E-ISSN 2503-1430
ISSN 2541- 3090

Journal Of Industrial Engineering Management
(JIEM Volume 6. No 1 Tahun 2021)

ANALYSIS OF THE EFFECTIVENESS OF CLEAN WATER DISTRIBUTION MACHINE USING OVERALL EQUIPMENT EFFECTIVENESS (OEE) METHOD

Abdul Mail[1], Muhammad Dahlan[2], Nurhayati Rauf[3], A. Nurul Chairany[4], Arfandi Ahmad[5], Khhairunnisa Jufri[6]
Department of Industrial Engineering, Faculty of Industrial Technology
Muslim Indonesian University
Urip Sumoharjo Street Km. 5, Makassar, South Sulawesi 90231
jufrikhairunnisa2904@gmail.com

Article history:
Submit 15 Januari 2021
Received in from 25 Februari 2021
Acceted 15 April 2021
Avilable online 15 May 2021

ABSTRACT

Clean water distribution machines are very important for local drinking water companies to be able to supply clean water to customers. The need for water continues to increase, so an analysis is needed to determine the decline in engine pump performance in the production process. Maintenance activities need to be carried out to maintain the reliability (realiability) of the machine so that it can operate properly. Therefore, a good strategy is needed to maintain the continuity of the production process. The purpose of this research is to measure the performance of the water distribution pump machine / equipment associated with the low level of clean water production, to identify the losses experienced by the company. The Overall Equipment Effectiveness (OEE) value obtained before repairs were carried out in November 2019 for Lapi I was 69.38% and Lapi II was 69. 75% while in December 2019 for Lapi I it was 74.02% and Lapi II was 73.65% still below the JIPM standard, namely ≥85%. From the results of the six big losses, the clean water distribution pump machine as a whole still needs evaluation to make improvements in increasing effectiveness and productivity, especially in the problem of redeuced speed losses so that suggestions can be made to improve the clean water distribution machine. After repairs in January 2020 for Lapi I was 87.90% and Lapi II was 87.26% while in February 2020 for Lapi I it was 90.34% and Lapi II was 85.81%. From the results of the six big losses, the clean water distribution pump machine as a whole still needs evaluation to make improvements in increasing effectiveness and productivity, especially in the problem of redeuced speed losses so that suggestions can be made to improve the clean water distribution machine. After repairs in January 2020 for Lapi I was 87.90% and Lapi II was 87.26% while in February 2020 for Lapi I it was 90.34% and Lapi II was 85.81%. From the results of the six big losses, the clean water distribution pump machine as a whole still needs evaluation to make improvements in increasing effectiveness and productivity, especially in the problem of redeuced speed losses so that suggestions can be made to improve the clean water distribution machine. After repairs in January 2020 for Lapi I was 87.90% and Lapi II was 87.26% while in February 2020 for Lapi I it was 90.34% and Lapi II was 85.81%.

Keywords: Maintenance, Overall Equipment Effectiveness (OEE), Six Big Losses

Published By:
Faculty of Industrial Technology
Universitas Muslim Indonesia
Address :
UripSumoharjo Km. 5 Street (Campus II UMI)
Makassar Sulawesi Selatan.
Email :
Jiem@umi.ac.id
Phone :
+6281341717729
+6281247526640

