IJEC
International Journal of Economics
https://ejournal.ipinternasional.com/index.php/ijec

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

Machine Maintenance Scheduling Design Using Reability Centered Maintenance (RCM) method and Maintenance Value Stream Mapping (MVSM) at XYZ

Nico Pranata Mulya
Sekolah Tinggi Agama Buddha Sriwijaya Tangerang
Correspondence Authors: nico.pranata.mulya@sekha.kemenag.go.id

Article history: received June 16, 2023; revised June 23, 2023; accepted June 30, 2023

ABSTRACT

The problem in this study is the occurrence of damage to the *Oven, Mixer, Bread Sicer, Proofer, Despositor, Breadline, Vacuum sealer machines.* XYZ has not yet scheduled planned maintenance on production machines. The purpose of this study is to determine the reliability of the machine in operating according to the desired function for a certain period of time at XYZ and to design machine maintenance scheduling at XYZ. This research is a quantitative research with the method used is *Reability Centered Maintenance* (RCM) and *Maintenance Value Stream Mapping* (MVSM). The data used is secondary secondary data obtained from XYZ, namely data on damage to *Oven, Mixer, Brread Slicer, Proofer, Despositor, Breadline, Vacuum sealer* machines in 2021. The results of this study state that the reliability of the machine operates according to its function states that *Ovens* had an average operating time of about 584 hours between 5 failures, *breadslicer machines* had an average time of about 1460 between 2 failures, *proofer machines* had an average time of about 1460 hours between 2 failures, *breadline machines* had an average time of about 1460 hours between 2 failures, *vacuum sealers* have an average time of about 2920 hours between 1 failure, and *deposit* machines have an average time of 2920 hours between 1 failure. Designing proper machine maintenance scheduling for XYZ, namely *Mixer maintenance or replacement* every 30 days, *Depositors* every 60 days, *ovens* every 90 days, *proofers* every 120 days, *breadline* siever 60 days, *bread silicer* every 60 days and *vacuum sealer* every 30 days.

Keywords: Reability Centered Maintenance (RCM), Maintenance Value Stream Mapping (MVSM)

INTRODUCTION

Arsyad & Sultan (2018) stated that just like humans, the condition of machines and equipment will experience a decrease in their ability to carry out their duties as they get older. In addition to the problem of engine age as an *internal factor,* there are several *external factors* that affect the ability of the machine to work. Some of these factors include errors in machine operation, errors in the installation of supporting equipment. The design of machine maintenance scheduling is a basic requirement in supporting user activities, especially in the operational activities of transportation machines, production machines, and other home equipment machines. Particularly in Indonesia, efforts to maintain these machine tools are very important considering the large comparison between the productivity of machine use and maintenance.

XYZ is an industry engaged in the manufacture of bread, which was founded by the late Alm. Willy Prayetno on April 2 2017, which is located at Jl. Palm Griya Indah Gurun Lawas, Padang, directly led by Yulzul Fazriat. This factory has approximately 30 employees. This XYZ produces several types of bread, namely white bread, sweet bread and dry sugar bread, in the production process for each product the machines are almost the same, namely, the first step is selecting raw materials, then the raw materials are weighed according to a predetermined dosage, then a mixing process will be carried out the dough *(Mixing)* and the frementation process, the next step is the forming stage

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

(Despositor) then the cutting stage *(Bread slicer)* and re-weighing will be carried out, the next process is roasting or baking *(Oven),* the finished bread is baked then brought to *(Proofer)* to carry out the developing stage and then cooled, some of the bread that must be filled, such as sweet bread, will be brought to *(Breadline)* to carry out jam filling, and ready for packing (*Vacuum sealer)* or packaging. Roti New Prima Bakeri itself is spread throughout West Sumatra Province and parts of Jambi Province (Sungai Full and Kerinci) where currently XYZ has operational *breakdown problems* caused by unexpected damage to production machines. Information obtained from workers at XYZ, the scheduling of machine maintenance (*maintenance)* carried out by XYZ is carried out based on damage *(corrective maintenance),* this causes continuous machine damage every month. Another problem is the unscheduled maintenance of production machines, this causes critical machines, namely, damage to the *Oven, Proofer, Despositor, Breadline, Vacuum sealer, Mixer, Bread slincer machines*. These problems will certainly cause operational termination *(breakdown)*.

Research that has been carried out by (Marpaung, 2018) states that scheduling maintenance and maintenance of machines can be overcome by the *Reliability Engineering* and *Maintenace Value Stream Mapping* (MVSM) methods which have a positive impact, namely knowing machine reliability and being able to schedule machine maintenance effectively reducing *breakdown risk production process.* Therefore, planning production machine maintenance is very important.

