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Research Articles

Waste Identification Using the Value Stream Mapping (VSM) Method on the PT XYZ Transparent Bar Soap Production Line

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A B S T R A C T

The production process is an activity to create or increase the function of a good or service by using existing factors such as human resources, machines, materials and money to make it more useful for human needs. PT XYZ is a cosmetic manufacturing services company that has been established for more than 15 years producing quality cosmetics, skincare and beauty soap. However, during the production process there were various problems, namely waste was found. The aim of this research is to identify waste and provide suggestions for improvements to PT XYZ's transparent bar soap production line. The method used in this research is Value Stream Mapping (VSM) by conducting interviews and direct observation as a data collection method. The results of the research that has been carried out are the discovery of waste in the form of transportation, waiting, and defects caused by various factors. These factors include human factors, methods, machines, processes and the environment. From the identification results, several recommendations for improvement were proposed, such as holding training on the use of sealing machines, implementing the 5R culture, routinely checking raw materials, optimizing the use of cutting machines, and routinely monitoring products and employee activities. After carrying out the improvement process, the production time was 2,581.36 minutes with a lead time of 26.29 minutes, compared to the initial condition, which was 4,102 minutes with a lead time of 39.89 minutes. Thus, it can be concluded that after carrying out the improvement process, it is hoped that the production process will run faster than before.

INTRODUCTION

The production process is an activity to create or increase the function of a good or service using existing factors such as human resources, machines, materials and money to make it more useful for human needs (Maulana et al., 2023). According to (Indriati et al., 2019), the production process is quite an important part of a business because it can affect the costs incurred and the quality of the products produced. Quality is one of the factors considered in choosing a product (Dermawan et al., 2021; Sumasto, Arliananda, Imansuri, Aisyah, & Pratama, 2023; Sumasto, Arliananda, Imansuri, Aisyah, & Purwojatmiko, 2023).

PT XYZ is a cosmetic manufacturing services company. This company has been established for more than 15 years producing quality cosmetics, skincare and beauty soap. One of the products widely produced by PT XYZ is transparent bar soap. The problem that still occurs in the transparent bar soap production line is waste during production due to activities that are inefficient and do not provide added value. The waste that occurs is because the production process is still semi-manual, so it takes time to move materials from one process to the next (Kurnia & Widyadana, 2022; Nurlaelah, 2023). Defective products are also still a problem in the transparent bar soap production line. Some visible defective products include red soap, dirty soap, soap cut in half, and so on.

One method that can be used to minimize waste is lean manufacturing. According to (Fannysia et al., 2022; Fatma et al., 2022; Salim et al., 2021) states that lean manufacturing is a method that focuses on minimizing waste in the manufacturing system while increasing productivity. The implementation of a lean manufacturing system is a system that focuses on identifying and eliminating all forms of waste so as to create a lean and efficient manufacturing system.

One of the analytical tools in lean manufacturing is Value Stream Mapping (VSM). According to (Khunaifi et al., 2022) stated that value stream mapping is all activities (value added or non-value added) required to produce a product from the main production stream (Ali, 2023; Zulfikar & Rachman, 2020). The aim of this activity is to create better performance in the proposed future state map. One of the advantages of value stream mapping is that it helps companies use the entire production flow which includes the flow of information and materials. Therefore, the Value Stream Mapping method is used to identify activities or activities that do not have added value so that they can be minimized, so that the transparent bar soap production process runs effectively and efficiently.

Research using the Value Stream Mapping (VSM) method has been carried out before. Several studies have used the Value Stream Mapping method, including VSM to improve the flow of the chocolate bar production process (Indriati et al., 2019), Implementation of Lean Manufacturing to minimize waste at PT. Pura Barutama (Khunaifi et al., 2022), Identification of Waste in the Housing Industry (Maulana et al., 2023), Application of Lean Manufacturing to Reduce Waste in the Material Checking Process of Raw Materials to the Production Line (Fatma et al., 2022; Perdana et al., 2021; Sumasto, Riyanto, Pratama, Imansuri, & Putri, 2023). Based on the literature study conducted, research using the Value Stream Mapping method in cosmetics companies has never been carried out before. Based on the explanation above, this research aims to identify waste and provide suggestions for improvements to the transparent bar soap production line so that it can increase the efficiency of PT XYZ's production time.

