

Effect of Total Productive Maintenance (TPM) on the Overall Equipment Effectiveness (OEE) On Production Line Bottled Water Bottle

(Case study Beverages PT. "XYZ")

Doni Susanto ST¹⁾ and Ir. Isdaryanto Iskandar M.Sc IPM²⁾

Fakultas Teknik, Universitas Katholik Indonesia Atma Jaya

Jln. Jend. Sudirman No 51, Jakarta 12930

Donisusanto09@gmail.com

Abstract

PT "XYZ" is beverage company with bottle as its main packaging. It is important for the company to focus on the productivity which can be done through Total Productive Maintenance (TPM) method. This method uses all the elements that exist in the plant to improve the productivity. Previously maintenance was carried out in part, now transformed into integrated process from upstream to downstream, which taking other elements into consideration, not only machine, but also human, methods, environment and materials.

Plant's productivity level can be seen from Overall Equipment Effectiveness. In this study, we will discuss on the OEE achievement. In 1st period, OEE achievement was reached at 65.84% and at 7th period OEE had reached at 82.75%. Data was collected and take for one month period. This research also will explain the causes why the OEE results were up or down to prove the key success of the OEE improvement not only from the machine/engine factor, but other factors also contributed.

Keywords : Total Productive Maintenance, Overall Equipment Effectiveness

I. INTRODUCTION

PT "XYZ" have many varieties of products. In this study we only discuss on bottled mineral water. The company put high priority on the quality of the products they produce. The company is really concerned on doing regular maintenance of the machines in order to keep the high standard of the quality. This observation was made at PT "XYZ" and focused on the results of Overall Equipment Effectiveness for 7 period. On the 7th period, the result was showed an increase of the value of Overall Equipment Effectiveness. Keegan Muluh Cheh. (2014)] said the average OEE each industry in Sweden and he also explained lack of competency of the worker who working on their fields.

II. LITERATURE REVIEW

II.I Total Productive Maintenance (TPM)

According to the site that I read [1] Total Productive Maintenance is a concept that makes the operator empowered to be involved in maintaining their own equipment, and with a proactive and preventive maintenance that will be the basis for an increase in a production so will result in less damage or no damage, fewer stops, and no defects. TPM program creates a shared responsibility for the equipment manufacturer. In the right environment can be very effective in increasing productivity (increasing time, reduce cycle time, and eliminate defects).

II.II Fishbone Diagram

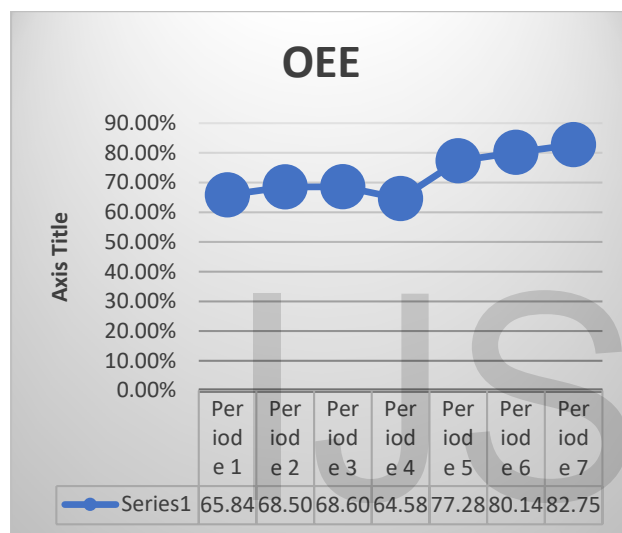
Fishbone diagram is a diagram of "cause and effect" with a visual method to look at the relationship

between the problem and the source of the problem potential. This method is used for a simple approach to reducing the effects of a problem. There are six main branches, namely the material, human / labor (people), machine, method (process), and the measurement environment. [2]

III. DISCUSSION

Overall Equipment Effectiveness Data obtained at PT "XYZ" is as graph follows :

Graph 1 Data Achievement OEE.