Jayantari et al (2018) explained that *Maintenance Value Stream Mapping* is appropriate for scheduling machine *maintenance* on production machines. Then research has been carried out by (Manasyakana, 2018) in dealing with a problem of machine damage in the production process analyzed using the MVSM method and *Lean manufacturing* is applied to minimize *downtime*. (Indriati, 2019) states that one of the engine health factors that determines the smooth operation of the process is *engineering reliability*. According to (Damanik et al, 2020) provide *alternatives* and solutions to existing problems in mapping work station machine scheduling with MVSM and components on the machine.

Ulfah & Ferdinand (2021). PT TMMI, *Reliability engineering* is appropriate for determining critical components, failure factors, MTBF and MTTR values, *maintenance* and appropriate maintenance schedules and proposing the need for critical spare parts to support the maintenance process, (Fathliana et al, 2020) application of *lean manufacturing* using *maintenance* MVSM *value stream mapping* to help create work station machine performance that can be relied on. (Rahmanto et al, 2021) the MVSM method is able to explore the possibility of shortening waiting times for repairs, waste, and highlighting important strategies. (Rimawan et al, 2021) explains that using *the Reliability Engineering* and MVSM methods can carry out engine maintenance / replace component parts when damaged components occur in production. (Sembiring et al, 2021) research using the *Reliability engineering method* to determine machine reliability and implement maintenance of factory machine components, concerning smoothness and congestion on production machines.

Darno (2020) states that the decision that is applied in machine reliability chooses the *Reliability engineering method*. there are two materials that are used as thoughts, the system that will be analyzed, functions and malfunctions, components are an analysis process. *Reliability engineering* will provide clearer information in making system selection, and the system will be analyzed to determine engine reliability. (Sembiring et al, 2018) maintenance *is* organizing maintenance to provide a general view of the maintenance of production machine facilities, in an effort to maintain that each equipment and machine can be used continuously for production.

Then according to (Hidayat et al, 2021) MVSM succeeded in identifying problems that occurred as a result of waiting for service, reducing the waiting time for express maintenance services from 120.60 minutes to 64.00 minutes and succeeded in increasing service process capability. (Rusmawan, 2020) states that *maintenance* activities are to carry out periodic maintenance once a month, such as

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

checking the oil, checking the carburetor and engine lubrication systems, repairing the engine or replacing engine components, MVSM is suitable to be implemented so that the company can carry out scheduled maintenance. (Bugvia et al, 2021) said that the MVSM method was able to explore the possibility of shortening waiting times, waste, and highlighting important strategies, steps that might be taken by management to increase machine productivity and quality in machine components.

(Nwanya et al, 2020) stated that the delay in the work station in producing was due to machine damage at the work station, the shorter the *downtime*, the faster the time to market products and reduce customer waiting time. Ansori & Mustajib (2013) *Reliability Centered Maintenance* where the implementation of this maintenance system is maintenance that is carried out before the occurrence of engine failure. This system is considered good enough to prevent unplanned machine stops and with this method is considered to be able to determine what actions will be taken to maintain physical assets. continue to operate as desired. (Sembiring & Nasution, 2018). Said *Reliability engineering* and MVSM are efficient tools as a determinant of engine reliability and engine maintenance planning.

This research was conducted to determine the level of reliability on critical machines and to design machine maintenance scheduling, using the *Reability Centered Maintenance (RCM)* and *Maintenance Value Stream Mapping* (MVSM) methods at XYZ. The advantages of the *RCM method* are to determine the reliability of more complex machines in operating according to the desired function for a certain period of time, and the MVSM method is to design scheduled machine *maintenance*. With this research it is hoped that it can be used as a support in research using the *Reliability Engineering* and *Maintenance Value Stream Mapping* (MVSM) method and also as a reference in further research. This study aims to determine the reliability of the machine in operating according to the desired function for a certain period of time at XYZ. To design machine maintenance scheduling at XYZ.

METHOD

This type of research is quantitative research with the category of systematic scientific research on parts and phenomena and their relationships. The research was conducted on the production floor of XYZ which is engaged in the production of white bread, sweet bread and dry sugar bread. XYZ is located on Jl. Plam Griya Indah Desert Lawas, Padang. Research will be conducted in December 2022. This research uses reliability centered maintenance (RCM) and maintenance value stream mapping (MVSM) methods. The data used is secondary data obtained from XYZ, namely data on damage to *Oven, Mixer, Bread Slicer, Proofer, Despositor, Breadline, Vacuum sealer machines* in 2021. Data processing begins with the reliability centered maintenance method which starts with making flowchars, Pareto diagrams, MTTF, FMEA, LTA and continues with the Maintenance *Value Steam Mapping* (MVSM) method.

