makes the warehouse a crucial part for the company. Therefore, good warehouse management is needed starting from the right system, adequate human resources, the right procedures will facilitate the process of handling goods so that processing time is more effective and efficient.

In the process of receiving goods at PT Emudah Fulfillmen Indonesia, it can be said that it is not optimal because there are still wasteful activities in the process of receiving goods that occur, causing reception activities to be hampered.

Based on the problems that occur, it is necessary to make improvements to reduce or eliminate the waste contained in the acceptance process in the finished goods warehouse, one of which is through the lean warehouse approach. It is hoped that the industry can obtain information and good solutions in an effort to increase the effectiveness and efficiency of work in the receiving process at the PT Emudah Fulfillmen Indonesia finished goods warehouse.

Warehousing management is a warehouse management system that regulates the process of handling goods from receipt to delivery. Warehousing management is a series of activities in planning, implementing and controlling as well as corrective actions for activities in procurement, receipt, storage, maintenance, distribution, stock elimination and recording activities as documents to support effectiveness and efficiency in achieving organizational goals.

Warehouse is a place used to store goods in the type of raw materials, work in process goods or finished goods. Finished goods warehouse is a warehouse that is prepared to store finished goods or products from the end of the production process or can also be in the type of goods/products that are ready to be distributed. Receiving is receiving the company's ordered material, ensuring the quality of the material sent by the supplier, and distributing the material to the production floor.

Waste is all activities that do not add value in the process where these activities only use resources but do not provide added value to customers. There are 7 types of waste including extra processing, needless transportation, waiting, movement, inventory, defects and over production.

Lean is a continuous improvement effort to eliminate waste and increase added value. (value-added) products (goods and/services) and provide value to customers (customer value). Lean warehouse is a method that simplifies activities in the warehouse in order to improve employee performance and reduce costs. The adoption of lean in warehouse activities can lead to significant improvements, such as elimination of waste, reduced lead-time (unnecessary part of the time from the order-to-delivery process), time to take orders, time to material handling and better value creation. This can be achieved through reducing non-value added activities and increasing the speed of flow in the warehouse.

Method

The data collection techniques to get primary data were observation and communication (interviews). The secondary data were obtained from existing sources. The analytical methods include:

1. Big Picture Mapping

Big picture mapping serves to describe the flow of processes and makes it easier to find potential waste, causes, consequences and possible solutions that can be applied. Big picture mapping will present the process flow to understand the observed system such as the physical flow and information flow required for receiving activities in the finished goods warehouse. The stages of making big picture mapping are as follows:

- a. Observing the receiving process
- b. Conducting interviews with workers who are directly related to the admissions process
- c. Record all data
- d. Make Big Picture Mapping on Ms. Application Visio

2. Process Activity Mapping

At this stage the process activity mapping was explained in more detail. Each stage of the acceptance process was grouped into several activity criteria such as Delay (D), Transportation (T), Operation (O), Inspection (I), and Storage (S). Process activity mapping also grouped each activity in the category of value added, necessary non value added and non value added activities. The steps to create a process activity mapping, among others:

- a. Observing the receiving process
- b. Conducting interviews with workers who are directly related to the admissions process
- c. Record all data and processes in detail.
- d. Making process activity mapping on the Ms. application. Excel.
- e. Make a summary of the results of the activity mapping process

3. Waste Weighting

The next step is to identify the waste that occurs. The stages in doing the weighting are as follows:

- a. Identifying waste based on the seven wastes depicted in the big picture mapping and process activity mapping.
- b. Distribution of questionnaires filled out by employees who are directly related. The questionnaire contains an assessment column on the waste that occurs using the consequence and likelihood methods. Consequence is the result of an event that is usually expressed as a loss from a risk and likelihood is the probability in a period of time of a risk that will arise