DOI :http://dx.doi.org/10.33536/jiem.v6i1.884

I. INTRODUCTION

To ensure machines / equipment, it is necessary to have an organized maintenance and repair system, machines or equipment that are maintained and monitored for better condition at the end of their productive life than those that are not maintained [1]One of the things that supports the smooth operation of a company is machine / equipment readiness, so that losses caused by machine breakdown can be avoided [2]. Damage to the engine also affects, Availability, performance and quality that cause the situation to be bad, in line with the length of use and the age of the machine. This will cause losses for the company, therefore, the company must strive for machinery and equipment to function properly
so that the supply of clean water runs smoothly[3]. In order to maintain the effectiveness of production machines / equipment, the company must implement regular maintenance for smooth production. To determine the factors that cause decreased effectiveness through six big losses and identify the main causes of failure and conduct an analysis of the factors that contributed the most to failure [4].Overall Equipment Effectiveness (OEE) is a measurement of the effectiveness of machines / equipment by calculating the resulting Availability, Performance and Quality. OEE is also a measuring tool to evaluate and improve the right way to ensure increased productivity of machine use[5].This study aims to determine the value of the engine's Overall Equipment Effectiveness (OEE), determine the factors that cause decreased effectiveness through six big losses and identify the main causes of failure and analyze the factors that contribute the most to failure [6].

II. RESEARCH METHODS

2.1 Place and Time of Research

The place of research in this writing was conducted at PDAM IPA III Antang, Jl. Lasuloro Raya, kec. Manggala kel. Bangkala, Makassar city for three (3) months during January-March 2020

2.2 Data Collection

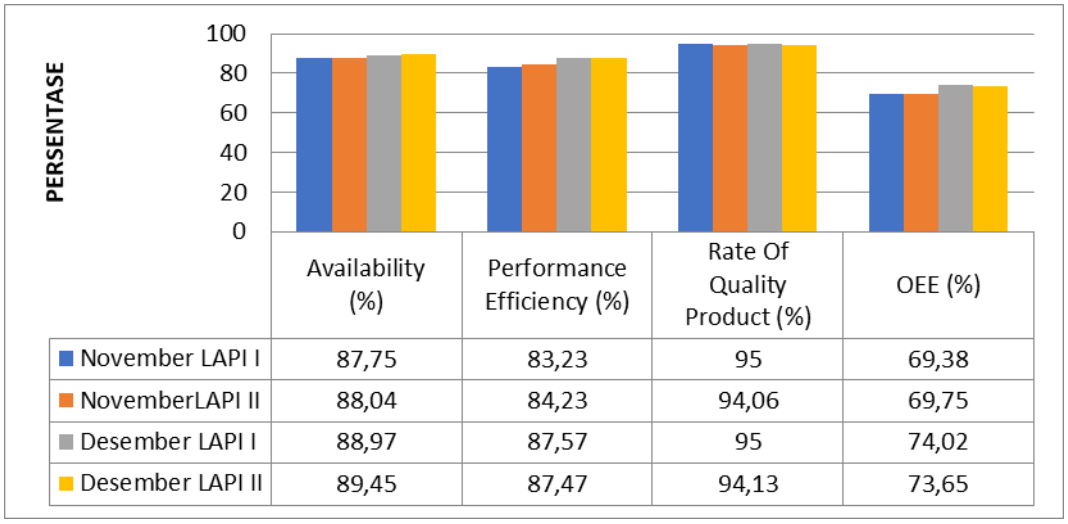
Data collection methods used in this study are library research and field research in the form of observations and interviews. The type of data used is Lapi I and Lapi II water pump engine breakdown time data, Lapi I and Lapi II water pump engine planned downtime data, Lapi I and Lapi II water pump engine setup time data, and Lapi 1 and Lapi II water pump production data.

2.3 Research Methods

The data processing steps in the OEE method are: 1) Calculating the avaibility value of the water distribution pump engine, 2) Calculating the performance efficiency of the water distribution pump engine, 3) Calculating the Rate of quality product for the water distribution pump machine, 4) calculating the Overall Equipment Effectiveness (OEE), 5) Calculating OEE six big losses and a fishbone diagram.

III. RESULTS AND DISCUSSION

Measurement *Overall Equipment Effectiveness* (OEE) shows how well the company uses its resources including equipment, workers and the ability to satisfy consumers in terms of delivery. The results of the calculation of Overall Equipment Effectiveness (OEE) were carried out to determine the effectiveness of using the Lapi I and Lapi II water pump machines in November-December 2019.



