

# A case study for Overall Equipment Effectiveness improved in manufacturing industry

Dr. A. J. Gujar<sup>1</sup>, N. M. Kambale<sup>2</sup>, S. D. Maner<sup>3</sup>, S. S. Joshi<sup>4</sup>, S. G. Chandne<sup>5</sup>, A. A. Chavare<sup>6</sup>.

<sup>1</sup>Professor, Dept. of Mechanical Engineering, D. Y. Patil College of Engg & Technology, Kolhapur, Maharashtra, India.

<sup>2,3,4,5,6</sup>Student, Dept. of Mechanical Engineering, D.Y. Patil College of Engg. Kolhapur, Maharashtra, India.

\*\*\*

**Abstract** - Industries are working hard to set a benchmark in this period and they are constantly focusing to increasing their production and efficiency. Overall equipment effectiveness (OEE) helps to increase efficiency and effectiveness of the industry. Availability, performance rate and quality are the three factors of OEE if these three factors collectively gives above 95% then that industry gives better performance. In this paper while collecting data of three OEE factor we also used work study, time study method which is also helps to reach towards the solution. In our study it is found that we need to focus on to improve in performance rate which is below than 95%. It is concluded that maintaining this factor above 95% and small changes in operation flow process will enhance the efficiency of the industry.

**Key Words:** Overall Equipment Effectiveness, Work Study, Time Study, etc.

## 1. INTRODUCTION

To achieve the sustainable growth, it is essential to proper utilization of resources. Maintaining continuous profit of any industry is largely depends on minimizing excess work and productivity improvement. Productivity measurement turns a comparison of outputs to inputs.

**Productivity = output / input**

Overall equipment effectiveness (OEE) clearly shows current status of production with minimum calculation which also helps to find out bottlenecks in the system and diverted our attention towards it. It also shows scope of improvement. We choose Avison industry to carry out our study. Statistical data collected from Avison Industry results into useful information for improvement area. This paper will thoroughly focused on Overall equipment effectiveness (OEE) in Avison industry Kolhapur and OEE indicated by the industry performance for manufacturing.

**OEE (%) = Availability rate × Performance rate × Quality**

## 2. METHODOLOGY

Various parameters of OEE, contributes to overall OEE in different manner. In this paper, by using trial and error method we reached up to the solution of the problem. While

carried out this process we also used work study and time study methods to getting macro view on this production process. In work study method, step by step procedure is the most important for improving productivity to reduce work content of particular products. Here is given key steps of this study. We try to develop a conceptual framework for our work. This frame helped to accomplish our research work in systematic way.

In this study we used following steps:

1. First we select a machine shop where we do study of specific production process.
2. After that we selected a specific production line for accomplishing our study.
3. We observed all the particular operations with the help of stopwatch.
4. After observing all the operations, identified the existing problem by critical questioning technique.
5. After identifying problems, we developed new method or process for particular products.
6. When our proposed method applied to this particular product, the productivity has been improved.

Our contributed research objectives are:

1. Analyze the production system with the help of work study technique for productivity improvement. I.e. improvement in effectiveness of the equipments.
2. Identify the existing problem in a particular production line and develop new system with the help of critical analysis.

## 3. DATA COLLECTION

Following product dimension taken into consideration:

Height of the lever = 146.82 mm

Length of the lever = 64.63 mm

Outer diameter of lever where operation is performed = 18.2 mm

Inner diameter of lever where operation is performed = 8 mm

Production / Day (drilling) = 380 Nos

Production /Day (whole process) = 135 Nos

Material of the lever = Cast iron

Material of the tool = Carbide tool

#### 4. PROBLEM IDENTIFICATION

Above 95% considered as better performance of the equipments. OEE calculation by using table no. 1 data it is clearly seen that, performance rate are poor of the whole process i.e. below 95%

Here we need to increase performance rate without hampering other parameters. Hence we asking question critically to every point of the whole process and observe the following points:

1. On top face of the lever one hole of  $\Phi 7.8$  mm being drilled by using conventional drilling machine, actually it is difficult to find out correct center positions of lever top face hence drilled hole shift sometimes during drilling operation.
2.  $\Phi 7.8$  mm drill is used to drilling operations, as more material is removed and due to absence of any cooling medium temperature of drilling face increases. Then immediately operator change to reaming tool and perform reaming operation and check whether GO gauge is going or not. This is all happened when temperature of drilled face is more and then problem is come forward when temperature falls down.
3. Non value added processes are taking more time whilst whole production.
4. Heat transferring medium is absent.
5. Backtracking is more as compared to other products.
6. Job handling and temporary storage amid operation is more.
7. Tool substitution and fixture redesigning is necessary.