RESEARCH RESULTS AND DISCUSSION

Research result

Reliability Centered Maintenance (RCM) method, which is an application of design to machines, components or spare parts so that these components or spare parts can perform their functions properly, without any failure. , in accordance with the design or process when it is made, the proposed preventive maintenance *uses* the *Maintenance Value Stream Mapping* (MVSM) method.

Data Processing Using the Reability Centered Maintenance (RCM) Method

IJEC
International Journal of Economics
https://ejournal.ipinternasional.com/index.php/ijec
e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

Reliability centered maintenance is a method that functions to ensure that several physical components of the machine at XYZ Bakery can function continuously by minimizing the occurrence of machine *breakdown*.

Flow chart

The flowchart is the steps or sequence in carrying out production machine maintenance, which can be seen as follows:

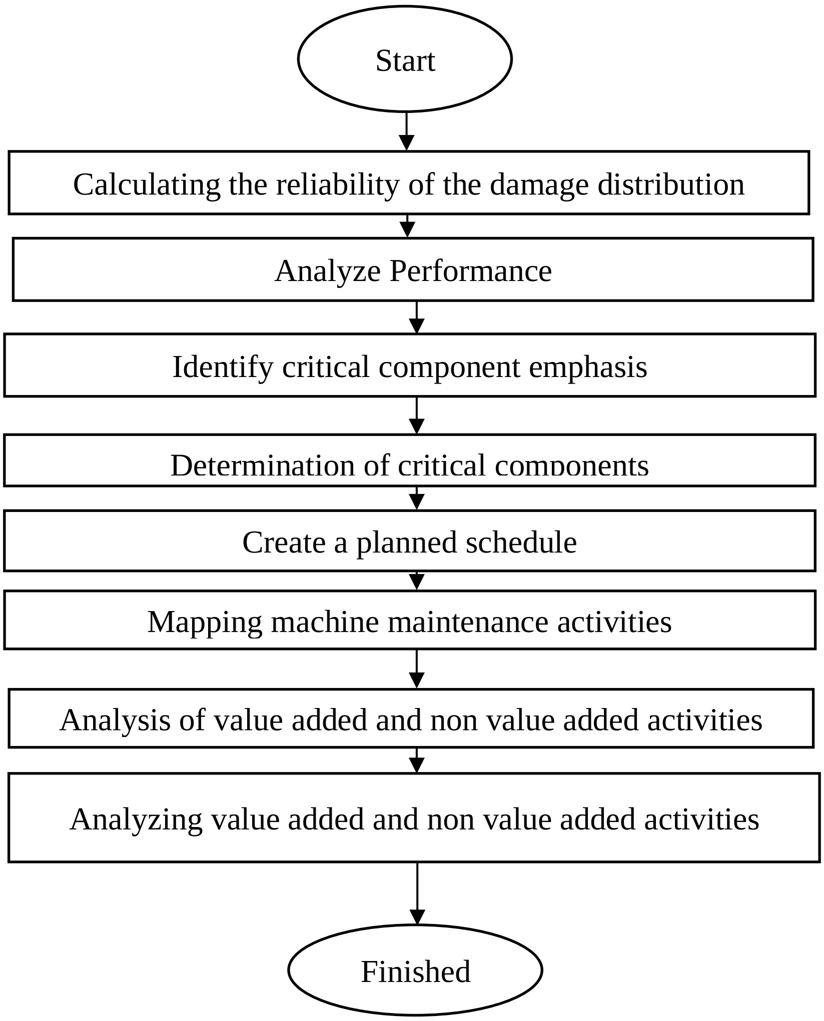

Figure 1. Fresh Bread Product Flow Chart
(Source: Data Processing, 2022)

2) Pareto Charts

Below is a pareto diagram of the total damage that occurred to XYZ which can be seen in Figure 1, namely:

IJEC
International Journal of Economics
https://ejournal.ipinternasional.com/index.php/ijec
e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

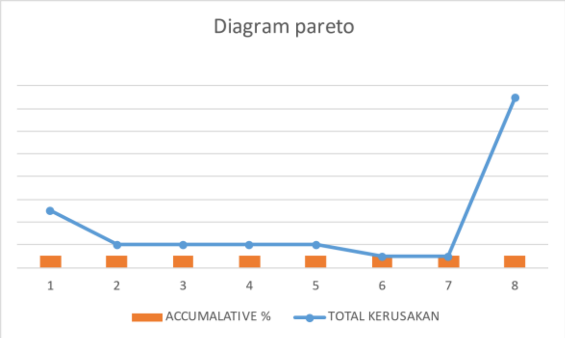

Figure 2 Machine Damage Pareto Diagram

3) Reliability (MTTF)