	Availability (%)	Performance Efficiency (%)	Rate Of Quality Product (%)	OEE (%)
November LAPI I	87,75	83,23	95	69,38
NovemberLAPI II	88,04	84,23	94,06	69,75
Desember LAPI I	88,97	87,57	95	74,02
Desember LAPI II	89,45	87,47	94,13	73,65

Figure 1. Bar Graph of OEE Value of Lapi I and Lapi II Water Pump Machines in November - December 2019

From Figure 1.The results of measuring the OEE value of the Water Pump Machine are still below the world class standard recommended by the Japan Institute of Plant Maintenance (JIPM), namely OEE = 85.% This shows that the water distribution machine is affected by the value of availability, performance and quality, which is below the minimum limit. Because it is necessary to make improvements so that the OEE number is in accordance with the Institute of Plant Maintenance (JIPM) standards.

Results of Overall Equipment Effectiveness (OEE) Six Big Losses This is done so that the company knows the losses that have the greatest effect on the clean water distribution machine so that it shows the losses that need to be taken care of.

Below will be shown the value of Six big losses in the form of a Pareto diagram. A Pareto chart is a series of bar charts depicting the frequency or effect of a process / state / problem. Pareto diagram uses include: showing dominant problems, stating comparisons and showing the level of improvement after corrections have been made

.

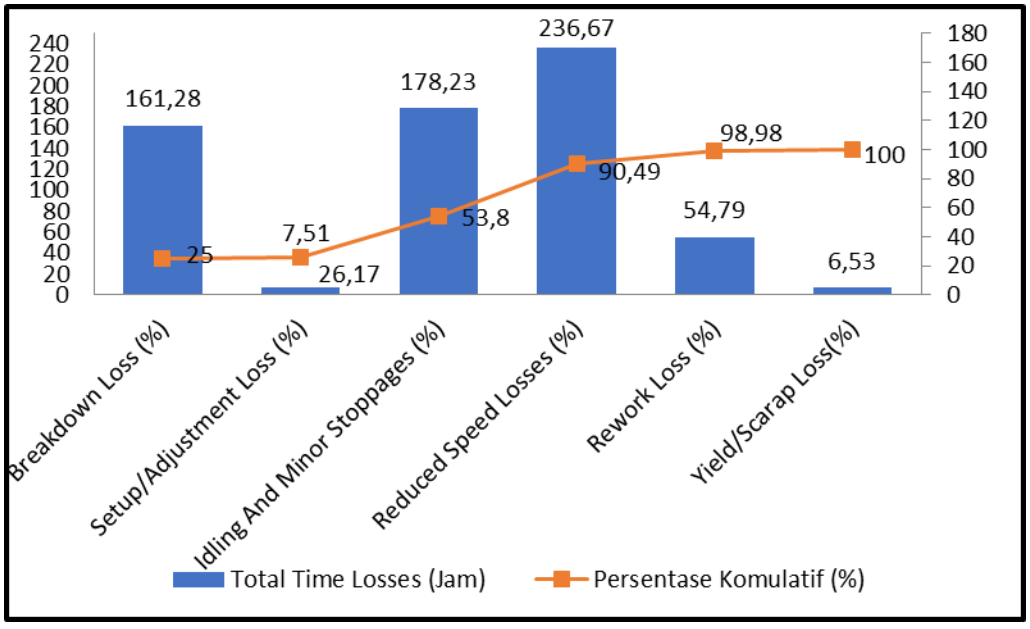


Figure 2.Pareto Diagram of Six Big Losses Value of Clean Water Distribution Machines at Lapi I Bula November - December 2019

