Using 7 Waste Approach and VSM Method to Improve the Efficiency of Mackerel Fish Crackers Production Time at Small Medium Enterprise (SME)

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ABSTRACT

Mackerel fish crackers is a product made by home industries, one of the local products which potentially could increase exports from Indonesia to other countries, especially for ASEAN markets. Being able of competing in the industry, it should improve its product quality and production efficiency. There are some issues in the production process, such as heating oil inefficient time, packing process, and the calculation period of the finished goods after the packing process. It is also sometimes exacerbated by the occurrence of reject products. These issues cause the product storage and labor costs become higher.

This research aims to improve the effectiveness of productions process of mackerel fish crackers using 7 waste and VSM method. The 7 waste analysis intends to find the problem in every work stations by eliminating waste and speeding up the production process time. Followed by VSM method to reduce the transportation time at some work stations so that at the end of the research resulting 0.33% of production time improvement.

Keywords:
7 Waste, Value Stream Mapping, Current State Map, Future State Map, Cycle Time, Efficiency

1. INTRODUCTION

In 2017, the ASEAN free-market competition is effectively applied, therefore the small medium enterprises (SMEs) of fish mackerel crackers should also be able to improve its product quality and production efficiency.

Due to these factors, SMEs should begin to improve the efficiency of the production systems so that it can participate in the competitive existing market of ASEAN. The requirement for a SME to keep running well in the global business competition is by achieving five long term goals i.e. improve product quality, reduce production costs, determine the strength of business in the future, assure the effort to remain capable of being up to the development of technology in the future and determine success in the product development or ability to take advantage of opportunities.

One important factor in increasing the efficiency of a product is implementing the appropriate production methods and enhancing the production process. Some of the constraints that occur at SMEs are the ineffeciency in oil heating, packing, and after packing process. It is also sometimes worsen with the existence of rejected products. This issue affects the cycle time so significantly that increases the production cost for storage and labor.

2. IDENTIFICATION OF THE PROBLEM

The problem to be discussed in this research is a waste of time at work stations on the frying pan work station, packing work stations and counting the number of work stations. In addition, business owners also don't yet have the idea the concept of Lean Manufacuring which can help increase the efficiency of the mackerel fish crackers production time.

3. OBJECTIVES OF THE RESEARCH

The objectives to be achieved after the research accomplihsed is as follows:

1. Finding the roots of the problem at the work stations of the SMEs for the mackerel fish crackers.
2. Applying the concepts 7 waste and VSM for improving the efficiency of the SMEs.

4. LIMITATION OF THE PROBLEM

The problem of the research should be limited to focus on the objectives tobe achieved and the scope of research tobe delivered. They are as follows:

a) The research scope only performed on the 3 production processes, namely the process of frying, the process of packaging and the process quantity calculation.
b) The discussion focuses on 7 waste and VSM.
c) The study conducted only on one sample of SME of the mackerel fish crackers (Crackers X).
d) The study conducted only focus at the time of the production process cycle which each of the process is examined.

5. THEORITICAL

- **Lean Manufacturing Concept**

  In lean manufacturing, there is a method called the value stream mapping which is used to identify waste arising in the process flow, then being removed to shorten lead time as well as increasing the percentage of activities that add value (Lovelle, 2001).

- **Waste**

  Waste can be defined as any activity that does not work to add value in the process of transformation of inputs into outputs throughout the value stream. There are seven waste which is known in the industry and affect the cost of production. The seven types of waste that are formulated by Ohno (Ohno, Taiichi. 1998).

- **Value Stream Mapping**

  Value stream mapping is a set of all activities which add value and provide no added value as it takes to bring a product or a group of products from the same source, starting from the raw material to make it to the hands of the consumer.

The goal of value stream mapping is to know clearly the wastage of resources and help make the area of a target for real improvement process (Hartini, 2009). So in this study, VSM is used to find out the waste at several work station units and create a target for efficiency improvement of time tobe achieved for a better production process.

6. DATA ANALYSIS

- **Working Time**

To find out the efficiency of working time working time, the data from each work station are examined. The data obtained from direct observation by taking the 3 time periods on average to have the measurement of time is more objective. So the time obtained is as follows

Tabel 1. Work Station Time

First Cooked Total Time	8 minutes 38,68 seconds	8,64 minutes
Second cooked Total Time	7 minutes 52,36 seconds	7,87 minutes
Packaging Total Time	15 minutes 5,34 seconds	15,09 minutes
Counting Total Time	9 minutes 44,68 seconds	9,74 minutes

- **Work Station Efficiency**

Once you have the data in the time sheet, then calculate the efficiency of work stations and the efficiency of the production pathway, the results before and after improvements achieved is compared. Here is the calculation of the efficiency of the work station and the efficiency of the production path.

