Waste Identification In The Production Process Ptc Ceramic Heating Element With Lean Manufacturing Approach At Cv. Sulis Keramik

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ABSTRACT

A firm called CV. Sulis Keramik makes parts for mosquito mats; these parts come in the shape of PTC heating elements. A kind of positive temperature coefficient thermistor used in heating applications is the ptc heating element. There are still many different waste indicators throughout the production process, which lowers the process's efficacy and efficiency. Defects with a 10% defect rate are among the main issues. Furthermore, there exist other indicators of waste associated with waiting times, transportation, and other wastes. With the use of lean manufacturing techniques, this project seeks to eradicate waste from CV Sulis Keramik ptc heating element production process. Value stream mapping in its current state, waste assessment models, value stream analysis tools, production system improvement, and designing future value stream mapping were all shown in the research's first stage.

KEYWORDS Lean Manufacturing, Waste, Value Stream Mapping, VALSAT, Waste Assessment Model

INTRODUCTION

Many companies are searching for strategies to reduce waste in order to increase productivity in today's expanding industry. When inputs are transformed into outputs in a value stream, any work activity that does not provide additional value is considered waste. Lean manufacturing is a notion that may be applied to eliminate waste. Lean manufacturing is a concept that emphasizes streamlining the production process from beginning to end in order to find and reduce waste. (Irawan & Putra, 2021).

According to (Nurdiansyah et al., 2022) The lean manufacturing methodology is an ongoing endeavor to reduce waste and boost the value added of goods and services in order to deliver value to consumers. Lean is centered on finding and removing processes that do not add value in supply chain management, operations, or production design, which are all directly tied to customers in the manufacturing or service industries. Using this method, Businesses can succeed in their mission of cutting waste. The seven categories of waste in lean manufacturing are overproduction, motion, inventory, overprocessing, wait time waste, transportation, and defects/rejects.

There are 7 kinds of waste defined, namely: Overproduction, producing quantities of goods that do not match customer demand; Defects, producing products with quality that does not match the established requirements or specifications, thus requiring a repair process Factors such as the amount of material used, time spent, and costs generated from the production process of unqualified products have a significant impact on the business; Unnecessary Inventory, Unnecessary Inventory is the activity of storing finished goods, semi-finished goods (WIP), and excess materials that can increase costs, storage areas, and labor required to supervise; Inappropriate processing, is a process in the production process that is not streamlined or adds value to the product. ; Excessive transportation of employees, information, or materials or products causes excessive time, effort, and cost; Waiting occurs in the process of waiting for employees, materials, or products. Machine losses, imbalance between machine and labor capabilities, and poor production flow are common causes of this activity; Unnecessary motion the movement of workers, also called movement, is a wasteful activity that does not need to be done or does not provide additional value to the product. One example of worker movement is placing a product component out of reach of the worker, so that the worker has to find and retrieve the component. (Yuri Delano Regent & Ginting, 2021).

According to (Restuningtias et al., 2020) the waste assessment model is a model developed to simplify the search and problem of waste and identify to reduce waste. Meanwhile, the fishbone diagram is an analytical tool that provides a systematic way of looking at the effects and causes that contribute to these effects. Because of the function of the fishbone diagram, it can be referred to as a cause and effect diagram, which has the basic function of identifying and organizing the causes that may arise from a specific effect and then separating the root causes (Miftakhul & Dewi, 2021). CV. Sulis Keramik is a manufacturing company that was founded in 2010. The company is engaged in the manufacture of mosquito coil components, this component is a ptc heating element. This ptc heating element is a type of positive temperature coefficient thermistor used for heating applications, the ptc heating element consists of a ceramic disk containing a PTC thermistor. In the manufacturing process of CV. Sulis Keramik found waste. Indications of waste that occur are defect / reject waste and waste waiting. Products that experience defects / rejects are in the form of ceramic plates and the type of defect is in the form of ceramic sizes that do not match the standard with a production amount of 300,000 each month and for the percentage of deffects of 10%. As for waste waiting in the amount of 14,400 seconds. Based on the above problem, namely waste, to improve the productivity and efficiency of the production process, we must know what can increase the added value of the product and eliminate waste. One way to solve this problem is using lean manufacturing. So this study aims to identify waste with the title Waste Identification in the PTC Ceramic Heating Element Production Process with a Lean Manufacturing Approach at Cv. Sulis Keramik.

