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Identification of Waste in Dolomite Stone Using the Waste Assessment Model Method in the Implementation of Lean Manufacturing

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Abstract

Production plays an important role in maintaining the quality and quantity of products until they reach consumers. The many important activities in the production process require companies to improve their performance to be effective and efficient in order to maintain trust. PT XYZ is a BUMD company engaged in the manufacturing of fertilizer and dolomite rock mining materials since 2018. In production activities, there are various activities that do not have added value or waste. This study aims to identify waste and find out the root causes of waste in production process activities. The implementation of Lean manufacturing is carried out by identifying the warehousing flow process with Value Stream Mapping (VSM), then identifying 7 wastes that occur in the warehousing process using the Waste Assessment Model (WAM) method. The results of the study showed that the waste with the highest percentage level was waste Processing (P) waste transportation (T) waste overproduction (D). From the proposed improvements and mapping of future flows, it was found that lead time was reduced to 264 minutes from 350 minutes, which means eliminating 86 minutes of activities that did not provide added value. Thus, activity increased by 22% from the initial condition.

Introduction

PT XYZ is a company engaged in the manufacturing of fertilizer industry and dolomite rock mining materials since 2018. The company's main product is fertilizer with a make to stock and make to order system, but the company also makes products other than fertilizer, namely crusher products including clay, dolomite, and calcium with a make to order system. Fertilizer is a material that is often used in agriculture to provide nutrients needed for plant growth.

The application of the Lean Manufacturing concept is to reduce lead time and increase output by eliminating waste that occurs in a company (Kumar et al., 2022; Sundar et al., 2014; El-Namrouty & Abushaaban, 2013). From the problems above, this study uses value stream mapping (VSM) which is one of the tools of Lean Manufacturing to solve existing problems. Value stream mapping is a mapping process that functions to identify the flow of materials and information in the production process from materials to finished products. This value stream mapping can be used as a starting point for companies to recognize waste and identify its causes (Dinis-Carvalho et al., 2019; Rother & Shook, 2003; Vilventhan et al., 2019).

In the dolomite stone production process in January 2025, the company can produce as much as 4,647 tons. However, this production volume has not reached the optimal figure because

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the raw materials used are greater, namely 4,959 tons, which should be the same as the output produced. This happens because there is waste in the machine as much as 7% of the production target. The machines that experience the highest waste are in the Loading Hopper as much as 0.5%, Open Bunker as much as 1.5%, and Silo as much as 5%. With the above problems, PT XYZ can make improvements to increase production efficiency and reduce waste that often occurs in the dolomite stone processing process. By using WAM, the company can identify the most dominant types of waste and measure their impact on the production process. The implementation of Lean Manufacturing supported by WAM allows optimization of resource use, such as raw materials, labor, and equipment. Therefore, this research is very necessary so that PT XYZ can achieve a more effective, efficient, and sustainable production system.

Manufacturing

Manufactum, meaning "handwork," is the Latin word for manufacture. Physical products are produced through manufacturing processes. In fact, fabrication is the most common way to transform unrefined components into tangible objects through a series of energy-focused tasks, each of which results in an adjustment of the physical properties or compounds of the material. The business of a manufacturing company consists of purchasing raw materials and processing them into products that can be sold while covering the costs of production (Sandopart et al., 2023; Novita & Santoso, 2025).

Lean Manufacturing

Lean manufacturing is a strategy in the production process of goods by eliminating waste. There are various definitions of lean manufacturing, but in essence it is about eliminating waste in the production process. Lean manufacturing helps companies improve quality, reduce costs, and reduce lead times. Basically, lean manufacturing can be applied in any area as long as the focus is on achieving a good workflow by minimizing waste (Nurwulan et al., 2021; Taher & Bashar, 2024; Taj & Berro, 2006).

Waste Classification

Waste refers to any activity that uses resources without adding value to the final product. The resources in question include raw materials, machinery, labor, capital, information, management, and processes. In manufacturing companies, significant waste often occurs due to the excessive use of labor, equipment, raw materials, and other production resources. If the amount of these elements is too high, this can lead to internal waste which in turn will increase production costs below a certain level of production (Novitasari & Rochmoeljati, 2021; Brunner &).