METHOD

The type of research used is descriptive research which is carried out by analyzing the work and activities of a production process (Hidayati & Nurhidayat, 2021; Mauluddin & Marwah, 2023). The data collection method used was an interview process and direct observation. The interview process was carried out with PT. The analysis method used in this research is Value Stream Mapping (VSM). Value stream mapping is a method of mapping production flow and information flow in the production process of a product. In this mapping method, value added activities and non value added activities will be found. There are several stages in identifying waste using value stream mapping as follows.

Initial Identification Stage

At this stage, identification of the production process and observation of the factory area is carried out. The production process observed starts from upstream to downstream processes, namely from the weighing process to packaging. During the production process, the cycle time is calculated and the activities carried out are recorded. After that, the activity is classified into value added activity or non value added activity. Value added activity is an activity that is used to carry out a work process so that it can provide value, while non-value added activity is a wasteful activity that does not add value so it must be eliminated.

Stage Current State Map

At this stage all production activities are mapped into the current state map diagram. This mapping aims to make it easier for companies to see material flows and information flows. The current state map explains the current conditions of the lead time and processing time of the ongoing production process.

Identification Stage Waste

At this stage, by looking at the current state map, waste is then identified in the production area which has a longer cycle time.

Cause Analysis Stage Waste

At this stage, the waste found from the identification results is then analyzed for its causes using a Fishbone Diagram. A fishbone diagram is a diagram to identify possible causes of an effect or problem. Analysis of the causes of waste can come from machine, human, material, method, process and environmental factors.

Repair Stage

After analyzing the causes of waste, the next stage is to propose improvements to the company so that the production process runs effectively and efficiently. Some of the improvements proposed by researchers include training on the use of sealing machines, implementing the 5R culture, routinely checking raw materials, optimizing the use of cutting machines, routinely monitoring products and employee activities.

Stage Future State Map

At this stage, a future state map is created which aims to provide an overview of the conditions of the production process in the future.

RESULTS AND DISCUSSION

Transparent Bar Soap Production Process

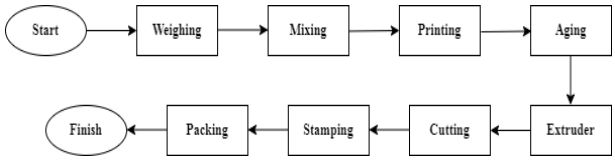

Fig 1. Production Process Flow

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1. Weighing

The first stage of the transparent bar soap production process is weighing (Figure 1.). All raw materials are weighed according to a predetermined scale. This weighing process is divided into two parts, namely weighing liquid raw materials and weighing powder raw materials.

2. Mixing

All raw materials that have been weighed are then mixed using a mixing tank machine. During this mixing process, the production operator must ensure that the temperature levels comply with the standards stated in the Batch Processing Note (CPB).

3. Printing

The raw materials that have been mixed in the tank mixing machine are then poured into a large container for printing. But before that, semi-finished products undergo a quality control process. If it is said to be suitable, printing is carried out by pouring the product into a pipe. This printing process is carried out by 5 production operators.

4. Aging

The cooling or aging process aims to ensure that the printed product experiences hardness so that it can continue to the next stage. According to interview results, the cooling process takes 24 hours.

5. Extruder

Products that have gone through the cooling stage are then released using an extruder machine. The product release process is carried out by 2 production operators. After this process continues with the cutting process.

6. Cutting

The finished product that has been removed from the mold then enters the cutting process. Product cutting is adjusted to the shape desired by consumers. The transparent bar soap that has been produced has various shapes, such as square, rectangular, round and oval so that the cutting process is not all carried out by machines. However, there are still things that are done manually.

7. Stamping

Branding or stamping is the process of giving a name in the form of a brand to a transparent soap bar product. This process is an option depending on the consumer's wishes. If this process is skipped it will not be a problem.

8. Packaging

The final process in the production process is packaging. Packaging for soap bars uses plastic sealing and innerbox. There are three stages in this packaging, namely the sealing stage, packing stage, and shrink stage.

Current State Map

*Current State Map*needed as an initial step in the process of identifying waste during the transparent bar soap production process at PT XYZ. Current state map is a description of the flow of production, materials and information in current conditions. By identifying waste in each process, you will know how to take corrective action to reduce waste. Before describing the Current State Map, cycle time, information flow, and material flow are determined. Below will be explained the Current State Map of transparent bar soap production.

Based on the results of the current state map mapping above, it can be seen that the production process time for transparent bar soap is 4,102 minutes with a lead time of 39.89 minutes.

