

PAPER • OPEN ACCESS

Propose Improvement Maintenance Activities Of Screw Press To Reduce Waste Using Lean Maintenance Concept

To cite this article: NA Sidabutar *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **505** 012045

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the **collection** - download the first chapter of every title for free.

Propose Improvement Maintenance Activities Of Screw Press To Reduce Waste Using Lean Maintenance Concept.

NA Sidabutar^{1 *}, AR Matondang², and J Hidayati³

^{1,2,3} Master of Industrial Engineering, Faculty of Engineering, University of North Sumatra, alma mater Street, USU

E-mail: naqasya.asyrori@gmail.com

E-mail: rivaijuliza@gmail.com

Abstract: Maintenance is an important factor to achieve the goal of becoming the best manufacturing company. To achieve the company that has the best performance, the treatment strategy should be linked to strategies such as the concept of lean manufacturing. Lean maintenance is a process to achieve continuous improvement. This system focuses on adding value and reducing waste in the care process so that maintenance lead time can be reduced, as well as identifying the waste that occurs in the activity of a treatment using Value Stream Maintenance mapping (VSMM), identify the factors that cause waste most dominant use of Root Cause Analysis (RCA), identifies the critical part of the screw press machine using Reliability Centered Spares (RCS) and provide recommendations for improvements screw press machine maintenance activity. Problems often occur is the waste to the type of waiting where the facts occurred in the field is a process of waiting for components, equipment and transport documentation wait staff, thereby extending the time to repair any damage. This study aims to reduce waste waiting in the screw press machine maintenance activity. The most high maintenance time is the first press of 10 132 minutes. The dominant type of waste is waste waiting that contribute to waste by 35%. a critical component of body cage, cage feed, feed worms, and main shafts. Improvement maintenance systems that do reduce the lead time on the first maintenance resse be 5,100 minutes.

1. Introduction

Maintenance is an important factor to achieve the goal of becoming the best manufacturing company [8]. To achieve the company that has the best performance, the treatment strategy should be linked to strategies such as the concept of lean manufacturing. Applying an effective treatment strategy can ensure the level of utilization, reliability, and availability of high manufacturing facilities especially in the process of continuous production. Managers must understand that care not only about the repair and conservation of machines and devices, but also the actions that seek to manage resources more efficiently and care for the safety of the natural environment [7]. Therefore, the maintenance management has become a crucial issue [3]. Maintenance management that allows a person to perform maintenance more productive, is a management system in a way that was planned and according to the rules, with good planning and scheduling, it is possible to save maintenance costs and to ensure increased competitiveness [9]. Maintenance is a substantial financial post. But, if managed strategically, maintenance of manufacturing equipment contribute to the competitiveness of enterprises and one third of the cost of maintenance should not be issued. Cessation of a process on the production floor often occurs because of a problem with the machine / equipment production [2], for example, the machine stops suddenly, a decreased rate of production machinery and the length of time tuning and



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

adjustment of the machine (set-up and adjustment) is often called waste. In the lean maintenance, used to eliminate waste in every area of care that include value stream in care activities within a company. Elimination of waste is done to achieve the goal of minimizing the human effort, minimize inventory, minimizing the time to develop the production process and the time to meet customer demand as efficiently as possible. With so efforts to eliminate waste is believed to stimulate the competitive advantage of companies. Judging from lean maintenance, sources of waste typically consists of a procedure that is less precise, planning is less precise, inventory is too much and do not use, such as components, materials, and equipment, even the facilities are not used appropriately, and their waste time, transportation, and labor surplus [6]. Lean maintenance is a process or journey in achieving continuous improvement. This system focuses on adding value and reducing waste in the care process so that maintenance can be reduced lead time. Judging from lean maintenance, sources of waste typically consists of a procedure that is less precise, planning is less precise, inventory is too much and do not use, such as components, materials, and equipment, even the facilities are not used appropriately, and their waste time, transportation, and labor surplus [10]. In his research on waste, divide the causes of waste into 6 groups: human, management, design and documentation, materials, execution and external [1] .. The cause of waste is management, personnel, information, supplier, product and process [5]

2. Research Method

Data processing is performed by using the concept of lean maintenance. Figure of research steps:

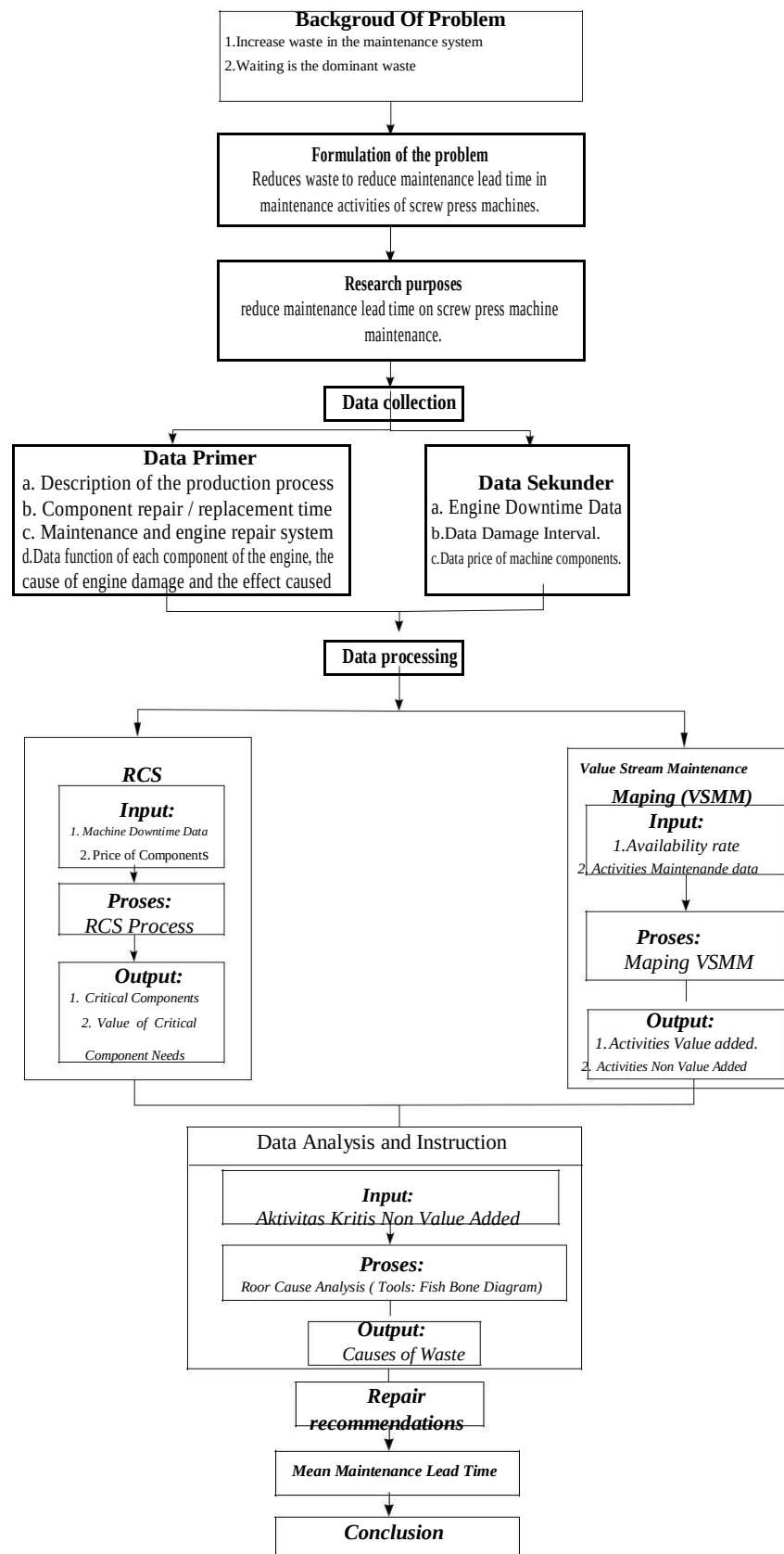


Figure 1. Step Research

3. Results and Discussions

Data processing begins with the assessment of existing conditions, then identifying the causes of waste and waste. After it carried out repairs and the calculated effectiveness of the engine after repair.

1. Lean Assessment

The initial stage of the implementation of lean maintenance is assessing the maintenance activities. This stage is to look at the initial conditions of the engine repair process and identify activities that are a waste that will be sought after the root cause of the onset of such waste. In this study, carried out against the head kuensioner deployment and maintenance section of the operator to determine the dominant factor of the causes of waste. Based on the calculation of correlation nilao that the method has the highest correlation coefficient value so that the method is a dominant factor of its waste occurs, resulting in increased maintenance time lead time

2. Critical Component Selection.

Components and parts were analyzed for criticality by using Reliability Centered Spares (RCS) using four factors: Consequence, Anticipation, Effect of stockout and Cost. Each factor has a weight that is 35%, 30%, 25% and 10% were obtained from the expert. The result of the calculation of each component can be seen in Table 1.