To calculate the MTTF and the value of each distribution, the MTTF formula is used

$$MTTF = \frac{\text{Total waktu operasi mesin}}{\text{Jumlah Kerusakan yang terjadi}}$$

Known: Total use a day 8 hours
Machine operating time for one year
8 X 365 days = 2920 hours
MTTF of mixers = 2920/2 = 1460 hours

It states that the mixer machine has an average time of about 1460 hours between 2 failures

Oven MTTF =2920/5 =584 hours

It states that the oven machine has an average operating time of about 584 hours between 5 faults.

MTTF Bread slicer = 2920/2=1460 hours

It states that the breadslicer machine has an average run time of about 1460 hours between 2 faults.

Profer MTTF = 2920/2 = 1460 hours

It states that the profer machine has an average time of about 1460 hours between 2 failures.

MTTF breadline =2920/2= 1460 hours

It states that breadline engines have an average time of about 1460 hours between 2 failures.

MTTF vacuum sealer= 2920/1= 2920 hours

It states that vacuum sealer machines have an average run time of about 2920 hours between 1 failure

MTTF depositor = 2920/1=2920 hours

It states that depositor machines have an average time of 2920 hours between 1 breakdown.

Hi, this can be seen in table 1 below:

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

Table 1. MTTF results

No	Machine	Total Damage (Units)	Time O'clock
1	*Mixers*	2	1420
2	*depositors*	1	2920
3	*Oven*	5	584
4	*Proofer*	2	1460
5	*Breadlines*	2	1460
6	*Bread slicer*	2	1420
7	*Vacuum sealers*	1	2920

Source: Data processing

Downtime data from machine components at XYZ can be seen in table 2 below:

Table 2. Machine Component *Downtime* Data

No	Machine	Damage amount	MTTF (O'clock)	*Downtime* Percentage
1	*Mixers*	2	1420	25%
2	*depositors*	1	2920	15%
3	*Oven*	5	584	25%
4	*Proofer*	2	1460	20%
5	*Breadlines*	2	1460	5%
6	*Bread slicer*	2	1420	5%
7	*Vacuum sealers*	1	2920	5%

a. Identification of Priority Components Using Failure Modes Effect Analysis (FMEA)

In determining priority components using the FMEA method the first step is to find out the components of the machine in XYZ Bakery. Each component of the XYZ Bakery machine will be calculated with *a Risk Priority Number* (RPN). The first step in identifying priority components is knowing the initial data of the machine such as *failure modes*, *causes*, and *failure effects*, which are *the failure modes* for determines the *detection category*, *causes* determines *the occurrence category* and *failure effect* determines the *severity category*. Next is the calculation of the RPN value using the values from the *severity*, *occurrence*, *detection categories*.

After obtaining the data, the next step is to *rank* each component, while *the ranking* of each component using the FMEA table is as follows. FMEA is a method that aims to evaluate system design by considering the various failure modes of the system consisting of components and analyzing their effects on the reliability of the system. RPN is the mathematical product of the seriousness *of the effect* (*severity*), the likelihood that *a cause* will result in a failure related to *the effect* (*occurrence*), and the ability to detect failures before they occur (*detection*). The preparation of the RPN consists of components *Severity of Occurance*, *Occurance*, *Detection Deficiency*.

IJEC
International Journal of Economics
https://ejournal.ipinternasional.com/index.php/ijec
e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

The RPN value can be seen in table 3 below:

Table 3. Value of RPN

PROCESS	MACHINE	EMPLOYMENT PERCENTAGE (O)	TOTAL DAMAGE (DD)	SO	RPN
INPUTs	MIXERS	25%	2	2	1
					0
					0
PROCESS	DEPOSITORS	15%	1	1	0.15
	PROOFEN	20%	2	2	0.8
	OVEN	25%	5	5	6.25
					0
OUTPUT	BREADLINES	5%	2	2	0.2
	BREAD SLICER	5%	2	2	0.2
	VACUUM SEALERS	5%	1	1	0.05
TOTAL		100%			

Table 4. RPN Value (Continued Table)

No	**Machine**	**RPN**	**Category**
1	*Mixers*	1.0	Evidence (Low Risk)
2	*depositors*	0.15	Evidence (Low Risk)
3	*Oven*	0.80	Evidence (Low Risk)
4	*Proofer*	6,25	Safety (Moderate Risk)
5	*Breadlines*	0.20	Evidence (Low Risk)
6	*Bread slicer*	0.20	Evidence (Low Risk)
7	*Vacuum sealers*	0.05	Evidence (Low Risk)