#### 4. CALCULATION

$$\text{Availability} = \frac{\text{Calendar hour} - (A+B)}{\text{Calendar hour}} \times 100$$

A = Preventive maintenance + Production planning

B = Complete failure of m/c + Loss due to process failure

Performance rate =

$$\frac{\text{Actual production in available time}}{\text{Actual production in available time due consideration of PRT}} \times 100$$

Planned rotational time (PRT) =

Loading time+ Planned process time+ Unloading time

Quality rate =

$$\frac{\text{Total production} - (\text{Rejected product} + \text{Reworked product})}{\text{Total production}} \times 100$$

Following calculation is done by using table no. 1 values:

#### Availability calculation:

Calendar hour = 24

Available hour =  $24 - (0.35+0.30+0.55) = 22.8$

Availability =  $(22.8 \div 24) \times 100 = 95\%$

#### Performance rate:

Planned rotational time = 9 min

Expected production in available time (in hour)

=  $(22.8 \times 60) \div 9 = 152$

Actual production =  $(126 + 3 + 4) = 133$

Performance rate =  $(133 \div 152) \times 100 = 87.5\%$

#### Quality rate:

Total production = 133

Rejected product = 3

Reworked product = 4

Quality rate =  $(133 - 3 - 4) \div 133 = 94.73\%$

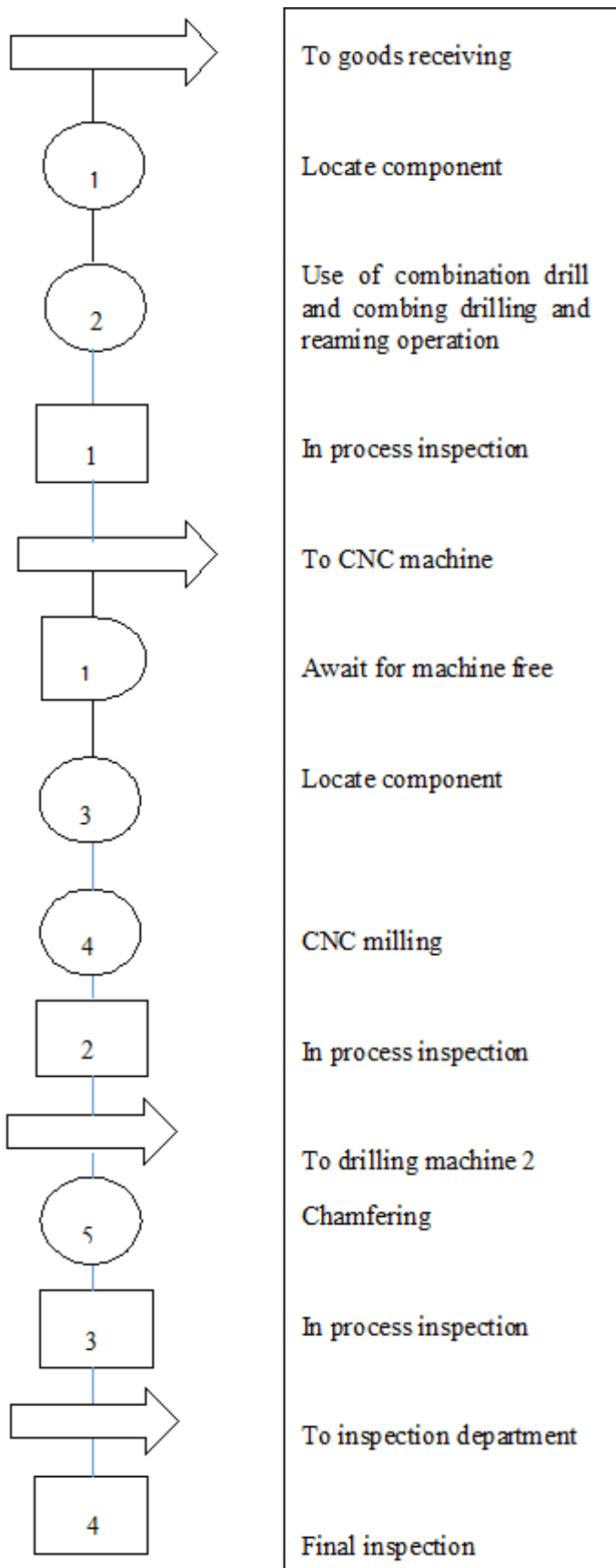
From above calculations, it is clearly seen that performance rate is below than 95% which is a minimum limit of the better performance of any equipments.

| Shift | Halt Period  | Reason                                 | A   | B | C |
|-------|--------------|--|-----|---|---|
| 1.    | 0.35<br>Hour | Current OFF, Raw Material Availability | 45  | 0 | 1 |
| 2.    | 0.30<br>Hour | In process Inspection, Correction time | 43  | 2 | 1 |
| 3.    | 0.55<br>Hour | Due to Planning                        | 38  | 1 | 2 |
|       | 1.2<br>Hour  | Total                                  | 126 | 3 | 4 |

Table -1: Observed value of day 12 September 2018

A= Accepted Product  
B= Rejected Product

C= NO. Of reworked product



### 5. SOLUTION

After doing calculations and identifying problem, we try to solve problem by using trial and error method. We check all possibilities in step by step manner. After using different methods and techniques we enlist the following solutions.