Waste Identification

Based on the observations of the Current State Map (Figure 2.), waste can be descriptively identified that appears in the soap bar production process, namely:

1. Transportation

Transportation is an important activity but does not add value to the product so it can be said to be waste. Transportation is the process of moving materials or goods in process from one work station to another work station using a forklift or conveyor.

One of the wastes caused by transportation is because the transportation of materials from work station to another work station is carried out repeatedly or continuously, the factory area is inadequate and there is a lack of manpower.

2. Waiting

Waiting namely waste because you have to wait for the next process. Waiting is a period of time that is not used by operators to carry out value-added activities because they have to wait for the product flow from the previous (upstream) process.

There were several wastes found due to waiting in the production section of PT XYZ, namely as follows.

a. Waiting for replacement of raw materials in the liquid weighing area because raw materials run out and machines experience problems.
b. There is a long processing time during the cooling or aging process, this causes the cutting process to be delayed.
c. Transportation of materials is carried out repeatedly, so operators have to wait for the arrival of materials for the next process.

The sealing machine operator takes too long to setup the machine.

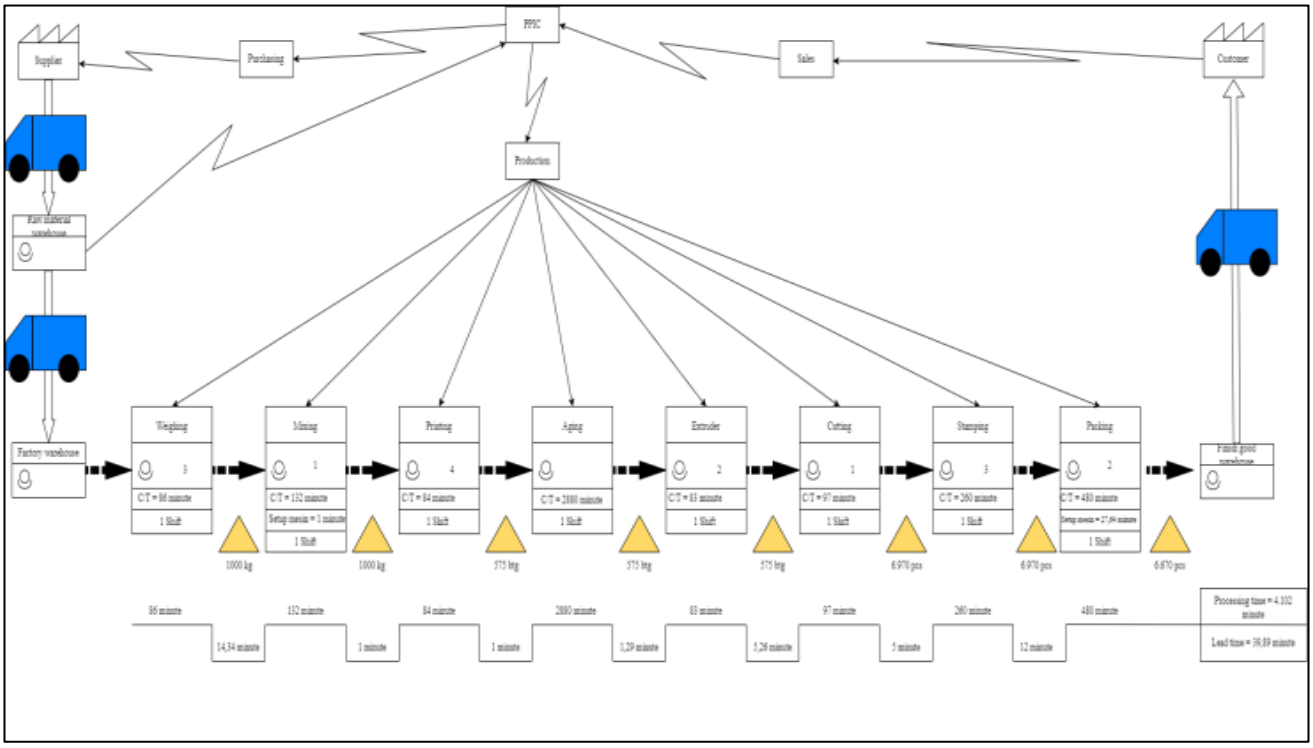

Fig 2. Current State Map

3. *Defect*

*Defect*is a product that is damaged or does not meet technical standards. This will result in inefficient rework, high levels of consumer complaints, and high levels of inspection.

After identification, defects were found in the transparent bar soap production process, namely red soap because the temperature was too hot during the mixing process, dirty soap, rough soap texture due to evaporation due to being stored in the container for too long, broken soap, and flattened soap.