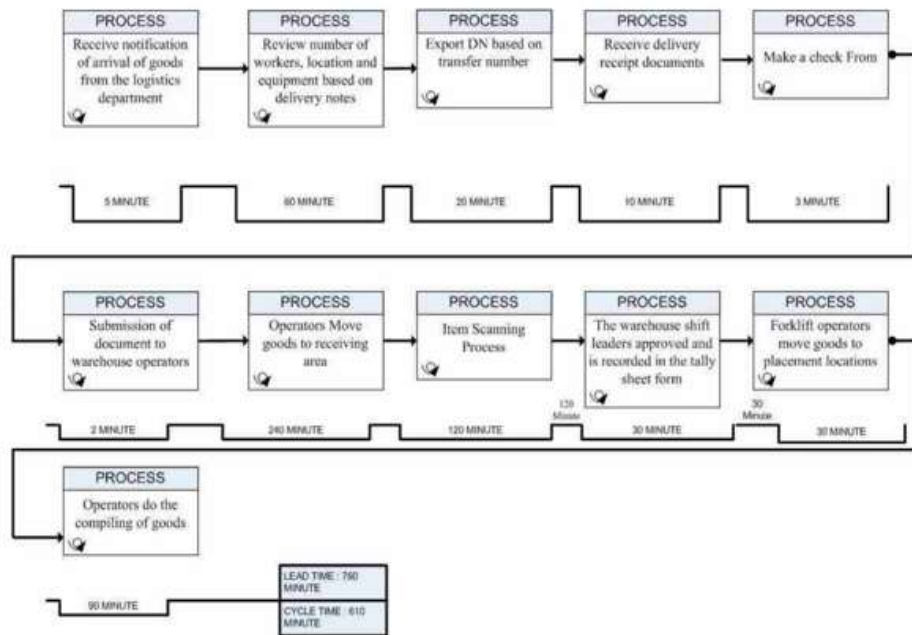
- c. Calculating the value of waste, the results of the questionnaire assessment will be the value of wastage
4. Fishbone Diagram
At this stage the root cause of a problem will be identified and the results will be presented with a fishbone diagram to make it easier to determine the repair process because the root cause of a problem is already known. The steps in making a fishbone diagram include:
 - a. Determine the main problem to be put on the fish head
 - b. Write down the main causes of the main problems that arise expressed as big bones such as man, method, environment, material and machine.
 - c. Write down the secondary causes of the occurrence of the main causative factor expressed as medium-sized bones.
 - d. Write the tertiary cause of the occurrence of secondary causes expressed as small bones.
5. Improvement Suggestion
Provide suggestions for improvement after knowing the factors causing the problem by minimizing or eliminating the waste that occurs in the receiving process at the finished goods warehouse of PT Emudah Fulfillmen Indonesia.

Discussion and Result

1. Big Picture Mapping

Big picture mapping is used to describe the process flow. Figure 1.1 shows the flow of the receiving process at the finished goods warehouse. Under the process flow is the information flow, physical flow, cycle time and lead time.

Figure 1.1 Big Picture Mapping of the Receiving Process in the Finished Goods Warehouse



Source: The data is processed from PT Emudah Fulfillmen Indonesia, 2021

Figure 4.2 is a big picture mapping that illustrates the flow of the receiving process in a finished goods warehouse of the Full Container Load (FCL) type with a total cycle time of 610 minutes and a total lead time of 760 minutes. The following is the flow of information and physical flow contained in the receiving process at the finished goods warehouse.

- 1) Information flow in the receiving process based on the observations as follows:
 - a) Receive notification of arrival of goods from the logistics department
 - b) Export DN based on transfer number
 - c) Receive delivery receipt documents
 - d) Make a check form
 - e) Submission of documents to warehouse operators
- 2) The physical flow that occurs in the receiving process at the finished goods warehouse is as follows:
 - a) Review number of workers, location and equipment based on delivery note
 - b) Operators move goods to receiving area

- c) Item scanning process
- d) The warehouse shift leader approves and is recorded in the tally sheet form
- e) Forklift operators move goods to placement locations
- f) Operator do the compiling of goods.

