# Implementation of the Lean Manufacturing Concept to Reduce Waste in Spare Part Repair Activities at PT. X

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**Abstract**

The competition in the manufacturing industry is currently moving very fast. Competitive advantage, increased production effectiveness in operational activities, continuous performance improvement and business strategy good quality is something that manufacturing companies must pay attention to be able to compete globally. PT. X is a manufacturing company that specializes in repairing Automated Teller Machine (ATM) machine spare parts. In the process of repairing this spare part, there are problems with the use of the application system, the number of parts that cannot be repaired as before and the performance of employees is lacking, causing waste. This waste has an impact on performance and operational activities being not optimal and hampering the process of repairing spare parts. The lean manufacturing approach aims to identify and eliminate waste that occurs during operational activities in order to be more efficient and effective with the method *Value Stream Mapping* (VSM)for mapping the flow of spare part repairs and information flow, identifying *waste* which is divided into 7 categories and conducting analysis. The root cause of waste with fishbone diagrams, the result of which is the cause of waste by humans, is the lack of insight or knowledge of employees, machines that are damaged due to continuous use and the methods used by the company are not appropriate. The results of the identification of waste are waste waiting, transportation, processing, inventory and defective products.

***Keywords*****:** *Lean Manufacturing, Waste, Value Stream Mapping, Fishbone Diagram.*

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## A. INTRODUCTION

PT. X is a manufacturing company that specializes in repairing automatic teller machines (ATM) spare parts. The process of repairing ATM machine spare parts carried out by PT. X is a reverse logistics process.

Reverse logistics or reverse logistics is the activity of returning goods to the factory because of damaged or defective goods to be recycled or repaired properly so that they can be reused or destroyed and taken to a landfill. In this process the company can reduce operational costs so that it becomes more efficient. In operational activities, spare part repairs at PT. X often experience problems. The problems that occur can cause obstacles in the production process or repair of spare parts. Several problems arise due to human behavior or employees of the company. However, the problem that most hinders and has an impact on operational activities is that the operating system used does not run perfectly.

The operating system used by PT. X is the SAP system (System Application and Product in Data Processing). The SAP system is an ERP (Enterprise Resources

Planning) based software used in a company to help operational activities become more efficient. The use of the SAP system at PT. X aims to monitor the movement of spare parts that will or are being repaired quickly. But in reality, the use of the SAP system in spare part repair activities in the company is not accurate so that repair activities become inefficient because spare parts cannot be monitored properly. The impact caused by the use of this SAP system is the occurrence of waste in the process of repairing ATM machine spare parts. SAP is an application used by companies in the finance department. The use of SAP can store and manage financial data such as revenues, budgets, bills and others related to company finances (Yona, 2016).

Waste arising from this SAP system causes production activities to become inefficient. In a manufacturing company such as PT. X, non-value added activities often occur. Efforts made by the company in the production process is to apply the concept of Lean Manufacturing. Lean Manufacturing is an effort or approach that is carried out repeatedly or continuously to reduce or eliminate all types of waste in increasing efficiency during the production process. According to (Gaspersz, 2007) there are "Seven plus One Types of Waste" that often occur in the manufacturing industry, namely:

1. Waste of over production
   Producing more than required by the customer or producing earlier than required time. The cause of over production is due to lack of communication and inappropriate systems.
2. Waste of waiting
   Time used to wait for delays in raw materials, equipment, machines to operators who carry out production.
3. Waste of transportation
   The process flow in handling materials, people or locations over long distances and takes a long time so that it can cause a lot of costs and wasted time.
4. Waste of processing
   Waste caused by the use of equipment or systems in inappropriate and unnecessary operational activities, causing inefficiency during the operational process.
5. Waste of inventory
   Inaccurate forecasting causes excessive production so that it requires a lot of storage space and costs.
6. Waste of unnecessary motion
   Movements of people or machines that do not need to be done so that they do not add value due to improper work methods.
7. Waste of defective products
   Product defects caused by operating procedures which then have an impact on product quality, work performance and customer satisfaction.