Analysis of the Causes of Waste

After identifying the waste at PT XYZ, the next step is to analyze the causes of the waste using a Fishbone Diagram. Fishbone diagrams or cause and effect diagrams are a structured approach that allows more detailed analysis to be carried out to find the causes of problems, non-conformities and deficiencies that arise. Thus, the causes of waste have been identified based on value stream mapping, namely transportation waste, waiting waste and defect waste.

1. **Transportation**

Based on the results of the analysis that has been carried out, there are several factors that cause the emergence of transportation waste, including machine, human, method and environmental factors. The results of this analysis can be seen in the Fishbone Diagram (Figure 3.).

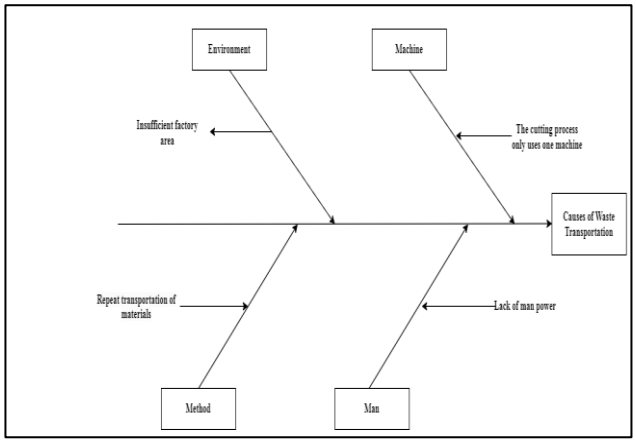

Fig 3. Fishbone Waste Transportation Diagram

From the analysis of the causes of transportation waste in Figure 3, the environmental factors that cause transportation waste are because the factory area is inadequate. Insufficient area means there is no place to store materials that have been previously processed so that material transportation must be carried out repeatedly. Using this method can determine the factors that cause transportation waste. For machine factors that make transportation waste visible in the cutting process. In the cutting process, of the three available machines, only one machine is used, causing the cutting time to take longer. Another factor causing transportation waste is humans. The lack of manpower in the production process means that transporting materials from work station to another cannot be carried out all at once.

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2. **Waiting**

Based on the results of the analysis that has been carried out, there are several factors that cause the emergence of waste waiting, including machine, material, process, human and method factors. The results of this analysis can be seen in the Fishbone Diagram (Figure 4.).

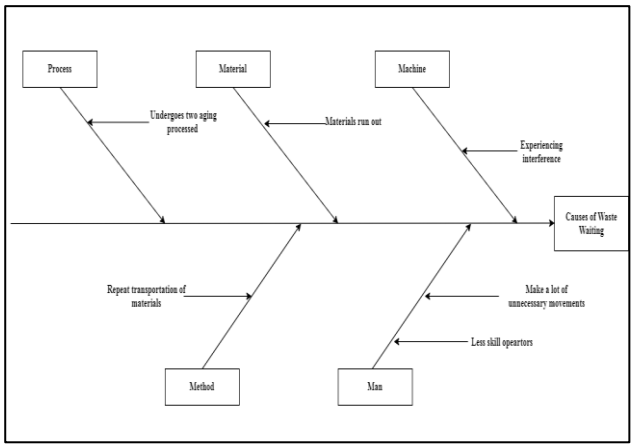

Fig 4. Waste Waiting Fishbone Diagram

From the analysis of the causes of waste waiting in Figure 4, the factor that causes the machine to create waste waiting is because during the cutting process, the machine experienced interference due to the power failure in that area. This makes the cutting process delayed for quite a long time. The material factor creates waste waiting because in the process of weighing liquid raw materials, the material to be weighed runs out so the operator has to replace the material with a new one. Thus there is a waiting time during the change of material. Based on the process factors that cause waste waiting, namely the cooling or aging process is carried out twice so that there is a delay in entering the next process. The reason the aging was done twice was because the hardness level of the transparent bar soap product did not meet the company standard, namely 2.75. Method factors also cause waste waiting because material transportation is carried out repeatedly so operators wait. The operator's lack of skills in setting up the machine and carrying out many unnecessary movements such as cleaning containers, moving products, arranging products which cannot add value to the product creates waste waiting which is caused by human factors.

3. **Defect**

Based on the results of the analysis that has been carried out, there are several factors that cause the emergence of waste defects, including machine, process, human and environmental factors. The results of this analysis can be seen in the Fishbone Diagram (Figure 5.).