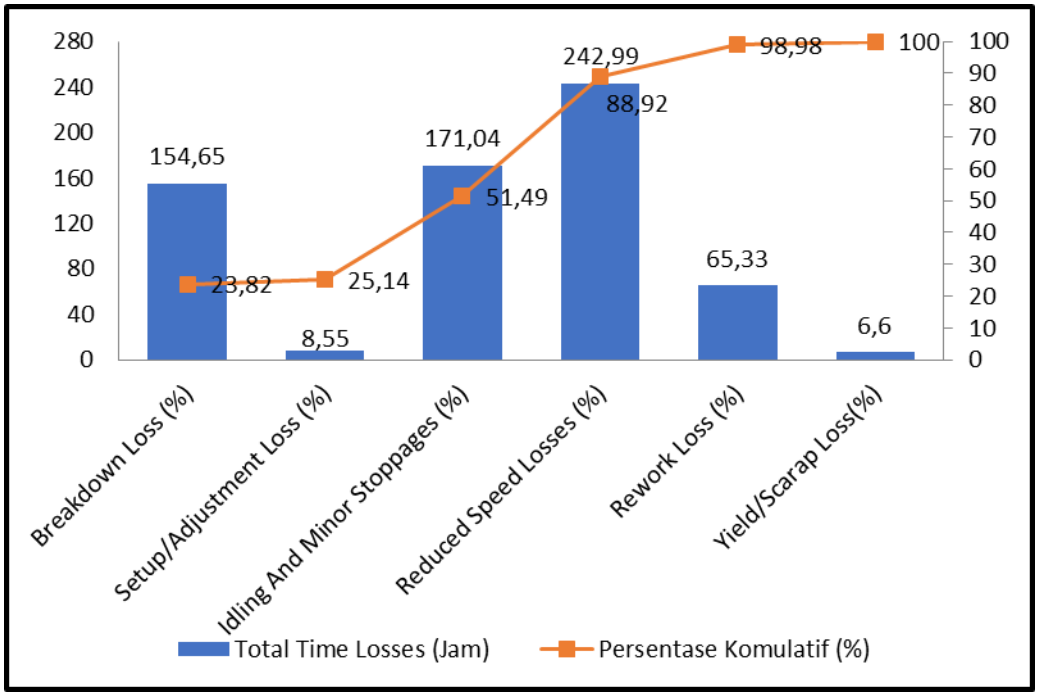
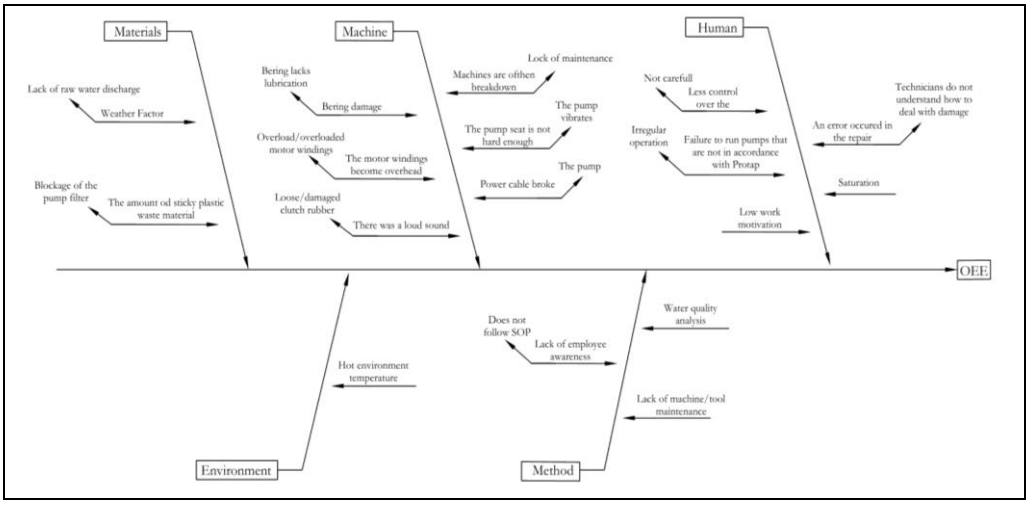


Figure 3. Pareto Diagram of the Value of Six Big Losses of Clean Water Distribution Machines at Lapi II Bula November - December 2019

Based on the Pareto Six Big Loss diagram, it can be seen that the factor that most influences the overall equipment effectiveness (OEE) value for November-December 2019 is reduced speed losses, namely 236.67% for Lapi I and 242.99% for Lapi II. This shows that the low actual engine speed makes the performance not as expected by the company. So it is necessary to get special attention to increase the effectiveness of the clean water distribution machine.