Data is obtained from the formula $OEE = \text{availability Rate} \times \text{Performance Rate} \times \text{Quality Rate}$. This is an example calculation how to get the data OEE in period 1, for the data availability Rate for the period 1 equal to 66.56%, 99.59% and the rate performance for Quality rate 99.33%, then if inserted into the formula $OEE = 66.56\% \times 99.59\% \times 99.33\%$ to 65.84%.

In 1st period OEE was at 65.84% due to lack of the worker's experiences and methods in solving the problems because they did not fully understand how the machine works. After the company conducted trainings to the workers such as operators and technicians, OEE increased to 68.50%.

In second period to the third period OEE increased by 0.1%. PT "XYZ" reduced the downtime by focusing on engine and invited some technicians from the engine maker/manufacturer to support to reduce the

downtime. The findings were some machines settings were incorrect and the machine was dirty with dust.

In the fourth period, OEE decreased from 68.60% to 64.58% due to the supply of raw material for carton machine was not comply with the existing standards, which causing OEE impairment. After complaints and improvements from the carton supplier OEE increased in the 5th period to 77.28 %.

In the 6th period increased from 77.28% to 80.14% as the company started to discipline labor/workers for not doing machine settings that should not be done,

OEE improvement is not solely derived from engine maintenance course, all of this derived from the methods performed by the engineering team working with the production team. Below are the following method :

1. Conduct daily meeting to discuss problems / downtime that occurred on the previous day, find the root cause and the action plan to solve the problems
2. Conduct weekly meetings to accommodate the problems / downtime which needs special actions (corrective maintenance and preventive maintenance)
3. Evaluate of maintenance activities that have been carried out
4. Conduct data collection to calculate processing downtime data of data OEE during a period that has been carried out and take biggest problem using Pareto with downtime 80% and then do breakdown (fishbone as is done in [3] using a fishbone in order to know the root of the problem and do action to address problems /the downtime.)

PT "XYZ" has maintenance system cycle align with production time, where maintenance is done every 5 days with consideration of time availability of machines to perform a production cycle to produce assured quality products.

Below are the problems during period 1-7 which will be explained using fishbon method to support an increase in OEE

Human

Lack of understanding and knowledge of the machine work flow, less caring of the machine operator who

handled the machine and less skillful operator/worker who dealing with the problems.

Method

Lack of supervision of the machine safety system and the cleaning process has not done well

Machine

Machine setting is not standard, the operator always changes the machine parameters, forget to do the settings when there is a change over the product type, less lubrication in machine area especially conveyors

Material

Most of the materials are not followed the company standards, such as the size and the material of the carbon box, the cap, the system that connected to sleeve company.

Environment

Dust in the area downstream machine

Bibliography

1. <https://www.leanproduction.com/tpm.html>
2. <https://leanmanufacturing.online/the-fishbone-diagram/>
3. Keegan Muluh Cheh. (2014). Analysis of Overall Equipment Effectiveness (OEE) within different sectors in different Swedish industries pp, 50-51
4. SRVijayakumar and S. Gajendran. (2014). Improvement Of Overall Equipment Effectiveness (OEE) In Injection Molding Process Industry. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), 59
5. Melesse Workneh Wakjira, Ajit Pal Singh. (2012). Total Productive Maintenance: A Case Study In Manufacturing Industr. Global Journal Inc. (USA), Vol 12 (1), 31

IV. CONCLUSIONS AND SUGGESTION

Based on the observations and research conducted at PT "XYZ" indicates an increase in OEE from period 1 to period 7, and the highest increase reached 82.75%. This study proved that in the improvement process of OEE, there are several factors influences. Not only coming from the engine, but insufficient knowledge of the workforces that will caused less precise when the problem occurred and also quality issue of raw materials of carton machinery that causes engine performance drop. If the company implement Total Productive Maintenance in proper way, it will gain increasing OEE. TPM results are known and a strategy to increase OEE as highlighted in the study [SRVijayakumar and S. Gajendran. (2014);Melesse Workneh Wakjira, Ajit Pal Singh. (2012)], Of several journals and research conducted most important factor in running a company TPM is to be consistent to what has been a joint decision and support in terms of facilities and infrastructure required to improve the OEE.