Value Stream Mapping (VSM)

In lean implementation, the main goal of value stream mapping is to eliminate waste and increase efficiency. By analyzing the value map, companies can identify opportunities for improvement such as reducing production cycle time, eliminating queues, reducing excess inventory, and improving workflow (Seth & Gupta, 2005; Mujtaba et al., 2010; Mujtaba et al., 2010). The result of this analysis is a redesign of the workflow that is smoother, more efficient, and more responsive to customer demand. The following are the steps in the value stream mapping method (Rochman & et al., 2024; Venkataraman et al., 2014; Rahani & Al-Ashraf, 2012; Hossen et al., 2017).

Waste Assessment Model (WAM)

The waste assessment model is a model developed to simplify the discovery of waste problems in order to identify and eliminate waste. The Waste Assessment Model describes the relationship between seven wastes, namely overproduction, waiting, transportation,

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excess processing, inventory, motion, and defects. The Waste Assessment Model (WAM) consists of the Waste Relationship Matrix (WRM) and the Waste Assessment Questionnaire (WAQ). This WAM has a fairly simple matrix model and is supported by a questionnaire that can cover many things so that it can achieve optimal and accurate results in the waste identification process (Astutik, 2022; Faccio et al., 2011; Irawan & Fitriani, 2024; Brander et al., 2020).

Waste Relationship Matrix (WRM)

Waste relationship matrix is an analysis of measurement criteria using a matrix. Each row of the matrix shows the relationship of a particular waste to six other wastes. Here is an example of a waste relationship matrix:

Table 1. Example Waste relationship matrix

F/T	O	I	D	M	T	P	W
O	A	E	I	I	E	X	I
I	E	A	I	E	E	X	X
D	I	I	A	I	E	X	E
M	X	O	O	A	E	I	O
T	O	O	O	I	A	X	O
P	O	O	E	I	X	A	I
W	O	O	I	X	X	X	A

The diagonal of the matrix has a value of A because each type of waste has a basic relationship with the waste itself. From the matrix symbol, it is then converted into a number with the conversion value of each symbol A = 10, E = 8, I = 6, O = 4, U = 2, and X = 0 (Alfiansyah, 2018).

Waste Assessment Questionnaire (WAQ)

The waste assessment questionnaire was developed to allocate waste that occurs in the production line. This assessment questionnaire consists of 68 different questions, where this questionnaire aims to determine waste. Each questionnaire presents activities, conditions, or properties that cause certain waste. Questions in the questionnaire are divided into 4 groups, namely man, machine, material, and method. Some questions are marked with the word "From", meaning that the question explains the type of waste that currently exists that can trigger the emergence of other types of waste based on WRM. Other questions are marked with the word "To", meaning that the question explains each type of waste that currently exists can occur because it is influenced by other types of waste. Each question has 3 answer choices and each answer is given a weight of 1, 0.5, or 0 (Alfiansyah, 2018).

Root Cause Analysis (RCA)

RCA is a problem-solving method that aims to identify the root cause of a problem or event and correct functional causes. Jucan in Khunaifi (2022) states that the purpose of using the RCA method is to find out the factors causing the problem and to identify the causes of the root cause of the problem. RCA is generally defined as a specific reason or set of reasons that can be identified logically, under management control to improve and provide effective recommendations.

Fishbone Diagram

Cause-and-effect diagrams or more commonly known as fishbone diagrams were first discovered by Dr. Kaoru Ishikawa who is a quality control expert from Japan, so this diagram is also often referred to as the Ishikawa diagram. A cause-and-effect diagram is a diagram that has a function to see the relationship between several possible causes that occur with a single

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effect. Cause-and-effect diagrams are created with the aim of identifying and controlling possible causes. Therefore, a cause-and-effect diagram is a tool that can be used to analyze the causes of a problem systematically, so that it will make it easier to overcome the causes of a problem (Armyanto et al., 2020).