After knowing the problems that cause time losses based on six big losses, the next step is to analyze the causes of six big losses using a fishbone diagram. Basically a fishbone diagram is used to present the causes of a problem with the aim of identifying the causes of a problem, looking for causes and effects and taking corrective action, helping to investigate further factors and selecting methods used to solve the problem



.

Figure 4.OEE Fishbone diagram

In order for the improvement to be done immediately, the analysis of the causes of the Six Big Losses factors which resulted in the low machine effectiveness in the OEE calculation was carried out using the Fishbone diagram. Based on the Pareto diagram which has been made the dominant factor that affects the amount of productivity and machine efficiency is reduced speed losses.

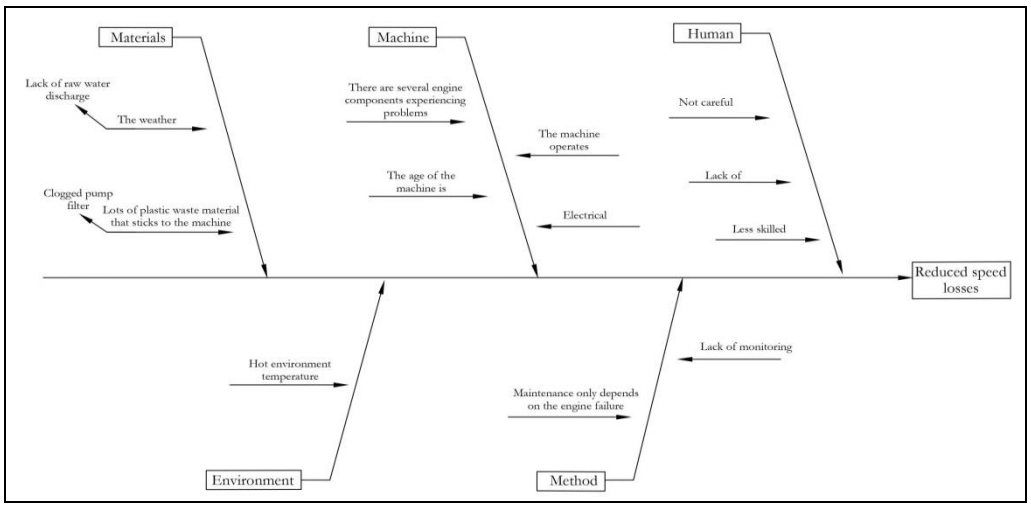


Figure 5.Fishbone Reduced Speed Losses Diagram

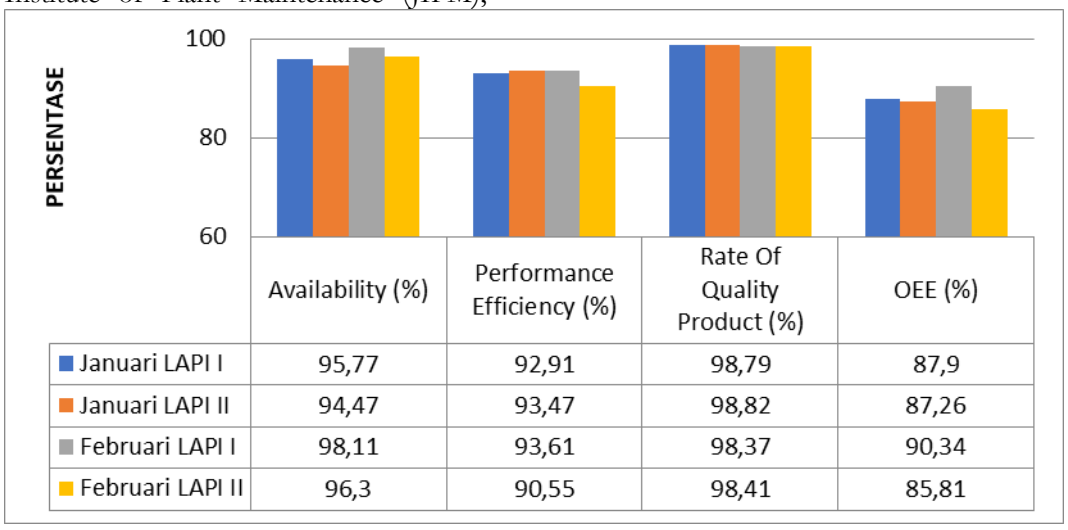
After describing the problem through the causal diagram, the following is a suggestion to solve the problem in order to increase the productivity of using clean water distribution machines, it is necessary to take steps to eliminate the factors of reduced speed losses from the description of the causal diagram in Figure 5.