Source: Data processing

Information:
1) Evident (low risk): RPN <10
2) Safety (Moderate Risk):10< RPN < 20
3) Outage (High Risk): 20 < RPN < 40
4) Critical (Very high risk): RPN > 40

Based on the RPN values in table 3 , it shows the priority of a component that has the highest risk and requires corrective action. after filling in the FMEA *worksheet table* from one of the components of the XYZ machine is the oven. *spare parts* must be replaced. The effect of failure caused by the oven is that the XYZ machine stops, because the oven has a function to bake dough

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

with a *safety of occurrence rate of* 5, an *occurrence rate of* 25% and a *detection deficiency level* of 5, has an evident low risk so that the RPN value is 6.25.

b. *Critically and Probability of Occurrence*

This step aims to critically analyze what possibilities can occur in the system by using *logic tree analysis* and *critically analysis for plant components.*

1) *Logic Tree Analysis* (LTA)

preparing *a logic tree analysis* is to give priority to each damage mode. Perform functional and fault review so that the failure mode states are not the same. The LTA process uses a simple logical question or decision structure into four categories, each question will be answered “Yes” or “No”. The important things in criticality analysis are as follows:

a) *Evident*, namely whether the operator knows under normal conditions, there has been a disturbance in the system?

b) *Safety*, i.e. does this crash mode cause safety issues?

c) *Outage*, i.e. does this damage mode result in all or part of the machine stopping?

d) *Category*, namely the categorization obtained after answering the questions above. In this section the components are divided into 4 categories, namely:

1. Category A (*Safety Problem*), consequences for personnel and the environment.

2. Category B (*Outage Problem*), consequences for plant operations.

3. Category C (*Economic Problem*), consequences for economic losses.

4. Category D (*Hidden Failure*), classified as a hidden failure which is then classified again into categories D/A, D/B, or D/C.

The recapitulation of LTA values can be seen in table 5 below this:

Table 5. LTA Recapitulation

No	Machine	Evident	safety	Outage	Categories
1	*Mixers*	Y	N	N	B
2	*depositors*	Y	N	N	B
3	*Oven*	N	Y	N	B
4	*Proofer*	Y	N	N	B
5	*Breadlines*	Y	N	N	B
6	*Bread slicer*	Y	N	N	B
7	*Vacuum sealers*	Y	N	N	B

Source: Data processing

c. Action selection

Action selection is the final stage in the RCM process. From each damage mode, a list of possible actions is made and then chooses the most effective action. In this process, the determination of the existing failure relationship is carried out, whether the existing failure is directly related to *Time Directed* (TD), *Condition Directed* (CD), *Finding Failure* (FF), namely:

1. *Condition Directed* (CD), actions taken with the aim of detecting damage by means of *visual*

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

inspection, inspecting tools, and monitoring a number of existing data. If there is detection of symptoms of equipment damage, then proceed with repair or replacement of components.

2. *Time Directed* (TD), an action aimed at direct prevention of the source of damage based on the time or age of the component.
3. *Finding Failure* (FF), actions taken with the aim of finding hidden equipment damage with periodic inspections.
4. *Run to Failure,* the component will be used until it is completely damaged because there is no action that can be taken to prevent damage to the component.
   The selection of actions for each component is determined by means of *time-directed* and *condition-directed* actions for FMEA and LTA, also by looking at the level of frequent damage from existing data and the economic level that can harm the company higher. Selection of actions for critical components for XYZ as follows:
   1. *Time Directed:* There are four components that fall into the *time directed category* , namely *the oven* .
   2. *Condition Directed:* There are 4 components that fall into the *condition directed category* , namely *Mixer, proofen, breadline, bread slicer.*

Data processing using Value Stream Steam Mapping (MVSM) Method

Following are the steps that can be carried out in the Value Stream Mapping method at XYZ, namely:

1) Identification of other processes and flows: identification of the bread production process and the flow of the bread-making process, including the oven
2) Time scale: Calculate the time required for each process and activity in the bread-making process, including the time required for the oven
3) Identification of wasted time: Identification of unproductive bread production time, including time lost due to damage to the oven .
4) Identification of Corrective Actions: Identification of actions that can be taken to reduce unproductive time and increase the efficiency of bread production, including servicing the Oven regularly
5) Implementation and Monitor: Implement corrective actions and monitor results these actions, including monitoring the performance of the oven and ensuring bread production continues to run efficiently and optimally. Because of this, the unitary function of the machine is recommended maintenance outside operating hours in order to reduce wasted time.
   a. *Maintenance* Scheduling Planning and Component Replacement

After knowing the minimum *downtime* of the critical components of the cutting machine, a maintenance schedule can be made which will be able to assist the company in carrying out effective maintenance and minimize machine *downtime* and costs incurred. Below is a form of maintenance scheduling for each cutting machine component in January 2022 – December 2022.