From the analysis of the causes of waste defects in Figure 5, the factor that causes the machine to create waste defects is because during the sealing process, the machine used is dirty so there is dirt in the bar soap product. This is because when the sealing process is carried out, the machine is not cleaned first from the previous process. The process factor that causes waste defects occurs in the mixing process because the temperature during the process is too hot, causing the soap to be colored, not in accordance with company standards. Apart from that, environmental factors such as bar soap being stored in a container for too long can cause the sugar content in it to evaporate, causing the product texture to not meet standards. Human factors also often create waste defects, such as when the operator is not precise in the cutting process when storing the product on the cutting machine, resulting in many parts being wasted. Apart from that, in the sealing section, operators are often inaccurate in setting up the machine. This causes the machine to overheat, causing the plastic sealing to melt and damage the product. Operators' lack of focus was found in this research to create waste defects such as not placing the soap correctly in the sealing machine so that the soap split into two parts and in one sealing plastic there were two transparent bars of soap.

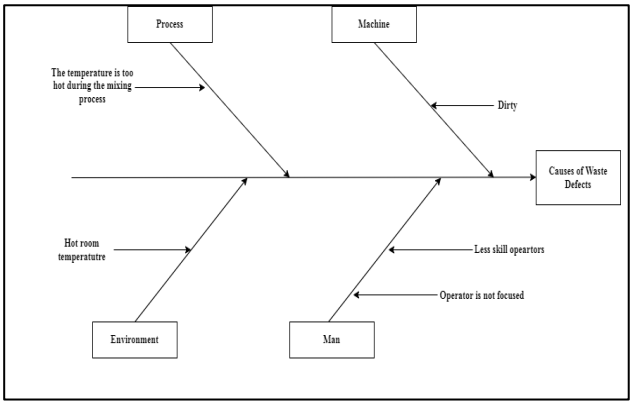

Fig 5. Fishbone Waste Defect Diagram

Proposed Improvements

Based on the results of identification and analysis of the causes of waste in the production process of transparent bar soap at PT Based on the waste that has been identified, the author's recommendations for improvement are as follows:

1. Training on Sealing Machine Use

The first recommendation, to reduce waste waiting, especially in the packaging area, is to provide sealing machine training for employees. This training is intended so that all employees who work in the packaging area can understand how to use the machine, from setup until the machine is finished using. Based on the results of interviews with employees, employees learn to operate the machine by self-teaching. Therefore, employees who do not understand it thoroughly will have difficulty setting up the machine, which will result in too long waiting times. Thus, it is necessary to provide training for all employees in the packaging area so that they are able to use the machines well and the packaging process runs efficiently.

This training can be held by the company internally, namely the Engineering Department.

2. Implementation of 5S Culture

Dirty products are one of the causes of waste defects. Efforts that can be made to reduce this are by regularly cleaning machines that have been used, especially for cutting and sealing machines. This is in accordance with the 5R culture, namely cleanliness, which means cleaning work equipment so that there are no traces of dirt from previous soap. This activity can be carried out after the machine is used and then there is a product change.

3. Routinely check raw materials

Checking raw materials, especially liquid raw materials, should be carried out routinely. This will result in waste waiting if during the weighing process the liquid raw materials run out. The author recommends proposed improvements so that when the weighing process is complete the operator is expected to monitor the inventory of liquid raw materials. This is because the location of the liquid raw material warehouse is far from the production area, so if something happens that the raw material runs out it can cause the weighing process to take longer.

4. Optimizing the Use of Cutting Machines

The proposed improvement that the author recommends to reduce transportation and waiting waste is optimizing the cutting machine. Based on observations made during the cutting process, there were three machines in the area, but only one machine was used. Therefore, the author proposes that the available cutting machines be used optimally to reduce waste and make the cutting process faster.

5. Routinely Monitor Products and Employee Activities

Monitoring products and employee activities aims to reduce defect waste. During the observations made by the author, there were product defects caused by human factors, such as inappropriate cutting results, products being cut during the sealing process, and there being two products in one plastic sealing. This is all caused by a lack of employee focus during the production process. Therefore, the author proposes that the production supervisor or quality control can carry out regular monitoring of employees during the process.

Apart from that, environmental factors can cause waste defects, such as evaporation of new soap products because they have been stored in containers for too long. Therefore, to reduce this, it is necessary to monitor product checks and create a cutting schedule.