2. Process Activity Mapping

Process activity mapping maps the receiving activities in the finished goods warehouse in detail, so that the total activity in the receiving process can be seen. Process activity mapping can determine the working time of each activity and the number of workers.

Process activity mapping is useful to make it easier to read the flow of the receipt process in the finished goods warehouse which has previously been described in the big picture mapping method, if the big picture mapping method only explains the big picture, by using process activity mapping it will be clearer to know the mapping of categories and activities on each activity.

Table 2.1 Process Activity Mapping

No	Warehouse Activity	Time (minute)	Total MP	Activity					Category
				O	T	I	S	D	
1	Receive notification of arrival of goods from the logistics department	5	1	O					VA
2	Review number of workers, location and equipment based on delivery notes	60	3			I			NNVA
3	Export DN by transfer number	20	1	O					VA
4	Receive delivery receipt documents	10	1	O					VA
5	Make a check form	3	1	O					NNVA
6	Submission of documents to warehouse operators	2	1		T				NNVA
7	Operators move goods to receiving area	240	5		T				NNVA
8	Item scanning process	120	1	O					NNVA
9	Waiting for item scanning process	120	1					D	NVA

10	The warehouse shift leader approves and is recorded in the tally sheet form	30	1			I			NNVA
11	The operator is waiting for the approval process from the warehouse leader	30	1	O					NVA
12	Forklift operators move goods to placement locations	30	1		T				NNVA
13	Operators do the compiling of goods	90	3		T				NVA

Source: Data is processed from the results of brainstorming, 2021

Table 2.1 shows the activity carried out in the preparation process for receiving in the finished goods warehouse which contains more detailed information related to processing time, the number of workers used, mapping activity criteria into five activity criteria, namely transportation, storage, operation, inspection, and delay activities. In Table 2.1 there is a mapping of activity categories which are included in added value, necessary non added value and non-added value. The results of the process activity mapping are summarized in Table 2.2 below:

Table 2.2 Summary of Process Activity Mapping Results

Category	Total Activity	Time (Minute)	Percentage
Value Added (VA)	3	35	4%
Necessary Non-Value Added (NNVA)	7	505	62%
Non-Value Added (NVA)	3	270	33%
Total	13	810	100%

Source: Data is processed from the results of brainstorming, 2021

In the summary of the process activity mapping, there are still activities that do not have added value so that there is waste that can be minimized or eliminated

3. Waste Weighting

3.1 Identification of Waste in the Receiving Process

After knowing the flow of the receiving process using activity mapping, it turns out that there are still activities that do not have added value, therefore it is necessary to conduct observations and interviews to find out more detailed waste activities.

Table 3.1.1 is the result of the identification and classification of the overall waste in the receiving process in the finished goods warehouse in detail. In the following table there are 7 wastes which are symbolized by the letters (P, T, W, M, O, I, D).

Table 3.1.1 Identification of Waste in the Receiving Process

Code	Identification of Waste in the Receiving Process
	P. Extra Processing
P1	The checking process is repeated on scanning activities
	T. Excessive Transportation
T1	Unnecessary forklift movement impacts the material handling process
	W. Waiting
W1	The operator is waiting for the goods approval process by the warehouse leader
	M. Unnecessary Movement
M1	Arrangement of goods that are not in appropriate with standards so that they are re-checked and repackaged
	I. Unnecessary Inventory
	Not Found
	D. Defect
	Not Found
	O. Over Production
	Not Found

Source: The data is processed from Figure 1.1 and Table 2.1

3.2 Determining Waste in The Receiving Process

Based on the questionnaires that have been distributed to the relevant respondents, the results of the questionnaire assessment are obtained using the consequence and likelihood methods. The assessment of the questionnaire for consequence uses a number from 1 to 4 and for likelihood using a number from 1 to 5. The reference in risk assessment can be adjusted to the company's condition because risk assessment can be subjective. Table 3.2.1 is the definition of the consequence scale and table 3.2.2 is the definition of the likelihood scale used in the weighting of the assessment.