Methods

The current research was carried out in PT Gresik Nusantara Fertilizer (GNF), which is a manufacturing plant of fertilizer located within the area of Jalan Raya Daendles B 115, Wadeng Village, Sidadu District, Gresik Regency, East Java. The study was started in January 2025 and went until the data needed to analyze it were collected. The research will center on Phoska fertilizer, which is among the flagship products of the company, and the main aim of the study is to find ways of lowering the cost of production. To this end, a mathematical optimization tool, the Dynamic Programming (DP) method, was implemented and the generated results were contrasted with the existing production planning process at the company. Because of it, the study can assess the efficiency of DP in a practical industrial situation and will show how the cost optimisation can increase the competitiveness of the company in the fertilizer market.

The study area included a series of variables that have a great impact on the cost architecture of the Phoska fertilizer manufacturing. The information about the production demand, cost of goods sold (HPP), composition of raw materials, raw material prices, and the cost of operations in terms of labour, electricity, and packaging was gathered and compared (Afwika et al., 2025; Selkimäki et al., 2010; Mayyas et al., 2019). These variables were chosen since they are some of the variables that can be controlled and those that cannot be controlled in the production process. Although demand and price of raw materials are highly influenced by the external market forces, other factors like labour deployment, packaging and use of electricity indicate internal cost parameters that the company can observe and control. Combining these variables, the study will bring a comprehensive picture of how the decisions about the production planning affect the total costs (Oluyisola et al., 2022; Elahi et al., 2023).

The company records were used to collect data and provided the historical data on the demand of fertilizers, price of raw materials, and the cost of running the company every month. The study was centered on a 6 months observation period, between September 2024 and February 2025. This period was specifically selected since it reflects the volatility of a demand and the price of raw materials thus providing a practical depiction of the production scene. To illustrate the input volatility, the changes in dolomite and molasses prices over this period; the cyclical nature of fertilizer requirements in agricultural markets is demonstrated by the changes in demand on a month in month out basis. The methodology anchored in this temporal context provides the optimisation model to be well-established on the practical production issues of the company instead of assumptions.

This analysis started with demand forecasting phase. Every production planning process has to be done with accurate demand forecasting because it guarantees efficient allocation of raw materials and operational resources. In this regard, the paper has conducted a test of three forecast methods: Moving Average, Weighted Moving Average, and Single Exponential Smoothing. Each technique has its own advantages - the Moving Average filters noise, the Weighted Moving Average lays more emphasis on recent trends, the Exponential Smoothing technique easier adapts to a change in the short run. Mean Absolute Deviation (MAD) was used to determine which technique gave the best forecast. It was then projected into the demand using the chosen model covering the next 6 months, i.e. March to August 2025. These estimates were used as a basis to simulate future production planning, and test the cost optimisation model with the expected conditions.

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After the stage of forecasting the research shifted to the calculations of the cost of production. There were two types of costs, which included variable and fixed costs. The variable costs included raw materials, the cost of which varies according to the conditions in the market, and the packaging material, which is directly proportional to the volume of output. Such fixed costs as labour wages and electricity consumption were also involved and do not alter much in terms of volume of production. This difference enabled the study to more effectively describe the dynamics of cost formation, owing to the strong effect of the changes in the prices of raw materials on the total expenses. The methodology identified the sources of inefficiencies more clearly by separating out these elements and leaving the focus of optimisation efforts on the sources that have the greatest contribution to inefficiency.

The main part of the methodology is the use of the Dynamic Programming method. The reason behind the choice of DP is the fact that it is highly applicable to intricate decision-making processes that demand the necessity to balance a number of constraints across a series of steps. The use of DP in the Phoska fertilizer production saw the utilisation of the tool to find the best mixture of raw materials, which would result in a minimum cost of production without compromising quality standards. The process works by breaking down the decision process into small and consecutive steps that are used to represent the production process stages. Recursive equations were used to connect these steps and so that every choice regarding the allocation of resources has taken into account the current expenses and the future ramifications. The DP approach found the cost-minimising strategy mathematically by step-by-step considering alternative decisions in a systematic way.