The application of the Lean Manufacturing concept during spare part repair activities can help identify and reduce waste that occurs during the repair process. With the application of the Lean Manufacturing concept by PT. X during operational

activities succeeded in reducing the waste that occurred due to the operating system. The impact of the successful implementation of the Lean Manufacturing concept on the company is that operational activities become more effective and efficient, operational time becomes shorter, operational costs are reduced, and company performance becomes more optimal. APICS Dictionary (2005), defines Lean Manufacturing as a business concept based on the use of resources in every company activity. The purpose of lean is to identify and minimize non-value-adding-activities in production in manufacturing, operations and supply chain management companies that are directly related to customers (Gaspersz, 2007).

Value Stream Mapping is a production flow mapping method that shows the process flow and information from each work area (Khannan & Haryono, 2017). According to (Suhendi et al., 2019) there are 2 types of stages that can be carried out in Value Stream Mapping are as follows:

1. Current State Map is a description of the flow of material and information within the company.
2. The Future State Map is a determination of the improvement that carried out in future work areas.

In analyzing the waste that occurs when spare part repairs take place, there is a Process activity mapping which is a tool used to describe all production activities in more detail in order to reduce activities that are not value added (Lestari & Susandi, 2019).

Activities in the production process are grouped into 3 groups, as follows:

1. Value added, namely activities that have added value in a product.
2. Non value added, namely activities that do not add value to a product and these activities must be eliminated because they result in wastage.
3. Necessary non value added, namely activities that are not value added but still required during the production process. This activity cannot be eliminated but can be replaced to be more efficient and effective.

To find out the root cause of the waste that occurs is analyzed using a fishbone diagram, which is a picture to find out the root cause of a problem to facilitate repair activities. The use of fishbone diagrams can facilitate the identification process and make improvements to each production activity (Siregar & Pitaloka, 2018).

This research was conducted in the spare part industry to find out how to eliminate waste and how the results of the application of lean. The purpose of this study is to identify waste using the VSM method and fishbone diagrams so that it can be an improvement for PT.X in implementing lean manufacturing to eliminate waste. The difference between this research and previous research is the results before and after the implementation of lean manufacturing.

## B. METHOD

The research location was conducted at PT. X which is a manufacturing company for ATM machine spare parts located in a special area of the capital city of Jakarta. This study uses a qualitative approach, namely conducting direct interviews

with resource persons and conducting observations to the research site to obtain accurate data. The informants interviewed by the researcher were managers, engineers and one of the employees of PT. X.

Sources of data obtained in this study are primary data and secondary data. Primary data are:

1. Direct interviews, namely data collection carried out by asking questions to Managers, Engineers and employees who know the conditions and problems that occur in the company related to the research topic. In the interview activity, the researcher recorded what was explained by the informant and documented it in the form of pictures.
2. Observation, namely data collection is done by observing directly the object of research and conditions that occur in the company.

Secondary data is data obtained from literature studies, journals, and books related to the object and topic of research.

At this stage the analysis is carried out in accordance with the data obtained. The analytical techniques used in this study are as follows:

1. Describe the flow of the spare part repair process at PT. X.
2. Identify the root cause of waste using a fishbone diagram.
3. Comparing after and before lean implementation.
4. The final stage is the conclusion and implication stage.

In this study, the authors used the interview method or direct interviews with sources of information to obtain data in accordance with the formulation of the problem. The steps in collecting data, including the following:

1. Literature study, namely by studying literature, books and references related to research to obtain secondary data.
2. Field Study, namely by visiting sources of information related to the object of research by conducting direct interviews to collect the necessary data and making observations or direct observations to the research site to see the real condition of the company.

## C. RESULTS AND DISCUSSION

Research results must be presented clearly and answer the problem formulation. The discussion in the discussion should explore the significance of the authors' research results. The discussion is carried out descriptively and narratively, avoiding excessive tables, pictures, and graphs.

### Value Stream Mapping

Value Stream Mapping describes the flow of the spare part repair process starting from forecasting for the use of any parts that will later be used throughout FSL and to find out which parts are most widely used until the acceptance and use of good parts by customers.