Table 3.2.1 Consequence Scale

Consequence Value	Definition
1	Causes low time loss (10 minutes – 30 minutes)
2	Causes moderate time loss (30 minutes – 60 minutes)
3	Causing a large time loss (60 minutes – 120 minutes)
4	Causes a very large time loss (120 minutes – 240 minutes)

*Source: Interview result, 2021***Table 3.2.2 Likelihood Scale**

Possible Value	Definition
1	The possibility of activities carried out in the warehouse for one year is less than 5%
2	The possibility of activities carried out in the warehouse for one year is between 5% - 25%
3	The possibility of activities carried out in the warehouse for one year is between 25% - 50%
4	The possibility of activities carried out in the warehouse for one year is between 50% - 75%
5	The possibility of activities carried out in the warehouse for one year is more than 75%

Source: Australia Standard / New Zealand Standard, 2004

Based on the results of the weighting of activities that cause waste in the receiving process, the following are the results of the questionnaire that has been carried out:

Table 3.2.3 Recap of Questionnaire Results

Questionnaire 1				Questionnaire 2			
Code	Consequence [C]	Likelihood [L]	C x L	Code	Consequence [C]	Likelihood [L]	C x L
P1	3	3	9	P1	2	3	6
T1	2	4	8	T1	2	3	6
W1	1	4	4	W1	1	4	4
M1	3	3	9	M1	2	4	8
Questionnaire 3				Questionnaire 4			

Code	Consequence [C]	Likelihood [L]	C x L	Code	Consequence [C]	Likelihood [L]	C x L
P1	3	4	12	P1	3	3	9
T1	3	3	9	T1	3	4	12
W1	2	5	10	W1	2	3	6
M1	3	4	12	M1	4	3	12

Source: The data is processed from the results of the questionnaire, 2021

Table 3.2.3 is a summary of the results of the waste weighting questionnaire in the receiving process that has been filled out by the four related respondents. From the results of the existing waste value, it can be seen the magnitude of the effect of the waste. If you know the magnitude of the effect of the total value of the waste, it will be easier to analyze the improvements that can be made to minimize or eliminate the waste that occurs.

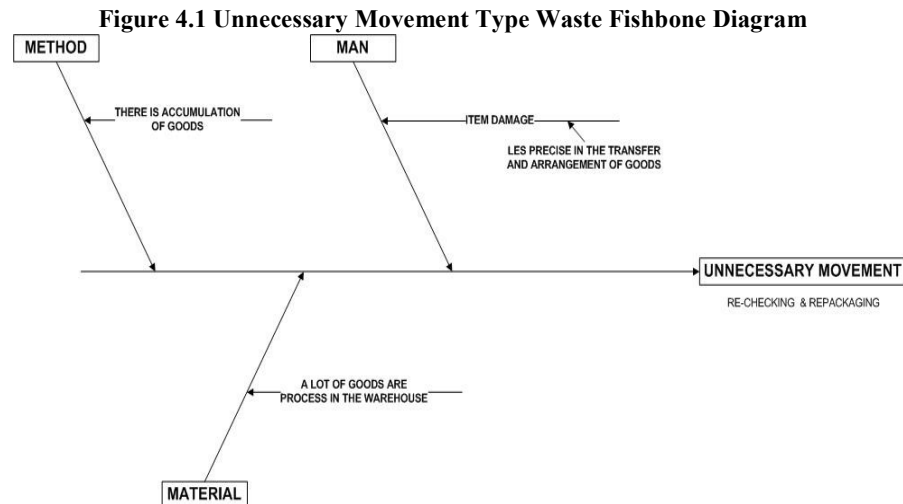
Table 3.2.4 Average Wasting Weight

Code	Activity	Average
P1	The checking process is repeated on scanning activities	9
T1	Unnecessary forklift movement impacts the material handling process	8.75
W1	The operator is waiting for the goods approval process by the warehouse leader	6
M1	Arrangement of goods that are not in appropriate with standards so that they are re-checked and repackaged	9.5