The last stage of the methodology process was the comparative analysis of the production costs produced by the company under the available planning strategy with those produced under the Dynamic Programming model. This was compared throughout the six-month period of observation to evaluate the level of cost-saving of the optimised model. In addition, future results of the forecasts of March to August 2025 have been incorporated into the DP framework to predict future production planning. This integration did not only help in testing the strength of the optimisation model but also offered practical information to be deployed in the production cycles of the company in the future. The methodology provided a balanced shift between empirical validation and predictive use by integrating both a historical study and forward-looking projections, then providing a holistic approach to cost optimisation.

Results and Discussion

Data Collection

Researchers collect data and information from the company PT XYZ to solve the problem. The data collected are primary and secondary data. Primary data is obtained from direct interviews with field supervisors in the form of qualitative and quantitative data, while Secondary data is information obtained through collecting data from other sources directly, by utilizing data that already exists in the office or company. This data can be in the form of reports, documents or archives related to the research. Secondary data provided to researchers includes company archives such as company profile data, standard operating procedures (SOP) of production processes, and company layout.

Table 2. Total Production Activity Time

No	Activity	Time (Minutes)
1	Raw Material Warehouse Station	143
2	Crusher Section	26
3	Vertical Roll Mill Section	14
4	Cyclone Section	19
5	Silo Product Section	30

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6	Packing	80
7	Inventory	38
TOTAL		350

From the data above, the warehousing flow process is poured into the value stream (VSM). An explanation is given regarding the conditions that occur in the dolomite production process flow starting from ordering raw materials to products reaching customers. The total production flow process time is 350 minutes. All activities are then defined into 3 categories, namely value added activity, non value added, and necessary non value added.

Table 3. Percentage of Frequency and Time of Each Type of Production Activity

No	Activity	Frequency	Percentage	Time	Precentage
1	Value Added (VA)	21	42%	177	51%
2	Non Value Added (NVA)	11	22%	86	25%
3	Necessary Non Value Added (NNVA)	18	36%	87	25%
Total		**50**	**100%**	**350**	**100%**

Based on the calculation results above, it is known that the time for each type of activity that includes value-added activities is 177 minutes with a percentage of 51%, non-value-added activities are 86 minutes with a percentage of 25% and non-value-added activities are required are 87 minutes with a percentage of 25%.

The Waste Relationship Matrix is used as a standard to measure the relationship between the waste generated. The Waste Relationship Matrix (WRM) is used as a standard reference in evaluating the level of relationship between types of waste that occur. This matrix is two-dimensional, consisting of rows and columns, each of which represents the types of waste. Rows indicate the extent to which a type of waste is influenced by other waste, while columns describe how much influence a waste has on other types of waste. The highest value in the matrix is usually located on the main diagonal, which shows the relationship of waste to itself. The level of relationship between the seven types of waste obtained from the calculation process is then converted into a Waste Relationship Matrix (WRM), as presented in the following table.

Table 4. Waste Relationship Matrix

F/T	O	I	D	M	T	P	W
O	A	E	O	U	E	X	O
I	U	A	U	U	U	X	X
D	U	U	A	I	E	X	U
M	X	U	I	A	X	U	E
T	U	U	I	Iha	A	X	I
P	U	U	U	U	X	A	U
W	U	U	U	X	X	X	A

The initial letter abbreviations of seven wastes are used as assessments, namely O is for overpurchase, I is inventory, D for defects, M is motion, P for processing, T is transportation and W is for waiting. For example, P_O shows the direct effect of over-processing on over purchase. The correlation score between wastes can be converted with each letter representing a range of scores. (A = 17 until 20 needs improvement; E = 13-16 is very important to improve; I = 9-12 is important to improve; O = 5-8 is not important to improve; U = 1-4 is not very important to improve).

