ANALYSIS OF MACHINES EFFECTIVENESS IN PRODUCTION FLOOR PT. 'X' USING OVERALL EQUIPMENT EFFECTIVENESS METHOD

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Abstract

The Company is increasing its production capacity in order to meet market demand. Engine performance continues to work without seeing the effect of engine performance. Companies just want to meet the needs of consumers with forgetting the actions to be performed on the machine used. The old machine has a declining performance that results in delays in the production process. Solutions to determine the factors that determine whether the engine performance decreased performance at each production process and find out the root cause of the problem, researchers using the method of Overall Equipment Effectiveness to calculate the value of machines the most critical.
Results from OEE method data processing machines used are inefficient because there are many machines that have a value below the general standard at 85% OEE. This is because performance decreases. To find out the root cause of the problem then do the fault tree analysis where done to determine the root cause of the problem from the decreased performance then found the root cause of the problem that occurred.
The root cause that occurs that includes the first two factors of the number of units manufactured and the second possible number of units. Of these two factors that cause the decrease in machine performance. *number of units manufactured is caused by long operation time and old machine life, then from old machine age caused big by bad treatment causing damage to machine component.*
Performance of the engine has decreased performance due to continuously increase its production capacity. So the solution to know the engine decline is done by using OEE method to find out the most critical machine values. The results of the OEE method show little performance due to the age of old machines, poor maintenance, and the lack of spare parts because of the expensive price.
Keywords : *Availability, Performance, Quality*

Preliminary

Background

The rapid technological advances in the field of production make the company increasing. The production capacity can meet the market demand. In general, the company is targeting how many products have to be made in one day. Performance of the engine is constantly working without seeing the effects of engine performance. Companies just want to meet the needs of consumers by forgetting the actions that must be done on the machine used.

Making the product in the production process that plays an important role is the performance of the machine, without forgetting the operator. Both the poor performance of the machine depends on the maintenance actions performed on the machine itself. This action is done to prevent breakdown and the production process continues to run.

The old machine is still used in the production process and has the same product target as the new machine. The old machine has a decreasing performance resulting in a delay in the production process. Real conditions in the company of old machines can not compete with new machines. Solutions to determine the factors that determine whether the engine performance decreased performance at each production process and find out the root cause of the problem, researchers used the method of Overall Equipment Effectiveness to calculate the value of the most critical machines in its performance that is experiencing a decline in effectiveness in each Performance and then will be followed up. After the factors that cause the engine performance decreased, the researcher made the fault tree analysis to find out the root cause of the decrease of machine performance and become the reference of improvement that will be done to improve the performance of the machine in order to fulfill the company plan. Therefore it is necessary preventive maintenance to avoid breakdown and keep the performance of the machine to remain constant, referring to the problem then the researcher conducts research with the title "Effectiveness Analysis of Machines On Floor Production PT. 'X' Using Overall Equipment Effectiveness Method " (Case Study at PT. 'X').

literature Review

Overall Equipment Effectiveness

"Overall Equipment Effectiveness (OEE) is the total measurement of the performance associated with the availability of productivity and quality of their processes. OEE measurements show how well a company uses its resources including equipment, workers and the ability to satisfy consumers in terms of deliveries that conform to customer quality specifications.

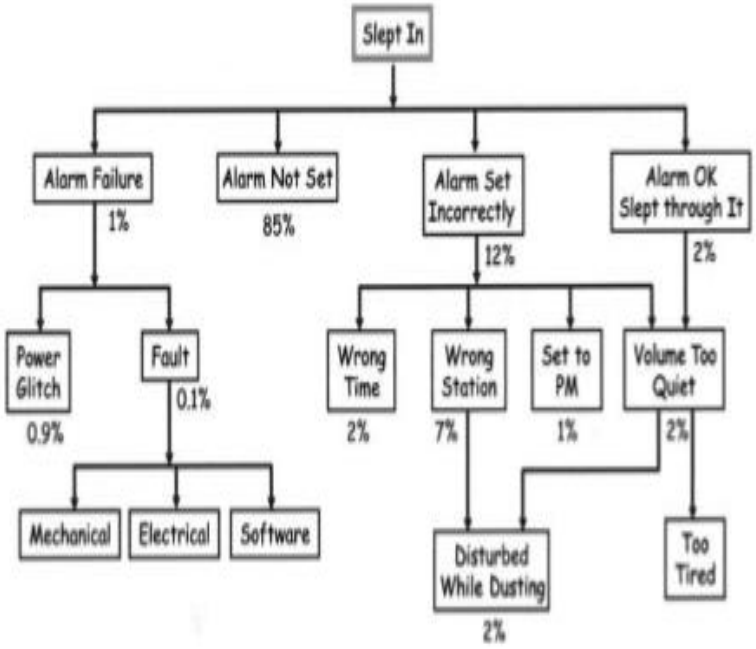
Based on the award given by Japan Institute of Plant Maintenance as the key promoter of TPM through PM Price, the ideal condition of OEE is as follows: (Nakajima, 1988, 27)

- *Availability* > 90%
- *Performance Efficiency* > 95%
- *Rate Quality Product* > 99%

Of the above three factors then for the calculation of Overall Equipment Effectiveness that is: OEE = *Availability Ratio* (%) x *Performance Ratio* (%) x *Quality Ratio* (%).