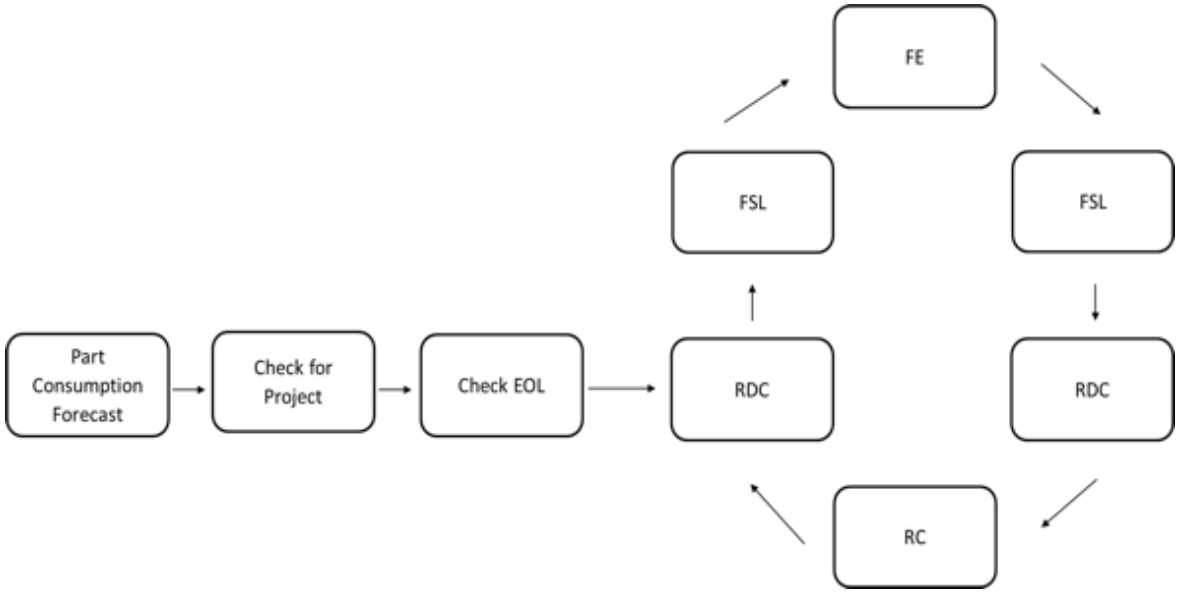



**Figure 2 Value Stream Mapping Spare Part Repair Activities**

Source: PT. X

The picture above is the flow of repairs and the flow of spare part information in the SAP system used by PT.X. During the spare part repair process, it is regulated and supervised by the data center responsible for the SAP system.

## Process Activity Mapping

Process activity mapping will describe the activities carried out by employees during the repair process in detail.