Once the Waste Relationship Matrix is obtained, each type of relationship identified is converted into a numerical value according to the provisions set out in the previous waste

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matrix value standard. These values are then used to calculate the percentage contribution of each type of waste, which is then utilized in the advanced calculation stage

Table 5. Waste Matrix Value

F/T	O	I	D	M	T	P	W	*Score*	%
O	10	8	4	2	8	0	4	32	22%
I	2	10	2	2	2	0	0	18	12%
D	2	2	10	6	8	0	2	28	19%
M	0	2	6	10	0	2	8	20	14%
T	2	2	6	6	10	0	6	26	18%
P	2	2	2	2	0	10	2	18	12%
W	2	2	2	0	0	0	10	6	4%
Score	20	28	32	28	28	12	32	148	
%	14%	19%	22%	19%	19%	8%	22%		

Waste Assessment Questionnaire stage, the questionnaire results obtained came from 68 questions with 3 weights Yes, Medium, No 1, 0.5, 0. The 68 questions are classified into 4 groups, namely humans, methods, machines, and materials. The first step that must be taken is to group and count the number of questionnaire questions based on "from" and "to".

Table 6. Grouping Of Qustion Types

No	Question Types	Total (Ni)
1	From Overproduction	3
2	From Inventory	6
3	From Defects	8
4	From Motion	11
5	From Transportation	4
6	From Processing	7
7	From Waiting	8
8	To Defects	5
9	To Motion	8
10	To Transportation	3
11	To Waiting	5

From the questions above, data processing is continued using WAQ method to find out and rank which waste has the greatest level of influence on the inefficiency of the warehousing activity process. The results of the calculation are as follows:

Table 7. Waste Assement Questionaire

Ket	O	I	D	M	T	P	W
Yj	0.37698	0.344384	0.373564	0.384405	0.351635	0.434436	0.405438
Pj Factor	1	0.730769	0.8	0.869565	1.533333	2.888889	0.6
Yj Final	0.37698	0.251665	0.298851	0.334266	0.539174	1.255038	0.243263
FR (%)	11%	8%	9%	10%	16%	38%	7%
Ranking	3	6	5	4	2	1	7

Based on the table above, the three types of waste identified as the largest of the seven wastes are processing (38%), transportation (16%), and overproduction (11%). This largest waste has a very large impact on the production process, namely inefficiency which results in delays in the production process and product delivery.

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Furthermore, an analysis of the causal factors of each type of waste is carried out in more depth using a fishbone diagram. This diagram functions to map the cause-effect relationship of the emergence of waste in the warehousing process flow, thus allowing the formulation of appropriate improvement recommendations. Figures 1. to 1.4 present the identification of the causes and impacts of each waste that occurs in the warehousing process flow through the fishbone diagram approach.