a. Working Station 1 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 1 = \frac{8,64}{16}\ x\ 100\%$$
$$= 0,54\ x\ 100\%$$
$$= 54\%$$

b. Working Station 2 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 2 = \frac{7,87}{16}\ x\ 100\%$$
$$= 0,4918\ x\ 100\%$$
$$= 49,18\%$$

c. Working Station 3 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 3 = \frac{15,09}{16}\ x\ 100\%$$
$$= 0,9431\ x\ 100\%$$
$$= 94,31\%$$

d. Working Station 4 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 4 = \frac{9,74}{16}\ x\ 100\%$$
$$= 0,6087\ x\ 100\%$$
$$= 60,87\ \%$$

e. Line Efficiency

$$Line\ Efficiency = \frac{8,64+7,87+15,09+9,74}{4\ x\ 16}\ x\ 100\%$$
$$= \frac{41,34}{64}\ x\ 100\%$$
$$= 0,6459\ x\ 100\%$$
$$= 64,59\%$$

- **Waste Identification**

The data collection process which causes waste identified by observing directly the activities in the field, and the waste data obtained is as follows.

a. the first Frying Process Waste

As for the waste found in a frying pan first process as follows.

1. Overproduction waste: no
2. Inventory: no wastage
3. Disability: the Pan sometimes charred because the oil is too hot
4. Transport: transfer of raw crackers need time because much of the station's frying pan
5. Excess Movement: a lot of repetition of the process to move the crackers half-baked because small spatula
6. Waiting: waiting for hot oil needs time
7. Excess Process: frying pan reset if there are crackers which scorched

b. the second Frying Process Waste

The waste found on the second frying process is as follows.

1. Overproduction waste: no
2. Inventory: no wastage
3. Disability: the Pan sometimes scorched because the oil is too hot, or crackers did not inflate because the process is not perfect;
4. Transport: no wastage
5. Excess Movement: no wastage
6. Waiting: waiting for hot oil needs time
7. Excess Process: frying pan reset if there is a scorched crackers or not inflate perfect

c. Waste On packing process

The waste found in the packing process is as follows.

1. Overproduction: there is an excess of products due to the unpredictability of ripe crackers
2. Inventory: no wastage
3. Defects: no wastage
4. Transport: Transfer of mature stations crackers Pan requires time.
5. Excess Movement: a lot of repetition of the process to place the crackers into a plastic dish
6. Waiting: waiting for engine sealant takes heat
7. Excess Process: repackaging if the sealant is not tight or is damaged

d. The process of calculating the amount of waste

The waste found in the process of counting the number of is as follows.

1. Overproduction: products after the calculated
2. Inventory: storage products more
3. Defects: no wastage
4. Transport: no wastage
5. Excess Movement: a lot of repetition of the process to move the product to a large plastic
6. Wait: no wastage
7. Excess Process: recount if the final number is forgeted by the operator

- **VSM**

In the process of making the current state mapping. There are two things to be obtained, namely flow of information from customers order until receipt of the physical flow and the flow of product in each manufacturing process until the product is ready to be sent to customers.

After getting the information flow and the flow of information as well as details of physical processes in the production of the mackerel fish crackers. Then it can be made to current state mapping with the description as follows.