RESEARCH METHOD

1. Depiction of Current State Value Stream Mapping

In making this research, value stream mapping is used to describe the production system that presents the current production system of CV. Sulis Keramik which includes material flow and information flow. By making current state mapping, it will be known which activities do not provide added value from the production system. The data required for making current value stream mapping is production system data including production processes, inventory, production time, number of workers, number of machines, and average production quantities.

2. Waste Assessment Model

In the preparation of this research, a waste assessment model is used to identify waste that occurs in the production system at CV. Sulis Keramik and find out which waste is the biggest from the production process at the company. The data needed to create a waste assessment model is waste assessment quetionare questionnaire data and the weight of the relationship between wastes.

3. Value Stream Analysis Tools

In the preparation of this research, Value Stream Analysis Tools (VALSAT) are used which are tools that function to identify value added activities and non-value added activities so that it can make it easier to find out the root of the problem in the production system.

4. Production System Improvement

Production system improvement is carried out to eliminate the most dominant waste that occurs in the production process.

5. Design of Future Value Stream Mapping

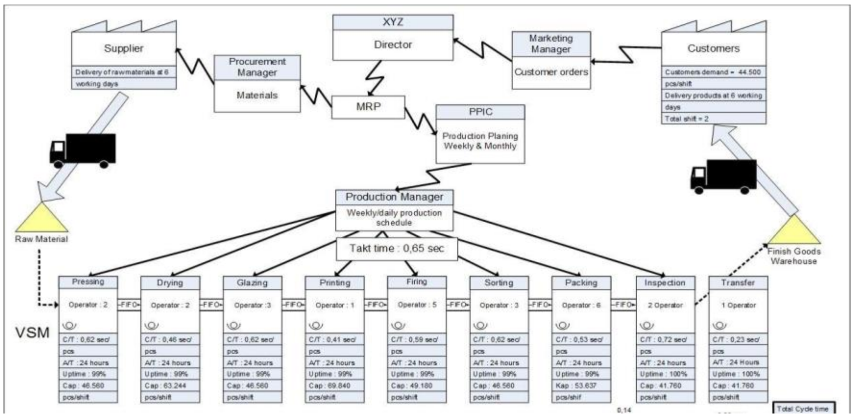
The future value stream mapping design is a description of the production system conditions that will be achieved in the future.

RESULT AND DISCUSSION

A. Identification of Waste

After making Value Stream Mapping, the next stage is to identify waste, in this study the identification of waste is carried out using Value Stream Mapping and Waste Assessment Model, which in this method there are calculations using Waste Relationship Matrix and Waste Assessment Quetionare.

a) Current Value Stream Mapping



Picture 1. Current Value Stream Mapping

b) Waste Relationship Matrix

After obtaining the weights and relationship categories between waste in table 1, the next step is to move the relationship categories between waste into the Waste Relationship Matrix. The Waste Relationship obtained is as follows.

Table . 1 *Score Waste Relationship Matrix*

F/T	O	I	D	M	T	P	W	Score	%
O	10	8	6	4	2	0	6	36	18,56%
I	2	10	4	2	2	0	0	20	10,31%
D	4	6	10	6	4	0	6	36	18,56%
M	0	2	2	10	0	4	2	20	10,31%
T	4	2	4	6	10	0	6	32	16,49%
P	4	4	2	4	0	10	6	30	15,46%
W	2	6	2	0	0	0	10	20	10,31%
Score	26	38	30	32	18	14	36	**194**	
%	13,40%	19,59%	15,46%	16,49%	9,28%	7,22%	18,56%		