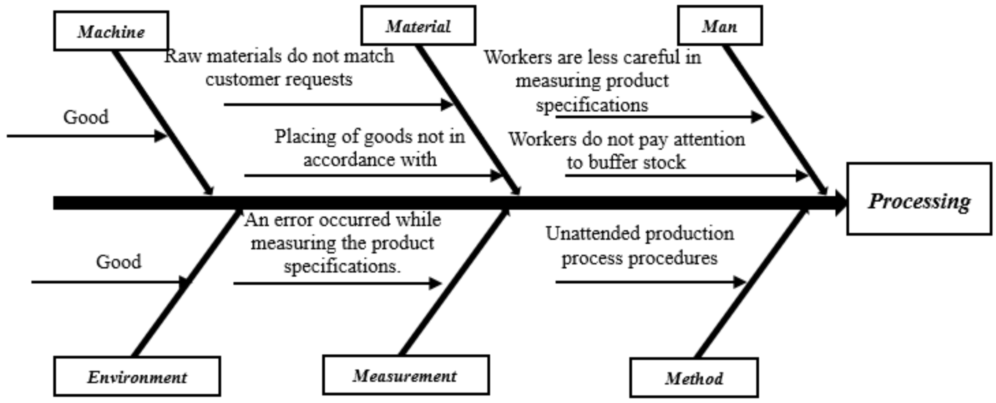

Figure 1. Fishbone Diagram Waste Processing

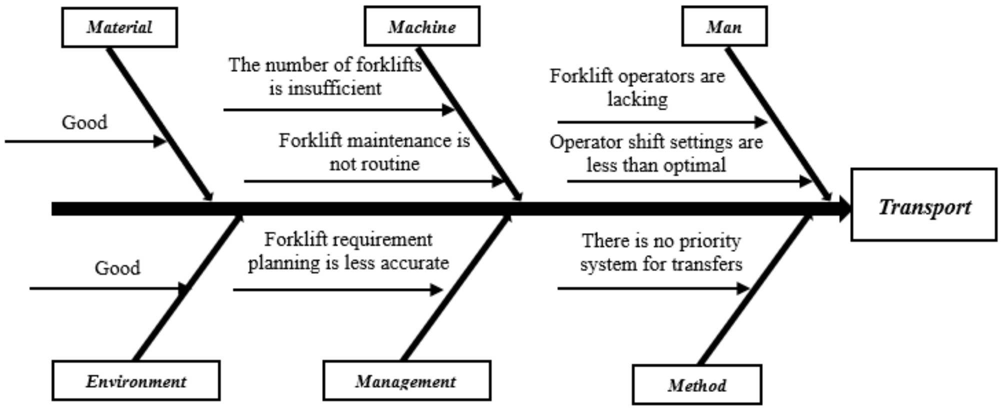

Figure 2. Fishbone Diagram Waste Transportation

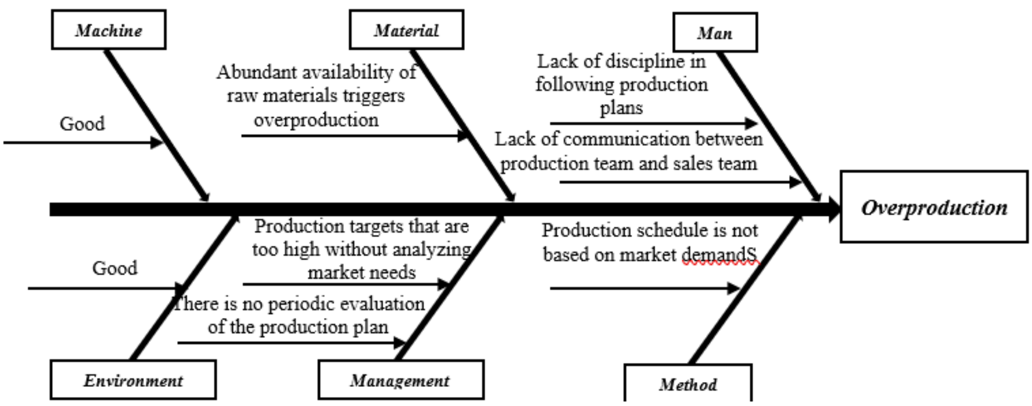

Figure 3. Fishbone Diagram Waste Overproduction

Recommendations for improvement using the 5W+1H method were made after the factors causing waste were obtained based on the fishbone diagram result of the identifying using the fishbone diagram. Then the results of the fishbone diagram were used as a basis for compiling recommendations to reduce waste in the warehouse at ABC Company.

Table 8. 5W+1H Analysis Waste Processing

(What)	(Where)	(Who)	(When)	(Why))	(How)

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Man	Production area	Operator Production	During the production process	Workers are not careful in measuring product specifications	Provide retraining for production employees
				Not paying attention to buffer stock	implement production work checklist
Method	Production area	Supervisor Production	During the production process	Production process procedures are not observed or not carried out according to SOP	Evaluate and enforce production SOPs and routine internal audits
Material	Production input area	Logistics department	When the material enters the production process	Raw materials do not match customer requests	Conduct strict inspection of raw materials before entering the production line
Measurement	Production area	Team QC	When measuring product specifications	Errors occur in measuring product specifications	Use standard measuring instruments and routine calibration