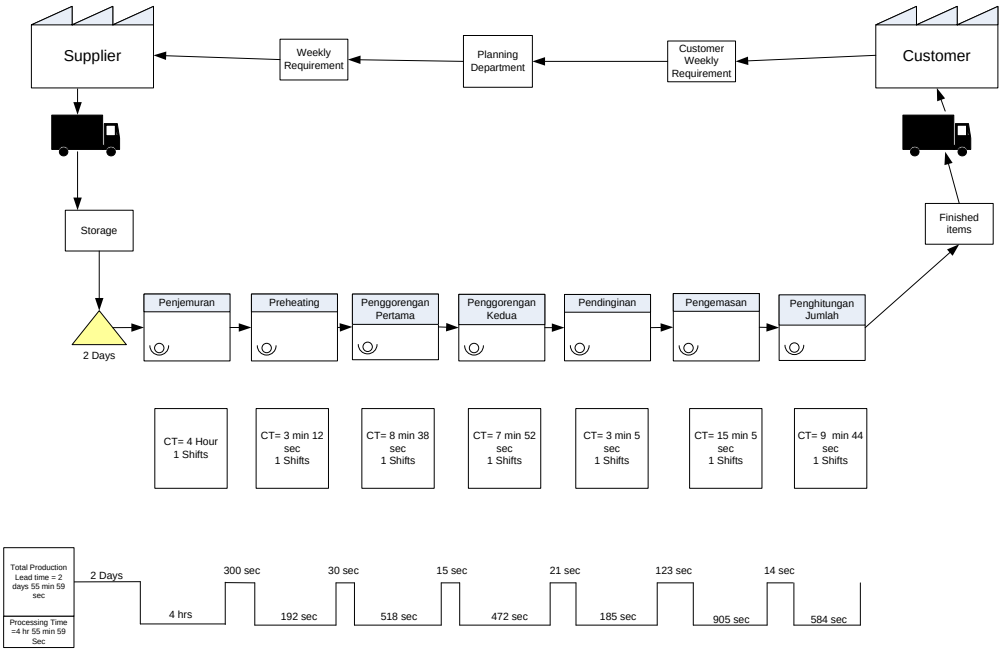

Figure 1. Current State Map

7. RESULT AND ANALYSIS

- **7 Waste Analysis**

After the data is collected, then the analysis using the application of waste 7 lean manufacturing to eliminate waste is done. The improvements are as follows.

a. the first Frying Process Improvement

the improvement applied against the waste found on the first frying process as follows.

1.Use a thermometer specialized for hot oil so it doesn't scorch crackers because the oil is too hot

2.Use a larger spatula so it doesn't require a lot of repetition of the process to move the crackers half-baked.

3.After using the thermometer, no frying process restarted because there was no scorched the cracker

b. the second Frying Process Improvement

the improvement applied against the waste found on the second frying process as follows.

1. use the thermometer specialized for hot oil so it doesn't scorch crackers because the oil is too hot

2.after the use of frying thermometer no process restarted because there was no scorched the cracker

c. improvements on packing process

the improvement applied against the waste found in the packing process as follows.

1. do weighing raw crackers before fried thus reducing excess products frying

2. frying pan at work station moved side by side with the next working station so as to save time

3. use of tools like a funnel in order to reduce the repetition of the process to place the crackers into a plastic

4. train the employees on the standard of packaging so that the sealant is tight.

d. improvements in the process of counting

the improvement applied against the waste found in the process of counting the number is as follows.

1. no excess product after calculated due to improvements on previous work station

2. no more inventory

3. by counting every 5 packs of crackers recently reduces the repetition of the process and reduces the large plastic used.

4. by compiling every 5 packs of crackers help the operator to do calculation correctly

- **Improvement Analysis**

The results of this research of the time improvements achieved from the process of frying pan first, second, and counting the number of packing has been analyzed and figure out in the time table. The time taken is from direct observation at each work stations using timer stop watch. The improved time tables as follows.

Tabel 2. The Time Improvement

First Cooked Total Time	7 minutes 51,68 seconds	7,86 minutes
Second cooked Total Time	7 minutes 12,68 seconds	7,21 minutes
Packaging Total Time	11 minutes 21,68 seconds	11,36 minutes
Counting Total Time	6 minutes 2,01 seconds	6,03 minutes

- **Efficiency Analysis**

After doing the improvement and apply it then the data collection is conducted on the average amount of time spent on each work station. The time used to calculate the efficiency of the improvement is achieved.

The calculation of each work station efficiency and each production paths efficiency after improvement is as follows.

A. Working Station 1 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 1 = \frac{7,86}{12}\ x\ 100\%$$
$$= 0,65\ x\ 100\%$$
$$= 65\%$$

B. Working Station 2 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 2 = \frac{7,21}{12}\ x\ 100\%$$
$$= 0,6008\ x\ 100\%$$
$$= 60,08\%$$

C. Working Station 3 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 3 = \frac{11,36}{12}\ x\ 100\%$$
$$= 0,9467\ x\ 100\%$$
$$= 94,67\%$$

D. Working Station 4 Efficiency

$$Efisiensi\ Stasiun\ Kerja\ 4 = \frac{6,03}{12}\ x\ 100\%$$
$$= 0,5025\ x\ 100\% = 50,25\ \%$$

E. Line Efficiency

$$Line\ Efficiency = \frac{7,86+7,21+11,36+6,03}{4\ x\ 12}\ x\ 100\%$$
$$= \frac{32.46}{48}\ x\ 100\%$$
$$= 0,67625\ x\ 100\%$$
$$= 67,625\%$$

- **Future State Mapping**

After conducting a review on the field and considering some of the reasons that allow to do improvement then the selected corrective actions by placing the work station pre heating, the first frying, the second frying, and cooling at each work station side by side. The transfer is done to shorten the time displacement of crackers at each work station. For now, only four of these work stations which can be moved because the space available is still sufficient around the first frying work station, while other work stations such as packing work station and counting the number work

stations is already permanent so it can't be moved. Here is the Future State of the folder after moving several work stations.