Fault Tree

"*Fault three analysis is an analytical methodology that uses graphical models to demonstrate visual process analysis. The FTA makes it possible to identify failed events based on a probability assessment of failure*. (Susetyo, Joko, 2009)"



Research methodology

After the required data is collected, the next process is to perform data processing:

Calculating the value of Overall Equipment Effectiveness (OEE)

- $Availability = \frac{(total\ time\ available - downtime)}{total\ time\ available}$
- The value of availability is obtained from the time of the production machine, the engine time to stop / downtime and then done the calculation with the OEE formula then got the value of availability of each machine.
- $Performance = (\frac{(number\ of\ units\ manufactured)}{possible\ number\ of\ units})$
- Performance Efficiency value is obtained from number of units manufactured and possible number of units. This value is derived from the production target of each machine divided by the actual value generated by each machine. Then get the value of Performance Efficience.
- *Quality* $= \frac{(number\ of\ units\ produced - number\ of\ defects)}{number\ of\ units\ produced}\ x\ 100\%$
- *Product Quality obtained from the resulting product minus the number of defects then obtained Product Quality value.*
- OEE = *Availability* (%) x *Performance* (%) x *Quality* (%)
- Create *Fault Three* analysis.

Fault Three analysis is a technique to identify the risk of failure from the root cause of the problem.

Results and Discussion

Overall Equipment Effectiveness (OEE)

From value availability, Performance and Product Quality then got value from Overall Equipment Effectiveness (OEEThe formula to determine the value of OEE is = Availability (%) x Performance (%) x Quality (%). Here is the result of Overall Equipment Effectiveness (OEE) of any blowroom machine, Carding, Drawing, Simplex, Ring Frame and Winding during the month of September 2017.

Table *Overall Equipment Effectiveness* (OEE) Blowroom Maschine

Data OEE In September						
No	***Mesin***	***Availability***	***Performance Efficiency***	***Quality***	**OEE**	***Presentase***
1	Blow Room	0.9714	0.9333	0.9920	0.8994	89.94%

Table *Overall Equipment Effectiveness* (OEE) Carding Maschine

Data OEE In September						
No	***Mesin***	***Availability***	***Performance Efficiency***	***Quality***	**OEE**	***Presentase***
1	Carding	0.9888	0.8469	0.9920	0.8307	83.07%
2	Carding	0.9888	0.7959	0.9920	0.7807	78.07%
3	Carding	0.9888	0.8338	0.9920	0.8179	81.79%
4	Carding	0.9888	0.8630	0.9920	0.8465	84.65%
5	Carding	0.9888	0.8222	0.9920	0.8064	80.64%
6	Carding	0.9888	0.8149	0.9920	0.7993	79.93%
7	Carding	0.9888	0.7230	0.9920	0.7092	70.92%
8	Carding	0.9888	0.7245	0.9920	0.7106	71.06%
9	Carding	0.9888	0.6574	0.9920	0.6448	64.48%
10	Carding	0.9888	0.7886	0.9920	0.7735	77.35%
11	Carding	0.9888	0.7974	0.9920	0.7821	78.21%
12	Carding	0.9888	0.7376	0.9920	0.7235	72.35%
13	Carding	0.9888	0.7770	0.9920	0.7621	76.21%
14	Carding	0.9888	0.7012	0.9920	0.6877	68.77%

Table *Overall Equipment Effectiveness* (OEE) Drawing Maschine

Data OEE In September						
No	***Mesin***	***Availability***	***Performance Efficiency***	***Quality***	**OEE**	***Presentase***
1	Drawing 1	0.9888	0.7341	0.9920	0.7201	72.01%
2	Drawing 2	0.9888	0.7106	0.9920	0.6970	69.70%
3	Drawing 3	0.9888	0.2053	0.9920	0.2014	20.14%
4	Drawing 4	0.9888	0.9434	0.9920	0.9253	92.53%
5	Drawing 5	0.9888	0.9591	0.9920	0.9407	94.07%
6	Drawing 6	0.9888	0.8429	0.9920	0.8268	82.68%