**Table 1 Process Activity Mapping**

| No | Activity | Amount TK | Activity | | | | | Category |
|---|---|---|---|---|---|---|---|---|
| | | | O | T | I | S | D | |
| 1. | FSL controller creates a list of buffer stocks according to TSL | 1 | O | | | | | VA |
| 2. | Warehouse admin prepares parts that are in accordance with the buffer list | 1 | O | | | | | VA |
| 3. | The warehouse admin provides a buffer stock list to the data center team | 1 | O | | | | | VA |
| 4. | Data center makes Purchase Order | 1 | O | | | | | VA |
| 5. | The data center creates a deliver number | 1 | O | | | | | VA |
| 6. | Data center makes inbound deliver for FSL | 1 | O | | | | | VA |
| 7. | The data center provides a print sequence number to the warehouse | 1 | O | | | | | VA |
| 8. | The warehouse admin does the packing part. In 1 box there is only 1 part | 3 | O | | | | | VA |
| 9. | The warehouse admin makes preparations for the delivery of parts to the intended FSL | 3 | O | | | | | NNVA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10. | Warehouse admin waiting for the arrival of the expedition to the warehouse area | 3 | | | | | D | NVA |
| 11. | Expedition enters the warehouse area | 2 | | T | | | | NNVA |
| 12. | Goods are taken and put into the expedition car by the picker | 2 | O | | | | | NNVA |
| 13. | The goods are checked again by the warehouse admin | 3 | | | I | | | NNVA |
| 14. | Expeditions leave to send parts to the destination FSL | 2 | | T | | | | VA |
| 15. | Waiting for loading and unloading | 2 | O | | | | | NVA |
| 16. | FSL checks the number of parts | 2 | | | I | | | NNVA |
| 17. | FSL accepts part | 2 | O | | | | | NNVA |
| 18. | FE request email to pick up parts to FSL | 1 | O | | | | | NNVA |
| 19. | Handover of parts from FSL to FE | 1 | O | | | | | NNVA |
| 20. | FE will repair the damaged part | 1 | O | | | | | VA |
| 21. | FE returns repaired parts to FSL | 1 | O | | | | | VA |
| 22. | FSL checks parts returned by FE | 1 | | | I | | | NNVA |
| 23. | FSL will return bad parts to CWH | 1 | O | | | | | NNVA |
| 24. | Warehouse admin checks for bad parts that have been returned by FSL | 3 | | | I | | | NNVA |
| 25. | The data center returns the cockpit to carry out the repair center process | 1 | O | | | | | NNVA |
| 26. | Repair center repairs damaged parts | 1 | O | | | | | VA |
| 27. | Good parts will be sent to the warehouse and stored in the rack according to the bin location | 1 | | | | S | | NNVA |
| 28. | Bad parts will be sent to final disposal | 1 | | T | | | | NNVA |

Information:

VA: Value Added, namely activities that add value in the improvement process.
NNVA: Necessary Non-Value Added, namely activities that do not add value but still need to be carried out in the ongoing improvement process.
NVA: Non-Value Added, namely activities that are not added value in the ongoing improvement process.
TK: Labor
O: Operations
Q: Transportation
I: Inspection
S: Storage
D: Delay

The table above shows information about the number of workers who carry out spare part repair activities from the beginning to the end of the activity. There are 5 activities, namely, Operation, Inspection, Transportation, Storage and Delay. It is known that there are 28 activities, namely 19 operations, 3 transportation, 4 inspections, 1 storage and 1 delay. In the activity mapping process there are no value added activities with a total of 12 and non-value added activities but are still needed

with a total of 14 it can be concluded that when spare part repairs take place there is some waste.

**Waste Identification**

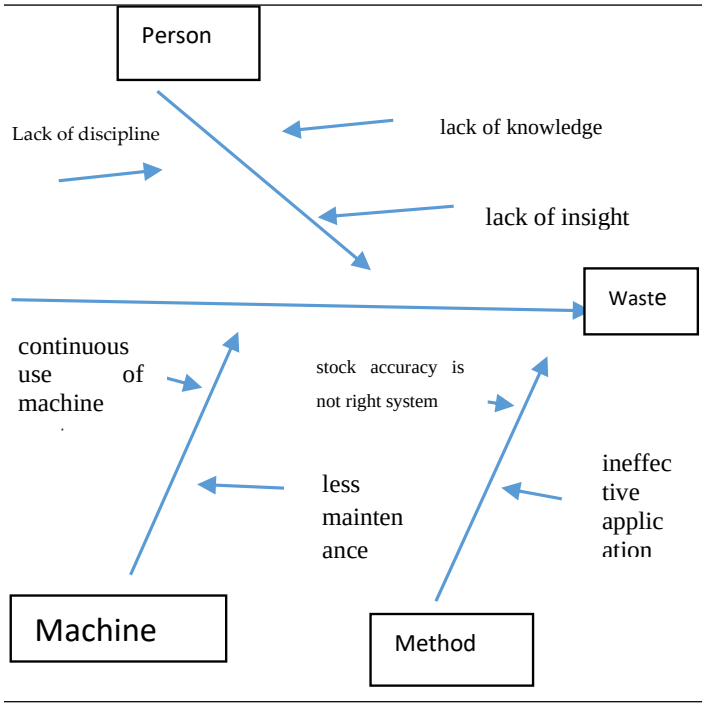
At this stage the identification of waste is done by looking at activities that do not add value to the spare part repair process taking place.