Table 1. Worksheet Critical Components

No.	Component name	Consequences		Anticipation		Effect		Cost		Critical Index
		Information	level	Information	level	Information	level	Information	level	
1	body Cage	Hidden	4	critical	4	Engine off and can not be repaired	4	12.42336 million	4	4
2	feed Cage	Hidden	4	critical	4	Engine off and can not be repaired	4	10,925,935	4	4
3	wear Plate	operational	2	critical	4	Engine off and can not be repaired	4	3274537	3	3.2
4	feed worm	Hidden	4	critical	4	Engine off and can not be repaired and affect other components	5	2.409 million	3	4.15
5	straight Collar	operational	2	critical	4	Engine off and can not be repaired	4	3.2188 million	3	3.2
6	Main Shaft	Hidden	4	critical	4	Engine off and can not be repaired	4	21.22 million	4	4
7	taper Collar	operational	2	critical	4	Engine off and can not be repaired	4	1.79795 million	3	3.2
8	Hand worm screw intermediate	operational	2	critical	4	Engine off and can not be repaired	4	2.987 million	3	3.2
9	worm	operational	2	not Critical	2	Ignition is off and can be fixed in 4 hours	4	3.174 million	3	2.6
10	Fri Nut	operational	2	critical	4	Engine off and can not be repaired	4	1193355	3	3.2
11	oil Seals	operational	2	critical	4	Ignition is off and can	2	29,900	1	2.5

be fixed in 4 hours										
12	Left Hand Lock	operational	2	critical	4	Engine off and can not be repaired	4	828 800	2	3.1
be repaired										
13	bearing	Hidden	4	critical	4	Engine off and can not be repaired	4	1.22 million	3	3.9
be repaired										
14	material Tysen	operational	2	critical	4	Engine off and can not be repaired	5	27.38 million	4	3.55
be repaired										
15	Lock Nut	operational	2	critical	4	Ignition is off and can be fixed in 4 hours	2	1,100,000	3	2.7
be fixed in 4 hours										
16	High Pressure Worm	operational	2	not Critical	2	Ignition is off and can be fixed in 4 hours	2	3.174 million	3	2.1

Based on the calculations above, then that is included in the high critical namely body cage, cage feed, feed worms, and main shafts

3. Maintenance of Value Stream Mapping (VSMM).

Wanted waste searches of activity level improvements that have been searched for the most influential engine components using VSMM. From these searches can know what activities are classified into waste. Waste identification Results are shown in Table 3 below:

Table 2. Body Component critical Cage

Waste category	Activity	Time
Motion	Reporting damage Operator	10 minutes
	Maintenance worker comes to the production floor	10 minutes
	Maintenance worker opened the press machine	30 minutes
	Maintenance workers bring to the press machine workshop	20 minutes
Process	Officers check for damage	15 minutes
	Officers made spare part orders	10 minutes
	Officers came a pending spare	144 minutes
waiting	Maintenance workers go to the equipment to receive part	15 minutes
Motion	Officers repair damage	120 minutes
	Officers restore the machine to the production floor	20 minutes
Process	The clerk put the press machine.	30 minutes

4. Wastage analysis

Waste identification is performed to determine the activity or process that belongs to the category of waste. Identifying waste is done through brainstorming with the related management. As for the kinds of waste that has been found at the time of engine maintenance will be outlined in the analysis below.

4.1. Motion

It has been found that there is a movement that is too often outside of the corrective action itself. The displacement activity include machine operators on the production line to report the damage to the Engineering authorized to create a work order (WO) if found to be an equipment repair. Once finished creating WO from the engineering, joint operator maintenance worker who has been delegated by the engineering to deal damage, returned to the production line to see the damage. The movement of this kind, it always happens in every kind of activity improvements in the production line. Because the absolute WO-making to be done before the maintenance workers carry out their duties. Excessive movement on the carrier to create a work order (WO), which can be categorized as waste. Another movement (motion) which is non-value added activity is the maintenance personnel should carry press machine to his workshop and brought back to the production floor after completion in the remodel. In addition to those mentioned above, there is more displacement operator of engineering parts to the equipment. The move from section to section of the equipment engineering done to make a request order a part that is required for the replacement of spare parts on a machine that is damaged, then the order request was brought to the equipment required to ask for spare parts.