Source: The data is processed from the results of the questionnaire, 2021

4. Fishbone Diagram

Based on the results of the questionnaire recap, it is known that waste will be resolved first from the order of the highest to the lowest average value that affects the acceptance process, then the next step is to determine the root cause of the waste activity that occurs using a fishbone diagram.



Source: Data is processed from the results of brainstorming, 2021

Based on Figure 4.1, it is the cause and effect of the waste that occurs and is included in the type of unnecessary movement waste in the receiving process at the finished goods warehouse, the following is the explanation:

1) Method Factor

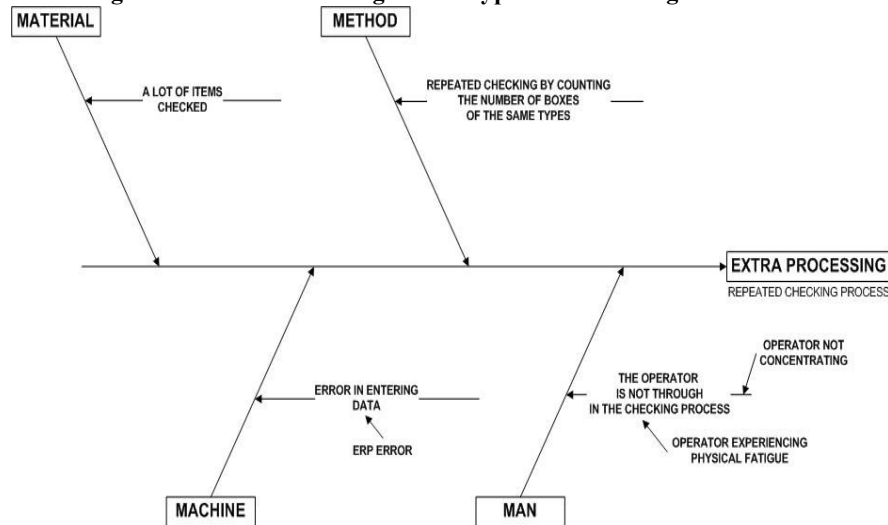
The method factor is a factor causing the main problem of waste activity in the receiving process at the finished goods warehouse, due to the inaccurate method used which results in the accumulation of goods.

2) Man Factor

In the human factor, there are problems related to the improper transfer and arrangement of goods carried out by operators which have an impact on damage to goods

3) Material Factor

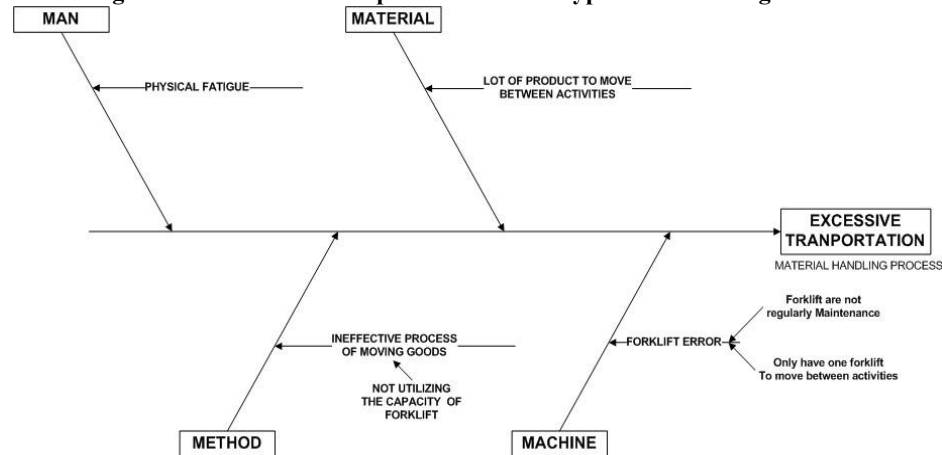
Based on material factors, the number of finished goods processed in receiving activities in the finished goods warehouse is large. The average number of delivery notes or the number of containers processed in a day is 3-5 containers.