Future State Map

Based on the proposed improvements to reduce waste, a Future State Map is created. The future state map is a description of the flow of production, raw materials and information in the proposed conditions. A future state map is created to show work that has been improved. The processes that are trying to be reduced are the process of transporting products from the extruder area to the cutting area, the process of transporting products from the stamping area to the sealing area, the waiting process in the weighing area and the sealing area. The results of the improvements are explained in the Future State Map (Figure 6.).

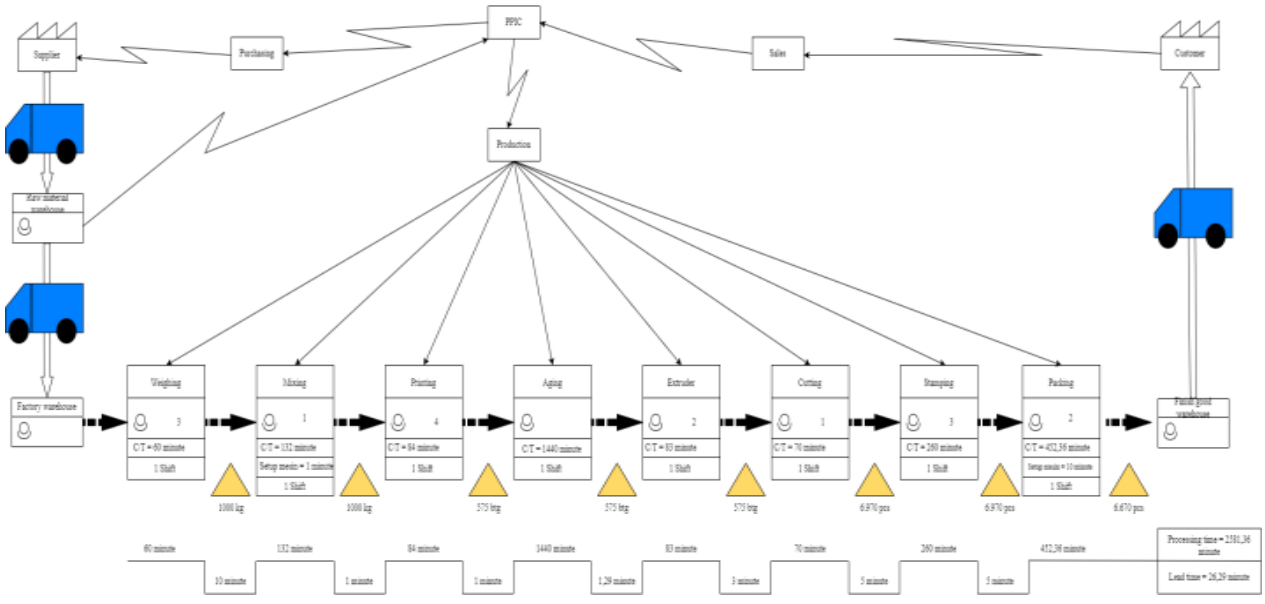

Fig 6. Future State Map

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In Future State Map conditions, after several improvements have been made during the production process, it is hoped that the processing time will be slightly shorter than in Current State Map conditions. In the initial conditions, it was identified that the time required for the production process was 4,102 minutes with a lead time of 39.89 minutes. However, after the improvement process was carried out, it can be seen on the Future State Map that production time decreased, namely 2,581.36 with a lead time of 26.29 minutes. This reduction in time is allocated so that there is no disruption to the weighing process, there is no disruption to the cutting machine, optimal use of the cutting machine. Thus, the future production process is expected to be faster than previous conditions.

CONCLUSION

Based on the results of the observations that have been made, it can be concluded that in the Current State Map conditions the time required for the production process is 4,102 minutes with a lead time of 39.89 minutes. This found waste, namely transportation, waiting, and defects. There is transportation waste because the process of transporting products is carried out repeatedly, resulting in the production process taking longer. Changing liquid raw materials, the aging process twice, and lack of operator skills in setting up the machine are the causes of waste waiting, while the presence of defective products such as dirty soap, split soap, and flat soap are the causes of waste defects.

To minimize the generation of waste during the production process, improvements are needed. Suggestions for improvements that can be made by the company include training on the use of sealing machines, implementing the 5R culture, routinely checking raw materials, optimizing the use of cutting machines, and routinely monitoring products and employee activities. Thus, several improvements were made to streamline production time. In future state map conditions the time required for the production process is 2,581.36 with a lead time of 26.29 minutes, therefore the production process is faster than the previous conditions. It is recommended that further research use additional methods to support value stream mapping so that research results are more accurate, objective and valid.

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