1. for Hole shifting problem we taken proper rib dimensions from customer i.e. after drilling minimum thickness of rib is allowed up to 3mm. hence it is possible to inspect visually during process and rework is also reduces due to preliminary finding of problem.

2. We already get allowance from customer, amid we modified GO-NOGO gauge. We give linear scale to end of the GO side of the gauge. Due to this modification inspection frequency is minimizes.

3. To deal with thermal expansion problem, we combined drilling and reaming operation by using combination drill, here one operation is automatically eliminated as well workers fatigue also reduced. To minimize thermal expansion problem we also check possibilities of using cutting fluid and compressed air during operation but this escalates another problem and some modification. After analyzing more area we realized that, this problem is created negligible rejection and rework.

4. After carefully analyzing operation flow process chart, we decided to change the sequence of operations. Drilling operation is created more no of rejection and rework. In previous flow process CNC milling is done before drilling. CNC machining cost is too high as compared to drilling cost, if in any circumstances drilling operation is not according to design, product rejected but here we successfully save CNC cost. as well to avoid backtracking and improper job handling we created excel sheet to monitories whole process and give instruction to production head to procure raw material exactly according to planning. This all things are considered while developing new operation flow process. This new flow process is shown in figure 1.

### 6. CONCLUSION

OEE is the performance measure of any equipment which is a product of three factors availability, performance rate and quality rate. These factors are depending upon various parameters in manufacturing industry. If these three factors are above 95% then it's conceded to be better performance of the industry. In our study, we clearly had seen that it is necessary to improvement in performance rate. After application of solutions and doing calculation of using new data we cross the slab of 95%. To achieved the OEE of 89.12%, improve values are Availability 95.12%, Performance Rate 96.37%, Quality Rate 97.23%.

Figure -1: modified operation flow process chart

**REFERENCES**

- [1] M. VivekPrabhu, R. Karthick, Dr. G. Senthil Kumar, march 2014, "Optimization of Overall Equipment Effectiveness in A Manufacturing System", *International Journal of Innovative Research in Science, Engineering and Technology*, Vol. 3, pp.1193-1196.
- [2] Priyanka Yadav, Suman Sharma, "A Case Study of Plant Layout: To Compare Production Efficiency Of Manual Plant Layout And Computerized Plant Layout Using ARENA Software", *International Journal of Engineering Research and General Science Volume 4, Issue 4, July-August, 2016*.
- [3] T Viswajit<sup>1</sup>, T Ravi Teja<sup>2</sup>, Y P Deepthi<sup>3</sup>, "A Case Study Of Printing Industry Plant Layout For Effective Production", *International Conference on Functional Materials, Characterization, Solid State Physics, Power, Thermal and Combustion Energy, AIP Conf. Proc. 1859, 020066-1-020066-7; doi: 10.1063/1.4990219, Published by AIP Publishing. 978-0-7354-1533-1/\$30.00*
- [4] Md. Abdul Moktadir, Sobur Ahmed, Fatema-Tuj-Zohra and Razia Sultana, *Productivity Improvement by Work Study Technique: A Case on Leather Products Industry of Bangladesh, Ind Eng Manage, an open access journal, Volume 6 • Issue 1 • 1000207*.
- [5] Mr. Satish Keru Raut, Prof. Kedar M. Relekar, Mr. Vikas Sarjerao Dhane, " A Case Study of Productivity Improvement by using IE Tools", *International journal of innovations in engineering research and technology [ijert]*, volume 1, issue 1 nov-2014.
- [6] S.R.Vijayakumar<sup>1</sup>, S.Gajendran<sup>2</sup>, "Improvement of overall equipment effectiveness (OEE) in injection moulding process industry", *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e- ISSN: 2278-1684, p-ISSN: 2320-334X PP 47-60*.
- [7] *Additive Manufacturing - From Trial and Error to a True Revolution by Dominic Galileo - President & CEO, MSC Software August, 2016*.
- [8] B. Lathashankar<sup>1</sup>, G. Ashritha, S. Asma, K. Shivam, K. Nitesh, " Cycle time reduction in manufacturing industry by designing a dedicated fixture: A case study", *International Journal of Engineering, Science and Technology Vol. 10, No. 3, 2018, pp. 34-42*.
- [9] H. Abdul Samat<sup>1</sup>, S. Kamaruddin<sup>2\*</sup> & I. Abdul Azid<sup>3</sup>, "integration of overall equipment effectiveness (OEE) and reliability method for measuring machine effectiveness", *South African Journal of Industrial Engineering May 2012 Vol 23(1): pp 92-113*.
- [10] D.H. Stamatis, "The OEE Primer Understanding Overall Equipment Effectiveness, Reliability, and Maintainability", 2010, Taylor and Francis Group.