Figure 4.2 Extra Processing Waste Type Fishbone Diagram

Source: Data is processed from the results of brainstorming, 2021

Based on Figure 4.2, it is the cause and effect of the waste that occurs and is included in the type of extra processing waste in the receiving process at the finished goods warehouse, the following is the explanation:

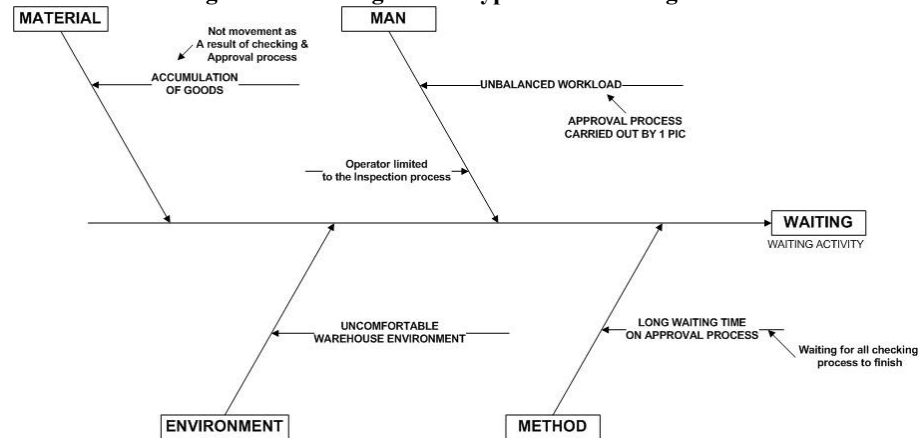
1. Material Factor
The container used is 40 HQ so that there are many items that must be checked on each product package, this results in the receiving process at the finished goods warehouse, especially in the less effective checking process carried out.
2. Method Factor
Method factor, there are repeated checking activities by counting the number of boxes of the same type or different types, resulting in excessive processing and impacting less effective processing time.
3. Machine Factor
The machine factor, one of the problems related to extra processing and lack of maintenance has an impact on the machine factor which results in errors in the data input process.
4. Man Factor
In the Man factor, the operator is less careful in carrying out the checking process. This is because the operator experiences physical exhaustion, besides the checking process that is carried out repeatedly causes the warehouse operator to lack concentration in checking each item.

Figure 4.3 Excessive Transportation Waste Type Fishbone Diagram

Source: Data is processed from the results of brainstorming, 2021

Based on Figure 4.3, it is the cause and effect of the waste that occurs and is included in the type of excessive transportation waste in the receiving process at the finished goods warehouse, the following is the explanation:

1. Man Factor
The material handling process carried out by the operator has not been effective and efficient. This is due to not using forklifts properly and still using manual methods in the process of moving goods between activities, causing physical fatigue experienced by operators.
2. Material Factor
A large number of items must be moved between activities.
3. Method Factor
The method factor applied to the process of moving goods between activities carried out in the receiving process has not been effective, this is because the operator does not utilize the capacity of the forklift.
4. Machine Factor
One of the tools used to assist in the process of moving goods between activities is using a forklift. Forklifts that are used often experience errors due to not doing regular maintenance (at least once per month) and only having 1 forklift to carry out the process of moving between activities.