In the table above, it can be seen that the value that has a considerable influence on other waste is from overproduction and from defects, it can be seen from the percentage of from overproduction and from defects which is the largest, namely 18.56%. In addition to this, it can also be seen that the waste caused by other waste is to inventory, it can be seen from the largest score to inentory, which is 19.59%.

c) Calculation of Waste Assessment Quetionare

The calculation of Waste Assessment Quetionare is done to find out what waste is dominant in the production system. This Waste Assessment Quetionare calculation uses the results of the previous Waste Assessment Matrix calculation and the Waste Assessment Quetionare questionnaire in the appendix. The stages carried out in the calculation of Waste Assessment Quetionare are as follows.

The table below shows the results of the calculation to find out what waste is dominant in CV. Sulis Keramik.

Table .2 Score Waste Assessment Model

	O	I	D	M	T	P	W
Score (Yj)	0,69	0,75	0,74	0,79	0,71	0,81	0,66
Pj Factor	248,70	201,93	286,96	170,05	153,04	111,60	191,31
Final result (Y final)	171,54	151,31	211,83	134,46	109,15	90,11	125,52
Final result (%)	17,26%	15,22%	21,31%	13,53%	10,98%	9,07%	12,63%
Rank	2	3	1	4	6	7	5

From the table above, it can be concluded that the dominant waste that occurs at CV. Sulis Keramik is defects with a percentage of 21.31%, second is overproduction with a percentage of 17.26% and third is inventory with a percentage of 15.22%.

B. Elimination of Waste

After knowing the waste in the production process, then determine the focus of improvement. Pareto analysis was used to find the process with the most NVA time. Three processes with the most significant percentage were taken as the focus of improvement, namely drying 22.03%, printing 16.93% and firing 15.37%.

The Ishikawa method was used to find the root causes of NVAs in the drying, printing and firing processes. The root causes of NVAs in the drying process are lack of operator training and late replacement of components. The root causes of NVA in the printing process are late replacement of components, absence of periodic checks on the conveyor line, and lack of operator attention. The root causes of NVAs in the firing process are oversupply from the printing area, lack of operator attention, and late replacement of components. The 5W1H method is used to design improvement proposals on the production floor. Based on the root causes of NVA problems, the suggested improvements are as follows:

a) There is a common cause of NVA in the drying, printing and firing processes: delays in replacing components. This causes the machine to have problems during operation, so that the drying, printing and firing process operators must repair or replace components. The proposed improvement is to conduct preventive maintenance and replace damaged components regularly.
b) Lack of operator training in the drying process causes operators to set the conveyor motor speed too fast. This causes the conveyor belt to wear out quickly and is often loose. Suggested improvement is to conduct operator training in regulating conveyor motor speed.
c) The cause of NVA in the printing process is the overlapping of materials entering the printing machine. This is caused by the absence of periodic inspection on the conveyor line from the glazing process to the printing

process. The proposed improvement is to assign operators to inspect the conveyor line at the beginning of each shift.

d) The cause of NVA in the printing and firing process is the lack of operator awareness of their duties. Because the operators of the drying, glazing and printing processes are not focused, they are not aware of broken or damaged materials that can cause the machine to stop. The proposed improvement is to increase employee awareness while working through training and group discussions.

CONCLUSION

This paper describes the implementation of lean manufacturing in a ceramic manufacturing industry. Current state map helps to identify waste in the production process. The largest NVA times are found in the drying, printing and firing processes. The root causes of NVA problems include late replacement of parts, lack of training for operators, lack of regular inspections on conveyor lines and lack of operator awareness. Improvements were made by adding operator tasks to the glazing process to inspect the conveyor line at the beginning of each shift. The results of the improvement implementation showed that VA time increased by 3.57% to 192.27 minutes and NNVA time increased by 1.32% to 2,759.70 minutes. However, the NVA time decreased by 3.03% to 1,367.56 minutes with a VA ratio of 4.46%. The total NVA movement distance decreased by 34.40 meters to 3,785.60 meters. The productivity level increased by 2.04% from 96.44% to 98.40%.

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