Table *Overall Equipment Effectiveness* (OEE) Simplex Maschine

Data OEE In September						
No	***Mesin***	***Availability***	***Performance Efficiency***	***Quality***	**OEE**	***Presentase***
1	Simplex 1	1.00	0.7194	0.9920	0.7137	71.37%
2	Simplex 2	0.9916	0.9098	0.9920	0.8950	89.50%
3	Simplex 3	0.9916	0.8954	0.9920	0.8808	88.08%
4	Simplex 4	1.00	0.8057	0.9920	0.7992	79.92%

Table *Overall Equipment Effectiveness* (OEE) Ring Frame Maschine

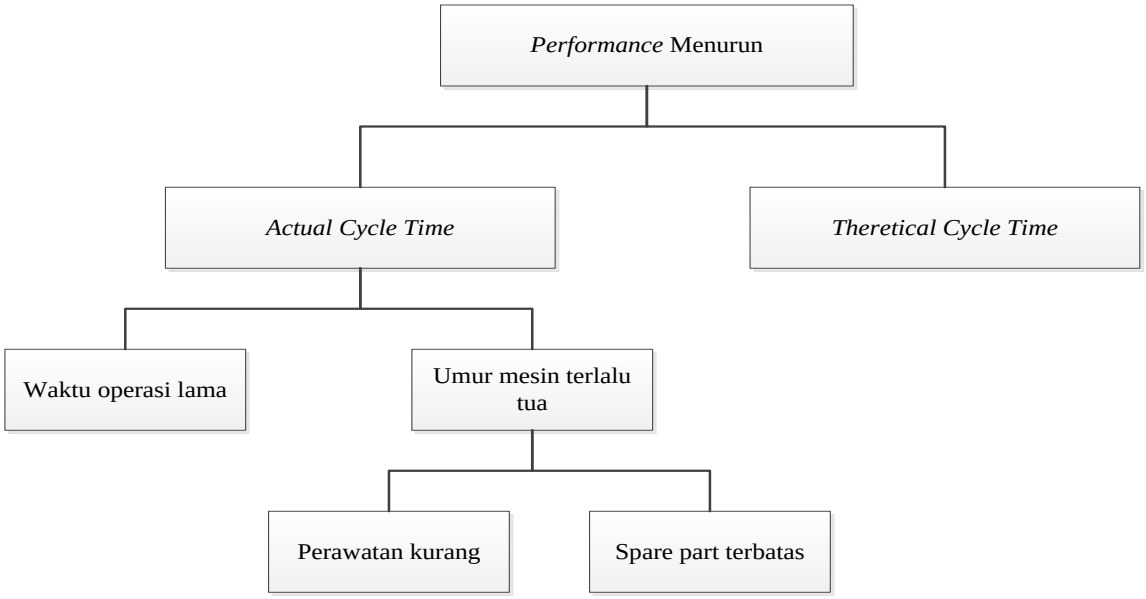
Data OEE In September						
No	***Mesin***	***Availability***	***Performance Efficiency***	***Quality***	**OEE**	***Presentase***
1	Ring Frame 1	0.9831	0.9360	0.9920	0.9128	91.28%
2	Ring Frame 2	1.00	0.9160	0.9920	0.9087	90.87%
3	Ring Frame 3	1.00	0.9200	0.9920	0.9126	91.26%
4	Ring Frame 4	1.00	0.9560	0.9920	0.9484	94.84%
5	Ring Frame 5	1.00	0.9480	0.9920	0.9404	94.04%
6	Ring Frame 6	1.00	0.9640	0.9920	0.9563	95.63%
7	Ring Frame 7	0.9916	0.9320	0.9920	0.9168	91.68%
8	Ring Frame 8	0.9916	0.9000	0.9920	0.8853	88.53%
9	Ring Frame 9	0.9916	0.9440	0.9920	0.9286	92.86%
10	Ring Frame 10	0.9916	0.9280	0.9920	0.9128	91.28%
11	Ring Frame 11	0.9916	0.9233	0.9920	0.9082	90.82%
12	Ring Frame 12	0.9916	0.9200	0.9920	0.9050	90.50%
13	Ring Frame 13	0.9916	0.9620	0.9920	0.9463	94.63%
14	Ring Frame 14	0.9916	0.9560	0.9920	0.9404	94.04%
15	Ring Frame 15	0.9916	0.9640	0.9920	0.9483	94.83%
16	Ring Frame 16	0.9916	0.9680	0.9920	0.9522	95.22%
17	Ring Frame 17	0.9916	0.9660	0.9920	0.9502	95.02%
18	Ring Frame 18	0.9916	0.9660	0.9920	0.9502	95.02%
19	Ring Frame 19	1.00	0.9792	0.9920	0.9713	97.13%
20	Ring Frame 20	1.00	0.9900	0.9920	0.9821	98.21%