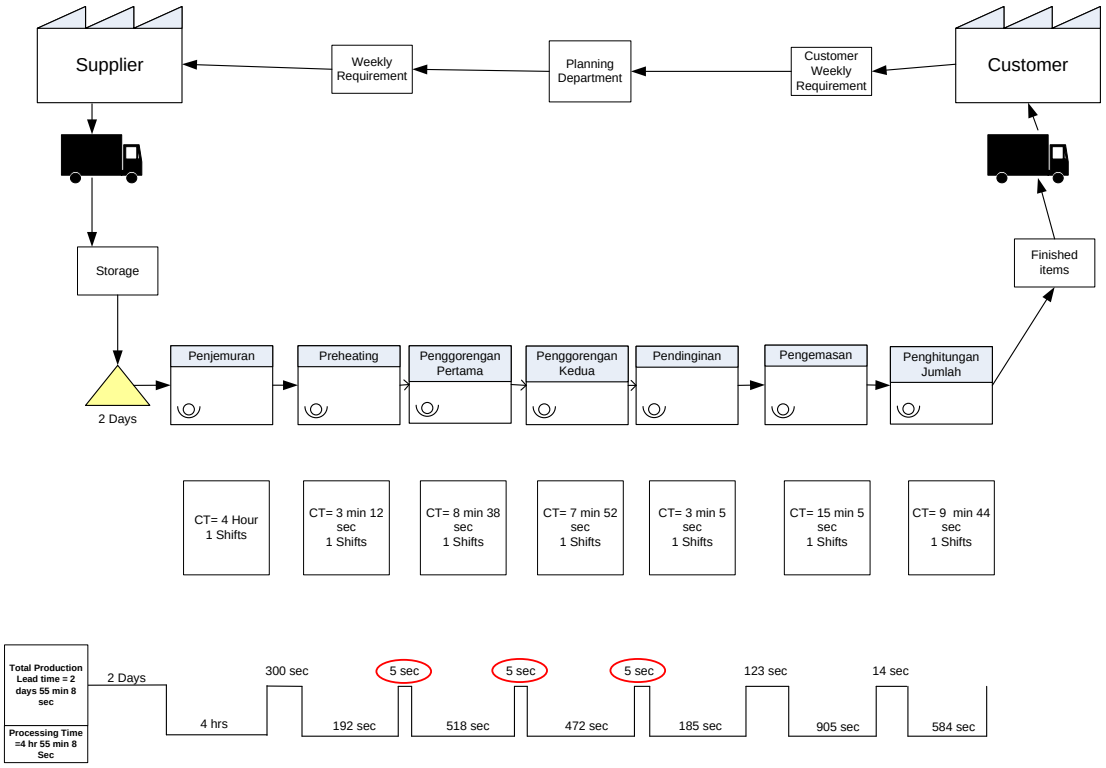

Figure 2. Future State Map

- **Percentage of Improvement**

After using the methods of improvement, 7 waste analysis and VSM, then the calculation of the percentage of the improvements that have occurred is done. The Time table before and after the improvements is as follows.

Tabel 3. The Improvement Achieved

Stasiun Kerja	Sebelum Perbaikan	Setelah Perbaikan
Penggorengan Pertama	8,64 minutes	7,86 minutes
Penggorengan Kedua	7,87 minutes	7,21 minutes
Pengemasan	15,09 minutes	11,36 minutes
Penghitungan Jumlah	9,74 minutes	6,03 minutes
Total Waktu	41,34 minutes	32,46 minutes

Then improvement performed is calculated as follows.

$$Persentase\ Improvement = \frac{Wa-Ws}{Wa}\ x\ 100\%$$

Description:

Wa = Current Time

Ws = Time After Improvement

So it can be deduced the percentage improvement achieved as follows.

$$Persentase\ Improvement = \frac{2935{,}98 - 2926{,}25}{2935{,}96}\ x\ 100\%$$

$$= \frac{9{,}73}{2935{,}96}\ x\ 100\%$$

$$= 0.0033\ x\ 100\%$$

$$= 0{,}33\%$$

8. RESULT

From the research carried out on the production process of the mackerel fish crackers, it can be concluded as follows:

1. The problems encountered in mackerel fish crackers production process are the use of a small spatula on the process of frying, the transport of the raw materials increase working time, differences between methods of work so that employees are not uniform, the method of calculating the inefficient and confusion, as well as other factors.
2. Implementing the 7 waste analysis and VSM can improve small business medium size efficiency. The improvement are on the declining number of reject product and also decreased the level of production so as to reduce excess inventory and reduce some costs such as the cost of raw crackers, plastic wrap, costs and the cost of sealent. This research focus solely to multiple work stations, so it does not cover the possibility if improvement is made at other work stations to increase the efficiency of working time.

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