Figure 4.4 Waiting Waste Type Fishbone Diagram

Source: Data is processed from the results of brainstorming, 2021

Based on Figure 4.4, it is the cause and effect of the waste that occurs and is included in the type of waiting waste in the receiving process at the finished goods warehouse, the following is the explanation:

1. **Material Factor**
On the material factor, there is an accumulation of goods because the checking process is carried out on each item and must wait for the process to be completed so that it can proceed to the next stage of the process, namely the approval process.
2. **Man Factor**
There is an unbalanced workload caused by waiting activities that occur in some activities
3. **Method Factor**
In the method factor, the person responsible for the approval process will wait a long time due to the previous process, namely checking so that the method used is still not right.
4. **Environment Factor**
The environmental conditions in the warehouse are hot, disrupting the performance of operators in carrying out receiving activities in each process, especially in activities that result in waiting times.

5. Improvement Suggestion

Based on the above analysis using a fishbone diagram, it can be seen the root causes that cause waste in the acceptance process at the finished goods warehouse.

1. **Unnecessary Movement**
Scanning is carried out in a focused state, increasing the number of operators reduces the burden on one operator
2. **Extra Processing**

The process of checking in a partial or partial way based on the same Stock Keeping Unit (SKU) number so that it does not require checking on every item.

3. Excessive Transportation

Perform machine maintenance (material handling forklift) periodically at least once per month to minimize the risk of forklift damage because it only has 1 forklift in the warehouse that is used to carry out the process of moving finished goods between activities.

Utilizing the capacity of the forklift so that the process of moving goods utilizes a forklift with the appropriate capacity and does not use manual operator power.

4. Waiting

The checking process on checking activities is carried out partially and then carried out to the next process stage, namely the approval process so that there is no buildup in checking activities and there is no waiting activity for the approval process by the warehouse leader.

Table 5.1 is a comparison of the time between before and after activities that cause waste in the receiving process in the finished goods warehouse to determine the amount of time reduction from wasteful activities that can be measured by simulation results, as follows:

Table 5.1 Comparison of Wasted Activity Time

No	Activity	Before			After			Minute reduction
		VA	NNVA	NVA	VA	NNVA	NVA	
1	Item scanning process		120			80		40
2	Waiting for item scanning process			120			90	30
3	The operator is waiting for the approval process from the warehouse leader			30			15	15
4	Operators do the compiling of goods			90			60	30
Total time before (minutes)			120	240				
Total time after (minutes)						80	165	
Total time reduction (Minute)								115

Source: Processing results from time measurement data and simulation, 2021

Table 5.1 is a comparison of the time of waste activities that can be measured. In the previous activity it took 360 minutes to process, after making efforts to minimize or eliminate activities that cause waste, there was a time reduction of 115 minutes. The total time required based on the simulation results to minimize or eliminate waste activities that can be measured is 245 minutes.

Conclusion

- 1) The activity process observed is the receiving process at the finished goods warehouse PT Emudah Fulfillmen Indonesia.
- 2) The types of waste found are unnecessary movement with a wastage weight of 9.5, extra processing with a wastage weight of 9, excessive transportation with a weight of 8.75, and waiting with a wastage weight of 6.
- 3) Suggestions for improvement that can be given include:
 - a. Unnecessary Movement
Scanning is carried out in a focused state, increasing the number of operators reduces the burden on one operator
 - b. Extra Processing
The process of checking in a partial or partial way based on the same Stock Keeping Unit (SKU) number so that it does not require checking on every item.
 - c. Excessive Transportation
Perform machine maintenance (material handling forklift) periodically at least once per month to minimize the risk of forklift damage because it only has 1 forklift in the warehouse that is used to carry out the process of moving finished goods between activities.
Utilizing the capacity of the forklift so that the process of moving goods utilizes a forklift with the appropriate capacity and does not use manual operator power.
 - d. Waiting
The checking process on checking activities is carried out partially and then carried out to the next process stage, namely the approval process so that there is no buildup in checking activities and there is no waiting activity for the approval process by the warehouse leader.

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