Maintenance scheduling planning can be seen in table 6 below:

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

Table 6. Maintenance Scheduling Planning

No	Machine	Treatment schedule (days)	Maintenance fee (Rp)	Treatment duration (Hours)	Work percentage after treatment (%)
1	*Mixers*	30	1000000	2	95
2	*depositors*	60	2000000	3	95
3	*Oven*	90	2250000	4	96
4	*Proofer*	120	3200000	5	97
5	*Breadlines*	60	800000	1	96
6	*Bread slicer*	60	950000	2	96
7	*Vacuum sealers*	30	320000	1	95

Source: XYZ New Prima baery

b. *Maintenance* Scheduling Planning and Component Replacement

After knowing the minimum *downtime* of the critical components of the cutting machine, a maintenance schedule can be made which will be able to assist the company in carrying out effective maintenance and minimize machine *downtime* and costs incurred. Below is a form of maintenance scheduling for each machine component at XYZ from January 2022 to December 2022.

The maintenance schedule can be seen in table 7 below:

Table 7. Treatment Schedule

No	Machine	Treatment Time	Treatment Date
1	*Mixers*	30	1/1/2022 31/1/2022 3/2/2022 1/4/2022 1/5/2022 31/5/2022 30/6/2022 30/7/2022 29/8/2022 28/9/2022 28/10/2022 27/11/2022 27/12/2022
2	*depositors*	60	1/1/2022 2/3/2022 1/5/2022 30/7/2022 29/8/2022 28/10/2022 27/12/2022

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

3	*Oven*	90	1/1/2022 1/4/2022 30/6/2022 28/9/2022 27/12/2022
4	*Proofer*	120	1/1/2022 1/5/2022 29/8/2022 27/12/2022
5	*Breadlines*	60	1/1/2022 2/3/2022 1/5/2022 30/6/2022 29/8/2022 28/10/2022 27/12/2022
6	*Bread slicer*	60	1/1/2022 2/3/2022 1/5/2022 30/6/2022 29/8/2022 28/10/2022 27/12/2022
7	*Vacuum sealers*	30	1/1/2022 31/1/2022 3/2/2022 1/4/2022 1/5/2022 31/5/2022 30/6/2022 30/7/2022 29/8/2022 28/9/2022 28/10/2022 27/11/2022 27/12/2022

Source: Data processing

Table 6 above can be seen the machine maintenance schedule according to the date, so that XYZ will find it easier to carry out maintenance or replace the machine if it has exceeded the useful life of the machine.

Discussion

Reability Centered Maintenance (RCM) Data Processing Analysis

In the production process, because there is only one machine at each stage of the process, the selection is made of the machine that has the highest frequency of machine failures. Oven is the machine with the most frequency of failures. Data for each component in the form of system

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

functions, function failures and risk of failures were obtained from the New Prima Bakery XYZ operator.

1) FMEA analysis

After knowing the critical components of the machine at XYZ, an FMEA (*Failure Mode and Effect Analysis*) analysis is carried out and the RPN value of each component can be known. Mixers have an RPN value of 1, Depositors have an RPN of 0.15. proofen has an RPN of 0.8, oven has an RPN value of 6.25, *breadline* has an RPN value of 0.2. bread silcer has an RPN of 0.2 and vacuum sealer has an RPN of 0.05 (table 3).

Based on the RPN values in table 3 , it shows the priority of a component that has the highest risk and requires corrective action. after filling in the FMEA *worksheet table* from one of the components of the XYZ machine is the oven. *spare parts* must be replaced. the failure effect caused by the oven is that the production of XYZ stops, because the oven has a function to bake dough with a *safety of occurrence rate of* 5, an *occurrence rate of* 25% and a *detection deficiency level* of 5, has an evidently low risk so that an RPN value of 6.25 is obtained.

2) LTA analysis

In LTA (*Logic Tree Analysis*) there is a malfunction caused by what, then what is the cause of the damage and what are the effects. Based on the results of the LTA analysis, several failure categories of each component can be identified. All components fall into category B (*Outage Problem*). After the LTA analysis, the selection of actions is carried out which is the final stage of the RCM analysis process. From each damage mode, a list of possible actions is made and then the most effective action is selected. The selection of actions must be applicable and effective, currently maintenance actions on cutting machines are *Run to Failure* where the machine is operated until it is damaged so that machine maintenance tends to be *corrective maintenance*. After analysis with RCM, changes in action were obtained based on CD/TD actions.