Table 1.Proposed Solutions to Reduced Speed Losses

No.	Factors	Troubleshooting
1.	Material	
	a. Lack of raw water discharge	-
	b. Clogged pump filter	a. Perform cleaning before using the pump machine
2.	Machine	
	a. There are several engine components experiencing problems	a. Provide spare parts inventory
		b. Operators are more focused on machine conditions.
	b. The age of the machine is old	a. Improve maintenance through the concept of maintenance through the concept of total productive maintenance and independent maintenance.
	c. The machine operates continuously.	a. Perform proper production scheduling by paying attention to operating times.
		b. Machine replacement with modern

	d. Electric disturbance	technology. a. The power plant owned by the company must be added to the power b. The generator uses an automatic switch
3.	Human a. Not careful b. Lack of response c. Undisciplined	a. Improved operator supervision a. Perform operator training on the machine being handled a. Operators must be responsive to machine conditions b. Imposing strict sanctions against employees who are not disciplined
4.	Work environment a. Hot environment temperature	-
5.	Working method a. Non standard treatment b. Lack of monitoring	a. Determine good machine maintenance standards a. Conduct operator training on existing pumping machines

Repair of Overal Equipment Effectiveness (OEE) was carried out to see the level of effectiveness of using clean water distribution machines during January - February 2020. For World Class standards recommended by the Japan Institute of Plant Maintenance (JIPM), namely OEE = 85%. Overal Equipment Effectiveness (OEE) is a combination of time factors, quality of machine operation and machine production speed. Below will be shown the OEE value in the form of a bar graph.



	Availability (%)	Performance Efficiency (%)	Rate Of Quality Product (%)	OEE (%)
Januari LAPI I	95,77	92,91	98,79	87,9
Januari LAPI II	94,47	93,47	98,82	87,26
Februari LAPI I	98,11	93,61	98,37	90,34
Februari LAPI II	96,3	90,55	98,41	85,81

Figure 6. Bar Graph of OEE Value for Clean Water Distributing Machines in January - February 2020

Calculation of the value of Overal Equipment Effectiveness (OEE) on the clean water distribution machine in January 2020 for Lapi I was 87.90% and Lapi II was 87.26%, while in February 2020 for Lapi I it was 90.34% and Lapi II was 85, 81%. This value is included in the level of effectiveness value for world class machines, proving that after knowing the cause of the low OEE value, then a recommendation is made to improve the water distribution machine to determine

the level of reliability, problems that occur in the machine, and the level of efficiency of the machine. So that in the end an action was decided for a clean water distribution machine in order to increase the productivity level of the machine.

Table 2. Comparison of OEE Values

No.	Month	Clean Water Pump Machine	OEE Value (%)
1	November	Lapi I Lapi II	69.38 69.75
2	December	Lapi I Lapi II	74.02 73.65
3	January	Lapi I Lapi II	87.90 87.26
4	February	Lapi I Lapi II	90.34 85.81

IV. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusion

The Overall Equipment Effectiveness (OEE) value obtained from the JIPM Word Class calculation before repairing it in November 2019 for Lapi I was 69.38% and Lapi II was 69.75% while in December 2019 for Lapi I it was 74.02% and Lapi II at 73.65%. This value indicates that the productivity of the water distribution machine is relatively low. The six big losses factor that most dominantly affects the low level of engine effectiveness is Reduced Speed Losses for the period November - December 2019, namely 236.67% for Lapi I and 242.99% for Lapi II, After repairs in January 2020 for Lapi I amounted to 87, 90% and Lapi II at 87.26%, while in February 2020 for Lapi I it was 90.34% and Lapi II was 85.81%.