Table 9. 5W+1H Analysis Waste Transportation

(What)	(Where)	(Who)	(When)	(Why))	(How)
Man	Goods transfer area	Forklift Operator & Field Supervisor	During the goods transfer process	Lack of forklift operators and suboptimal shift scheduling	Add forklift operators and optimize work shift schedules
Method	Production and warehouse area	Production & Warehouse Supervisor	During the production and distribution flow	No priority system for moving goods	Implement queuing and priority systems (e.g. FIFO or based on urgency)
Machine	Goods transfer area	Forklift Technician Team	During the warehouse operational process	Limited number of forklifts and routine forklift maintenance	Add forklift units and perform regular maintenance according to schedule
Management	Operational planning	Operational Manager	During daily needs planning	Inaccurate forklift requirements planning	Perform transportation equipment needs planning based on daily and seasonal actual data

Table 10. 5W+1H Analysis Waste Overproduction

(What)	(Where)	(Who)	(When)	(Why))	(How)
Man	Production area and team coordination	Production and sales team	During daily production	Lack of discipline in following production plans and minimal	Improve coordination between teams and conduct daily production-

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				communication between teams	sales briefings
Method	Production area	Production supervisor	During weekly/monthly production scheduling.	Production schedules are not based on market demand	Adjust production schedules with sales data and market trends
Material	Raw material warehouse and production line	Warehouse manager	During production planning and preparation	Excessive availability of raw materials encourages overproduction	Implement inventory control based on actual market demand
Management	Production strategic planning	Production strategic planning	During production target preparation	Targets are too high without analyzing market needs and no periodic evaluation	Set targets based on market data and conduct monthly periodic evaluations

The proposed improvement recommendations to reduce waste will have an impact on the results of the future value stream mapping, which is compiled based on the projection of conditions after the implementation of the proposed improvements. Improvement efforts can be made through simplifying the process flow. Activities that do not provide added value (Non-Value Added/NVA) are activities that do not provide direct contribution to the value of the product or service, so these activities need to be eliminated or minimized. NVA activities are categorized as a form of waste, so improvement steps are needed to eliminate or reduce their existence. The following table presents production activities after the implementation of the proposed improvements.

Table 11. Comparison of Production Activity Frequency and Time Based on NA, NVA, and NNVA Before and After Improvement

No	**Activity**	**Frequency Before Improve**	**Frequency After Improve**	**Time Before Improve**	**Time After Improve**	**Precentage of Improve**
1	Value Added (VA)	21	21	177	177	0%
2	Non Value Added (NVA)	11	0	86	0	100%
3	Necessary Non Value Added (NNVA)	18	18	87	87	0%
Total		50	39	350	264	

Table 12. Comparison of Production Flow Process Before and After Improvement

Types of Comparison	**Before Improvement**	**After Improvement**	**Precentage Improvement (%)**
Number of Activities	50	39	22%
Value Added	21	21	0%
Necessary Non Value Added (NNVA)	18	18	0%
Non Value Added (NVA)	11	0	100%
Lead Time	350	264	24%

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Based on the comparison table above, it can be seen that there is a simplification of the process where there is a reduction from 50 activities to 39 activities with a percentage of improvement of 22%. Based on value added (VA) and necessary non-value added (NNVA) activities, there is no reduction in activities because they are needed in production activities. However, in non-value added (NVA) activities, 11 activities were eliminated because they did not have added value and had to be eliminated so that production activities would be more efficient and eliminate waste with a percentage of improvement of 100%. There was a change in time where previously the entire production activity took 350 minutes. After the improvement proposal, the time required was reduced to 264 minutes with a percentage of improvement of 24%.