The CD action aims to detect damage *visually inspection*¸ checking engine indicators, as well as monitoring a number of existing indicators. The components included in the selection of this action are the contactor and the driving machine. TD action is a maintenance activity and component replacement that is carried out regularly based on *reliability calculations.* The component included in the selection of this action is the Oven.

Based on the recapitulation of LTA damage, the highest damage was selected which was a priority, namely the Oven Machine on the machine at XYZ which has a function for baking dough. Criticality analysis (failure mode) is obtained as follows:

1. Evident (can the operator be aware of a failure during normal circumstances?) = No
2. Safety (can the failure endanger work safety?) = Yes
3. Outage (can this failure mode cause part or even the entire system to stop?) = Yes
4. Category: B (Outage problem), where a failure that occurs in a component makes the working system of that component stop. This affects operational plans, affects the quality and quantity of products, and creates additional costs.

3) Reliability analysis (MTTF)

Based on data processing of each engine component in order to determine the level of reliability with a total daily use of 8 hours and one year of engine operation time. It states that *ovens* have an average operating time of about 584 hours between 5 faults, *breadslicer machines* have an average time of about 1460 between 2 failures, *proofer machines* have an average time of about 1460 between 2 failures, *breadline machines* have an average the average time is about 1460 hours between

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

2 failures, the *vacuum sealer machine* has an average time of about 2920 hours between 1 damage, and the *depositor* machine has an average time of 2920 hours between 1 damage (Can be seen in table)

MVSM Data Processing Analysis

Based on the results of data processing using the RCM method, the components included in the TD measure are calculated to determine the minimum *downtime* with the smallest TMD (*Total Minimize Downtime) approach.* A distribution test is carried out from the damage data for each component before determining the TMD value. The results of the TMD calculation obtained different results for each component. *Mixer* maintenance or replacement every 30 days, *deposits* every 60 days, *oven* every 90 days, *proofer* every 120 days, *breadline* every 60 days, bread silicer every 60 days and *vacuum sealer* every 30 days.

CONCLUSION

The conclusion from the researcher is the reliability of the machine operating according to its function states that *the oven* has an average operating time of around 584 hours between 5 faults, the *breadslicer machine* has an average time of around 1460 hours between 2 faults, the *proofer machine* has an average time of around 1460 hours between 2 failures, *breadline* machines have an average time of about 1460 hours between 2 failures, *vacuum sealer machines* have an average time of about 2920 hours between 1 failure, and *depositor* machines have an average time of 2920 hours between 1 failure. Designing proper machine maintenance scheduling for XYZ Bakery machines, namely *Mixer maintenance or replacement* every 30 days, *Depositors* every 60 days, *ovens* every 90 days, *proofers* every 120 days, *breadline* siever 60 days, *bread silicer* every 60 days and *vacuum sealer* every 30 days. Suggestions from this research are that it is hoped that the results of maintenance actions on critical components can be input for the company, so that XYZ can reduce downtime numbers and immediately take appropriate maintenance actions for oven machines. The company is expected to record complete data for machine maintenance on production machine components so that more complex problem solvers can be found. Future research can consider cost values, component reliability, more complex methods of maintenance action and longer time draws for more accurate efficiency results.

REFERENCES

Ashri Indriati, Dadang D Hidayat, Doddy A Darmajana, Indra Masrin, (2019) Improving the flow of the chocolate bar production process using the *Value Stream* Mapping method *Journal* JRTI *Vol.13 No.2, (2019)*

Ansory, & M Imron Mustajib. (2013) *Integrated Treatment System* . Yogyakarta: Graha Science

Buchari, Nurhayati Sembiring, Hermansah, (2021) Application of reliability engineering method in machine maintenance IOP Conf. Series: *Materials Science and Engineering 1122 (2021)*

Bayu Rahmanto, Ferry Setiawan, Edy Sofyan, (2022) Designing Maintenance Activities Using the Reliability Engineering Method in the Main Rotor Blade System of the Bell 412EP Helicopter Case Study of the Semarang Pilot *Journal Vol. 2 No. 1,* (2022)

Carvalho, CP, Carvalho, DS and Silva, MB, (2019) Value stream mapping as a lean manufacturing tool *: A new account approach for cost saving in a textile company* Year of Manag. Eng.(2019)

Dimas Mukhlis Hidayat Fathurohman, Humiras Hardi Purba , Aris Trimarjoko, 2021 *Value stream*

e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

mapping and six sigma methods to improve service quality at automotive services in Indonesia Journal Vol. 4, Issue 2, (2021)