4.2 Suggestions

1. It is necessary to check before the production process starts and provide training for production operators in order to improve performance for the operation of clean water distribution machines.

2. This research is a precursor to increasing the productivity of clean water distribution machines, so it is advisable to carry out further research with different methods.

REFERENCES

[1] Winarno, H., & Ferdiansyah, F. (2018). ANALYSIS OF THE EFFECTIVENESS OF THE MILL ROUGHING MACHINE. 3 (2), 67–78

[2] Nur, M., & Haris, H. (2019). Proposed Machine Effectiveness Improvement Through TPM Implementation Analysis Using OEE Method And Six Big Losses At PT. P&P Bangkinang. 8 (1), 57–67.

[3] Mulyati, D., Sentia, PD, & A, IZ (2017). Analysis of Clean Water Distribution Machine Maintenance Using the Overall Equipment Effectiveness (OEE) Method at PDAM Lambaro Unit. II (4), 176–181

[4] Febriyanti, D., & Fatma, E. (2018). Production Machine Effectiveness Analysis Using Failure Approach and Mode Effect Analysis and Logic Tree Analysis Production Machine Effectiveness Analysis Using Failure and Mode Effect Analysis and Logic Tree Analysis. 39–47

[5] Prabowo, RF, South, JM, West, J., & Hariyono, H. (2020). Total Productive Maintenance (TPM) in Grinding Machine Maintenance Using the Overall Equipment Effectiveness (OEE) Method. 5 (2).

[6] Energy, J., Teknologi, DAN, Jetm, M., Rezza, M., Utomo, W., B, HA, & K, MN (2018). PUMP 107 MAINTENANCE PLANNING USING RELIABILITY CENTERED MAINTENANCE (RCM) METHOD IN PT. PETROCHEMICAL GRESIK. 01 (02).

[7] Anggraini, M., Khikmawati, E., & Widiastuti, H. (2017). PRESS MACHINE PRODUCTIVITY ANALYSIS USING PADAPT OVERALL EQUIPMENT EFFECTIVENESS (OEE) APPROACH. JAPFA COMFEED INDONESIA LAMPUNG. 1, 132–138.

[8] Anthony, MB (2019). Analysis of the Application of Total Productive Maintenance (TPM) Using Overall Equipment Effectiveness (OEE) and Six Big Losses on the Cold Leveler Machine PT. KPS. 2 (2), 94–103.

[9] Industry et al., (2019)Industry, PT, Teknik, F., Science, D., West, T., South, J., & Effectivness, OE (2019). BOOBTS ON PACKAGING BOX MAKING. 2–3.

[10] Jannah, RM, & Nalhadi, SA (2017). Analysis of the Effectiveness of a Centrifugal Machine Using the Ovall Equipment Effectiveness (OEE) Method. (2013).

[11] Kameiswara, RA, Sulistyo, AB, & Gunawan, W. (2018). OVERALL EQUIPMENT EFFECTIVENESS (OEE) ANALYSIS IN REDUCING SIX BIG LOSSES IN COOLING PUMP BLOWER PLANT PT. INTEGRATED STEEL FACTORY. 1 (1), 67–78

[12] Management, I. (2016). Analysis of Overall Equipment Effectiveness (OEE) in Minimizing Six Big Losses on Production Machines at UD. New life. 5 (2), 52–57.

[13] Sundana, S., Thoriq, M., & Qodri, A. (2019). Analysis of the causes of low OEE values on the Heading Machine at PT DRA Component Persada.5(1).