**Table 2 Identification of Spare Part repair Waste**

| No | Activity |
|---|---|
| 1. | *Over Production* |
| | Not found |
| 2. | *Waiting* |
| | Waiting for delivery of goods to FSL |
| | Waiting for an empty item at FSL |
| | Waiting for the goods to be checked before being sent to the expedition |
| | Waiting for the expedition |
| | Waiting for loading and unloading |
| 3. | *Transportation* |
| | A hand pallet operator who picks up and places goods repeatedly because the warehouse is not too large. |
| 4. | *Processing* |
| | The repair process carried out is not in accordance with the request |
| 5. | *Inventory* |
| | Lots of used boxes in the FSL bad parts arrival area and in the workspace area |
| 6. | *Unnecessary Motion* |
| | Not found |
| 7. | *Defective Products* |
| | Parts that are heavily dusty, flooded, and badly damaged cannot be repaired or can be repaired but are not as perfect as they were before |

The results of the identification of waste in detail and thoroughly by conducting observations and interviews about the waste that occurs during spare part repair activities take place. It is known that there is waste in the form of waiting, transportation, processing, inventory and defective products. Waste Waiting is the biggest waste during spare part repair activities.

## Fishbone Diagram




Based on the picture above, it can be seen that the root causes of waste in spare part repair activities at PT.X are caused by 3 factors, including human factors, method factors and machine factors.

## Results of Lean Manufacturing Implementation

| *Before* | | | | |
|---|---|---|---|---|
| ***Sum of Invoice (USD)*** | **Ym** | | | |
| ***Debriefing*** | **2020/01** | **2020/02** | **2020/03** | ***Grand Total*** |
| *Good* | 786,830.97 | 710,866.82 | 467,547.56 | 1,965,245.35 |
| *Scrap* | 1,462,783.64 | 1,320,900.93 | 1,215,166.81 | 3,998,851.38 |
| ***Grand Total*** | **2,249,614.61** | **2,031,767.75** | **1,682,714.37** | **5,964,096.73** |

| *After* | | | | |
|---|---|---|---|---|
| ***Sum of Invoice (USD)*** | **Ym** | | | |
| ***Debriefing*** | **2020/10** | **2020/11** | **2020/12** | ***Grand Total*** |
| *Good* | 1,606,523.16 | 1,578,459.42 | 1,467,917.74 | 4,652,900.32 |
| *Scrap* | 447,693.23 | 526,128.31 | 489,072.29 | 1,462,893.83 |
| ***Grand Total*** | **2,054,216.39** | **2,104,587.73** | **1,956,990.03** | **6,115,794.15** |

| **Persentase** | **69.39%** | **60.17%** | **59.75%** | **63.42%** |
|---|---|---|---|---|

The overall results of the calculation of waste that are calculated every month show that PT.X has implemented lean manufacturing in its operational system well. It can be seen from table 4.7 in January when compared to October, the result of

reducing waste is 69.39%. In February when compared to November, the result of reducing waste is 60.17%. This shows a decrease in waste by 9.22%. And in March when compared to December, the waste result is 63.42%. Comparison between the results in January - October with the results in March - December there is a decrease in waste by 9.64%.

Based on the results of data processing, the average result of waste that occurs every month during operations is 63.42%. Thus, after repairs and implementing Lean Manufacturing for 3 months, waste that often arises can be minimized so that the movement of spare parts can be monitored properly, the time required is less and can reduce costs to be lower.

## D. CONCLUSION

The results of the application of lean manufacturing in spare part repair activities at PT. X indicate that PT. X is able to reduce the waste that occurs. It can be seen from the percentage every month after the implementation of lean manufacturing there is a decrease in the percentage of waste. Thus, the movement of spare parts can be monitored properly so that less time and energy are used, operational costs can be reduced and operational activities are more efficient and effective. The implication for the company going forward is that the company must continue to apply lean manufacturing to spare part repair activities in order to analyze the waste that occurs for continuous improvement and carry out the 5S movement to create a comfortable, safe and clean environment.

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