Darno, (2020) Planning for maintenance of diesel motors at the Teluk Lembu Pekanbaru PLTG, journal Surya Teknika *Vol. 7 No. 1,(2020)*

Erry Rimawan, MBA., Agus Fernando, Gabor Nemeth, Gerry Ignatius, (2019) Planning and Calculation of Machine Maintenance Cost using Reliability Engineering Method *Journal Volume 4, Issue 2, (2019)*

Fathliana Retno, Ningrum, (2020) Identification of jersey production waste through the application of lean manufacturing using value stream mapping (ssco case study sports apparel ciamis) JMIG *Journal , Vol. 1.1 (2020)*

Gray Miller Damanik, Siswoyo Soekarno, Ida Bagus Suryaningrat , (2020), design of a maintenance system for *V-belt components* in the transmission system using the rcm and mvsm methods (case study of Pt. Kebun Sentool Zidam v/Brawijaya Jember) *Lampung Agricultural Engineering Journal Vol. 9, No. 4 (2020)*

Iveline Anne Marie, Emelia Sari, Cut Alda Lika, (2020) Enhancing Sustainable Maintenance Performance Using Lean Competitive Manufacturing Strategy Solid State Technology *Journal Volume: 63 Issue: 6 Publication Year: (2020)*

Jatria, Amri Abdullah, *Machine maintenance management* , qiara media, (2021)

Muhammad Arsyad , Ahmad Zubair Sultanhttps, Machine care and maintenance (2018). https ://books.google.co.id/books?id=jz5VDwAAQBAJ&printsec=frontcover&dq=schedule+perawatan+machine+production&hl=id&newbks=1&newbks_redir=0

Maria Ulfah, Putro Ferro Ferdinant, (2021) Proposal for maintenance of the h-draw press machine in the stamping press division with the reliability method centered maintenance and reliability engineering (Case study: PT. TMMI) *Journal Industrial Services Vol. 7, No. 1, (2021)*

Nurhayati Sembiring, Mangara M. Tambunan, Jeanica Devany, (2021) Design of preventive maintenance system at PT. Y with reliability engineering approach *Journal of IOP Conf. Series* : Materials Science and Engineering 1122 (2021)

Okti Dwi Cahyani, Irwan Iftadi, (2021) Scheduling *Preventive Maintenance* with the *Reliability Centered Maintenance Method* at the Cabinet PU Station at PT IJK *Journal of Technoin Vol. 27, no. 1, (2021)*

Putri, S. Hartini, R. Purwaningsih , (2021) Sustainable Value Stream Mapping Design to Improve Sustainability Performance of Animal Feed Production Process *Journal March 25, (2021)*

Rusmawan, (2020) Lean Manufacturing Design With the Value Stream Method Mapping (VSM) At PT Tjokro Bersaudara PRIOK *Industrial Engineering Optimization Journal (2020) Vol. 02 No. 01*

Stephen C. Nwanya, Celestine N. Achebe, 2020 Reliability analysis of systems with discrete event data using association rules *Journal of Industrial Systems and Management Vol 4 No 1, (2020)*

Sandy Eka Fananda, Zulfah, Saufik Luthfianto, (2022) Increasing Efficiency with the MVSM Method to Reduce Waste in the Line Assembly *Production Process for Wooden Ships Scientific Journal of Industrial Engineering and Information Vol. 11 – No. 1 (2022)*

Salman Abu Bakar Bugvia, Khurram Hameeda, M. Fawad Jamila, Ali Irfana, Shahid Murtazaa, Muhammad Qaisera, Muhammad Bilalaa, (2021) Performance Improvement *through* Value Stream Mapping –A Manufacturing Case Study Salman *Journal of Vocational Affairs* 33(4) (2021)

Stevan Wijaya, Dina Natalia Prayogo, Mochammad Arbi Hadiyat, (2019) Design and Implementation of *Lean Maintenance Management* at PT. Hapete Surabaya University of Surabaya Student Scientific Journal *Vol.7 No.2 (2019)*

IJEC
International Journal of Economics
https://ejournal.ipinternasional.com/index.php/ijec
e-ISSN: 2961-712X
Vol. 2 No. 1, June 2023
DOI: 10.55299/ijec.v2i1.430

Winan Azhari, Muhammad As'adi, Alina Cynthia, Dewi, Halim Mahfud (2021) *Hoist Reinforcement Machine Maintenance Design Using Lean Maintenance Method (Case Study OfPt. Xyz)* *IOP Journal Conf. Series: Materials Science and Engineering1125 (2021)*