Table *Overall Equipment Effectiveness* (OEE) Winding Maschine

Data OEE In September						
No	***Mesin***	***Availability***	***Performance Efficiency***	***Quality***	**OEE**	***Presentase***
1	Winding 1	0.9565	0.9240	0.9920	0.8768	87.68%
2	Winding 2	0.9655	0.8800	0.9920	0.8429	84.29%
3	Winding 3	0.9655	0.8440	0.9920	0.8084	80.84%
4	Winding 4	0.9655	0.8600	0.9920	0.8237	82.37%
5	Winding 5	0.9655	0.9040	0.9920	0.8658	86.58%
6	Winding 6	0.9655	0.8080	0.9920	0.7739	77.39%
7	Winding 7	0.9655	0.8320	0.9920	0.7969	79.69%
8	Winding 8	0.9744	0.8640	0.9920	0.8351	83.51%
9	Winding 9	0.9655	0.8640	0.9920	0.8275	82.75%
10	Winding 10	0.9655	0.8040	0.9920	0.7701	77.01%
11	Winding 11	0.9655	0.9867	0.9920	0.9450	94.50%
12	Winding 12	0.9744	0.9300	0.9920	0.8989	89.89%
13	Winding 13	0.9744	0.9280	0.9920	0.8970	89.70%
14	Winding 14	0.9744	0.9160	0.9920	0.8854	88.54%
15	Winding 15	0.9744	0.9380	0.9920	0.9066	90.66%
16	Winding 16	0.9655	0.9460	0.9920	0.9061	90.61%
17	Winding 17	0.9655	0.9240	0.9920	0.8850	88.50%
18	Winding 18	0.9655	0.9280	0.9920	0.8888	88.88%
19	Winding 19	0.9744	0.9400	0.9920	0.9086	90.86%
20	Winding 20	0.9744	0.9575	0.9920	0.9255	92.55%

Fault Tree

Analysis of the fault tree used to determine the root cause of the problem. The roots of the problems is that the value of OEE performance, the engine has decreased which will then be repaired.



Kesimpulan

a. From a study in September 2017 care was taken. The maintenance division always does the cleaning every start of the work and perform the standard maintenance procedures set by the company. However, the number of machines on the floor of production and the limited maintenance of operators resulting in not focused on the work undertaken the impact of decreased performance on the machines of PT. 'X'. Limited availability of spare parts because of its expensive price is also a constraint on engine maintenance.

b. From the data processing done then got the value of availability, performance and quality of the machines in PT. 'X'. For availability and quality value shows above average value of general standard availability 90% and quality 99%. This is said to be good because the availability value has a small down time value on each machine and quality has a 0.8% reject on each of its production. For performance values have a percentage under the general standard of 95%. This is because the first two factors of the number of units manufactured and the second possible number of units. resulting in a small performance value.

c. To find out the root cause of the problem then do the fault tree analysis where it is done to determine the root cause of the problem, from the performance that decreased in the root cause of the problem that occurred. The root cause of what happened which includes two factors the first of a number of units manufactured and the second possible number of units. Of these two factors that cause the decrease in engine performance. number of units manufactured is caused by long operation time and old machine life, then from old machine age caused big by bad treatment causing damage to machine component. Engine damage resulting from replacement of spare parts on the engine components. Lack of spare parts and expensive price.

Bibliography

1. Borris, Steven. (2016), *Total Produktive Maitenence*, McGraw-Hill, United States of America.
2. Davis, R.K. (1995), *Productivity Improvement Trough TPM*, Prentice Hall. London.
3. Nakajima, Seiichi. (1998), *Introduction to TPMal Productive Maintenance*, Productivity Press, Inc. Cambridge, Massachusetts.
4. Rahmad, Pratikto, Wahyudi,Slamet (2012). Application of Overall Equipment Effectiveness (OEE) In Implementation of Total Productive Maintenance (TPM) (Case Study at Factory Gula PT. "Y".) Journal of Mechanical Engineering Vol.3, No.3
5. Said, Joko,Susetyo. (2008). Analysis *Total Productive Maintenance* On the Production Line Machine Tools To Improve Corporate Performance. National Seminar on Science and Technology Applications.IST AKPRIND Yogyakarta
6. Sudrajat, Ating. 2011. Practical Guidance: Industrial Machine Maintenance Management. Bandung.
7. Susetyo, Eko, A. (2017). Analysis *Overall Equipment Effectiveness* (OEE) To Determine the Effectiveness of Sonna Machines Web. Journal *Science Tech*. Vol.3, No.2
8. Susetyo, Joko. (2009). Analysis of Quality Control and Effectivity With Integration Concept Failure Mode & Effect Analysis and Fault tree Analysis As Well Overall Equipment Effectiveness. Journal of Technoscientia Technology.Vol.2, No.1