4.2. Process

Types of waste on this classification occurs because workers are not using the knowledge, skills and abilities optimally. At the moment the sound of a vacuum pump, then lowered maintenance workers, in identifying what causes the vacuum pump requires a sound very long time. It already includes activities disassembling the machine to find the point of engine damage. Long time to identify the proficiency level of damage is also a waste bentu, where maintenance workers lack skills sharp in identifying problems.

4.3. waiting

The waste types, characteristics are causing the machine and the operator are unemployed or do not do the job effectively.

5. Cause Analysis of Waste.

The analysis carried out is the analysis of the causes of waste that will be discussed in this section. The analysis was performed with the root cause of the problem by using Root Cause Analysis (RCA) Demi facilitate the search for the root causes of waste most influential, and therefore made by RCA. From the results of waste identification, finding the root cause of permasalahan traced by asking "why" as much as a couple of times, so that appropriate action with the root cause of the problem can be found and can solve existing problems. Search and determining the root causes of these problems is done through brainstorming with the company in the related field.

The following table indicated the root problems by using the tools 5Why, and made for each waste:

5.1. waste Motion

Below will be presented based on the method 5 why, search the root causes of waste.

Table 3. Root Cause of Motion Waste

type Problems	Rev 1	Rev 2	Rev 3	Rev 4	Rev 5
waste Motion	operator movement	from l			
		From the Engineering back to production			There is no
	Movements	From the production line to	The movement takes a long time	Not being in one location	integrated
	Section Maintenance	the workshop			information system
		From the workshop gets equipment			

5.2. Waste Process

Below will be presented based on the method 5 why, search the root causes of waste.

Table 4. Root Cause of Waste Process

type Problems	Rev 1	Rev 2	Rev 3	Rev 4	Rev 5
waste Process	hand screw worm Thirsty	Checking component damage			
		Make order part			
		repair the damage	Search damage takes a long time	Maintenance operators lack the expertise in the identification of problems	Lack of training to operators

Table 5. Root Cause of Waste Waiting

5.3. Waiting waste

type Problems	Rev 1	Rev 2	Rev 3	Rev 4	Rev 5
Waiting waste	The process of Requesting Komponenpart	Waiting Components available			
	Damaged		Component is not available in the warehouse	Poor inventory data expertise in the identification of problems	Calculation of critical parts.

6. Conclusions

waste waiting is the biggest waste, namely 35% of all existing waste. Lean Maintenance leadtime contribute to reduce maintenance by 50% of the total of the previous time due to have been successful in reducing the waiting time component maintenance section. Reducing waiting times affect the other waste that can be a significant reduction in maintenance leadtime do. Waste waiting is the biggest waste, namely 35% of all existing waste.

7. References

- [1] Alwi, S., 2002, "Waste in the Indonesian Construction Projects", Creating Sustainable Construction Industry in Developing Countries, p. 305-315.
- [2] Anggriani, Melani, et al. 2016. Evaluation of Effectiveness Machine Hammer Mill to approach Creeper Total Productive Maintenance (Case Study: Crumb Rubber Company in South Lampung). International Seminar and the National Conference of IDEC 2016
- [3] Arslankaya, Seher. 2015. *Maintenance management and lean manufacturing practices in Affirm Which produces dairy products*, ScienceDirect. Turkey.
- [4] BS Dhillon, 2006, *Maintenability, Maintenance and reliability for engineering*, Taylor and Francis Group, LLC, New York.
- [5] Duran, Orlando. 2017 *Lean Maintenance Applied to Improve Maintenance Efficiency in Thermoelectric Power Plants*.
- [6] Hidayati, Juliza, et al. 2017. Increased productivity through waste reduction effort in oil and gas company. IOP Conf. Series: Materials Science and Engineering 309 (2018)
- [7] Jasiulewich, M. 2015. Integrating Lean and Green Paradigms in Maintenance Management. IFAC. South Africa.
- [8] Mostofa, Sherif et al. 2015 *Lean Thinking For A Maintenance Process*. England
- [9] Smith R, (2004) *Lean Maintenance*. Elsevier. USA.