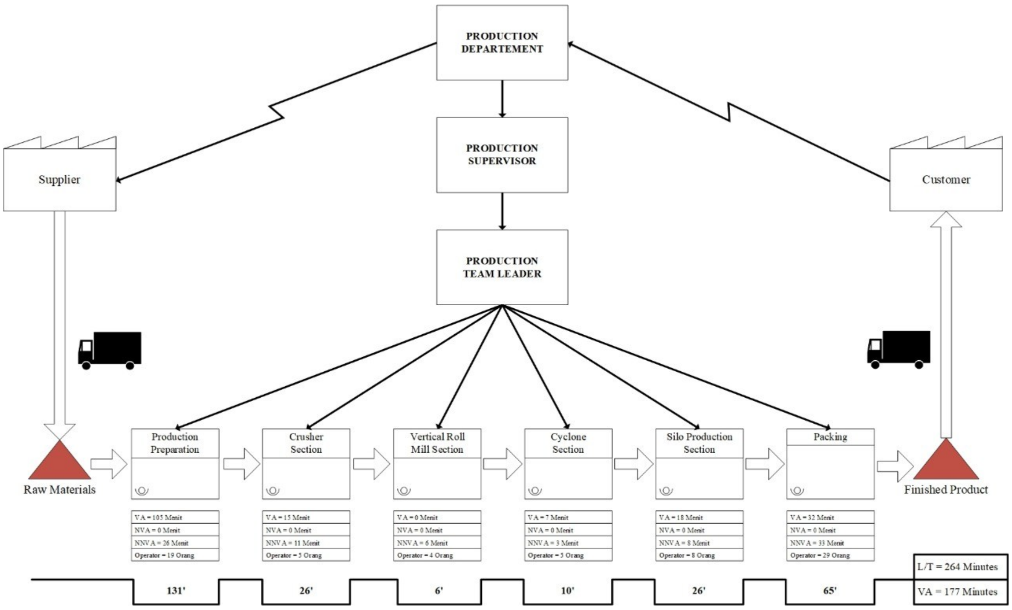

Figure 4. Future Value Stream Mapping

After improvements are made to production activities, the next step is to calculate the efficiency of production activities at PT XYZ after recommendations for improvements are made, so that the results are obtained on how much time efficiency increases in production activities. The calculation of time efficiency of production activities can be seen as follows:

$$\text{Efficiency} = \frac{Current\ lead\ time - lead\ time\ after\ improvement}{current\ lead\ time} X\ 100\%$$

$$= \frac{350-264}{350} X\ 100\%$$

$$= 24\%$$

From the calculation above, it can be concluded that after the provision of the proposed improvement, the efficiency of production activities increased by 22% during 1 daily activity cycle or the production process from the stage of ordering raw materials from suppliers to goods received by consumers. This means that the better the production activities carried out because activities that do not provide added value are eliminated so that the time for unnecessary activities is reduced. So, between the time of activities that provide added value and the total time of production activities increases.

Conclusion

Based on the results of the analysis using value stream mapping and process activity mapping, it was found that the total lead time of all production process activities at PT XYZ was 350 minutes with a total value added time of 177 minutes with a daily production process cycle starting from raw materials entering until the goods are received by consumers. These results indicate that the production process is inefficient due to the long time caused by activities that

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do not provide added value or waste. Therefore, it is necessary to conduct an analysis of 7 wastes to determine the most frequent waste so that improvements can be made.

Furthermore, mapping of current conditions was carried out using future value stream mapping. The lead time was reduced to 246 minutes, namely the elimination of non-value added time by 86 minutes. So that delay activities do not occur and the warehouse activity process increases by 24% from the initial condition. Based on the ranking results in the waste assessment model, three types of waste were obtained with the highest percentage levels which can be seen in table 4.17 and figure 4.6 regarding the results of the waste ranking. In the production process at PT XYZ, first, waste processing (P) with a percentage of 38%, second, waste transport (T) with a percentage of 16%, and third, waste overproduction with a percentage of 11%. The main priority in the proposed improvements is focused on the implementation of a barcode system on each product, in order to enable real-time and accurate activity tracking. Furthermore, the integration of the ERP (Enterprise Resource Planning) system is proposed to synchronize all operational activities in the warehouse area in a centralized and coordinated manner. In addition, updates to the company's Standard Operating Procedures (SOP) need to be carried out so that each activity can take place more effectively and efficiently, and encourage the creation of continuous improvement in the operational process.

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