

# The Use of Work Measurement to Increase Productivity and Optimizing Manpower

**Jayesh Patil<sup>1</sup>**

Dept. of Mechanical Engineering  
Lokmanya Tilak college of Engineering  
Navi Mumbai, India

**Nasir Shaikh<sup>2</sup>**

Dept. of Mechanical Engineering  
Lokmanya Tilak college of Engineering  
Navi Mumbai, India

**Sameer Pal<sup>3</sup>**

Dept. of Mechanical Engineering  
Lokmanya Tilak college of Engineering  
Navi Mumbai, India

**Subhashish Parhi<sup>4</sup>**

Dept. of Mechanical Engineering  
Lokmanya Tilak college of Engineering  
Navi Mumbai, India

**Abstract** - In our project we intended to study cycle time at different work stations and to calculate process time of various processes, so as to minimize the cycle time and to increase productivity. To improve productivity we need to minimize cycle time of workstation taking longer time. After observation we have found that the cycle time of assembly station is more. By reducing repetitive jobs and bottle-neck operations at the particular workstation is necessary to reduce cycle time. Use of recording techniques and layout study helps in reducing time which ultimately increases productivity by reducing inefficient time.

**Key Words:** Productivity, work study, time study, layout study, maintenance

## 1. INTRODUCTION

Production is defined as process of transforming a set of input into output and productivity is generating more output without consumption of much resources.

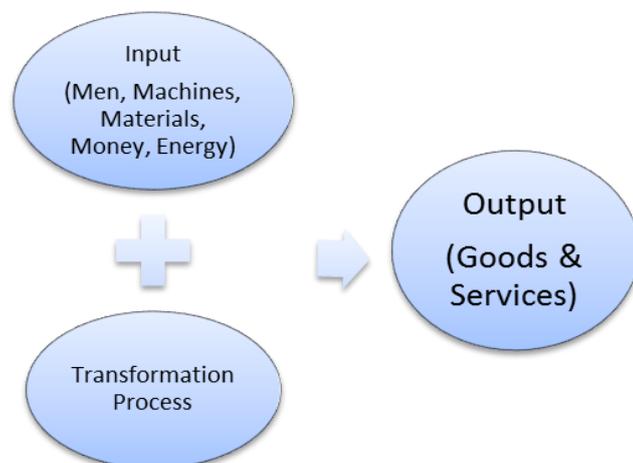


Fig -1: Production system

Productivity said to be increased when more output is produced with same input. Work study procedure efficient way to increase productivity. Work study is a method of improving production efficiency by cutting down unnecessary operations.

Time study is a technique of work study, with help of which standard time calculations for particular process is done. We have used time study technique for a process which takes longer time to complete, results of time study helps in manpower planning. Our project is intended to make processes better by reducing cycle time so as to increase productivity.

### 1.1 Work Study

Work study aims at enhancing the existing process by finding efficient way of doing work and by determining the standard time for work performance. Work study has two components, first is method study and second is work measurements.

In which method study is concerned with reduction of content of work or process of job or operation, whereas work measurements is mostly concerned with investigation or analysis of process and time related to it and establishing standard time for the operation when whole process is carried in improved manner, as determined by work study.

### 1.2 Work Measurement

Work measurement is use of such technique which is designed to establish time for a worker to carry out a task at defined rate. In order to study the process or operation for analysis, there are different techniques used like

1. Time study (stop watch technique)
2. Synthesis
3. Work sampling

4. Analytical estimating
5. Predetermined motion and time study

We have used time study technique, as it is easiest method for recording the times for specific job or process and to determine the time required for performing the job at defined level of performance. Time study is done particularly by using pen and stop watch to record the motion of worker and time required and recording it on different charts.

### 1.3 Procedure of time study (stop watch technique):

There are seven steps in time study and they are as follows:-

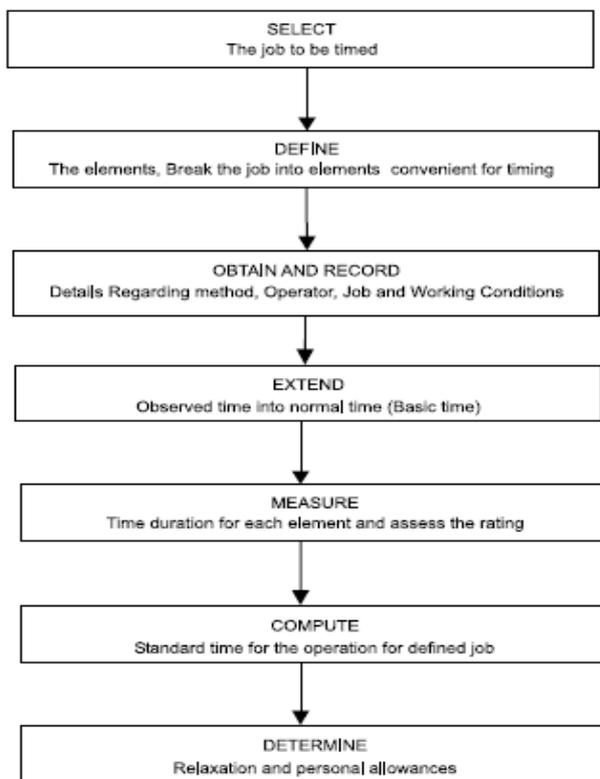


Fig -2: Steps to do time study

### 1.4 Stopwatch Technique

In this technique, the time taken by the worker for an operation is measure using stop watch. Then it is recorded on the chart using pen

Equipment required:

1. Stop watch
2. Time recording chart
3. Pen

The stop watch procedures for collecting Time study data are listed below:

- a) Analyzing the job in order to establish the quality that is to be achieved in the job.
- b) Identification of crucial operations which are to be timed in the job.
- c) Achieve improved procedure from the method study department.
- d) Organization of resources and also to explain the objectives to the supervisor and worker regarding time study.
- e) Details of improved working procedures to be explained to the workers.
- f) Break operation into sub-operation to separate the constant elements from variable elements.
- g) The time taken by an operator shall be observed and recorded.
- h) Determining the time for number cycles to be timed and then average or representative can be evaluated accordingly.
- i) Allotting the rate of performance during the observation for the worker.
- j) By using performance rating factor calculating normal time from observed time.
- k) In order to obtain standard time or allowed time add all the allowances.
- l) By the addition of allowances and normal time determine the standard time.

### 2. Time study observations

After selecting a process to study, we selected four skilled welders to study, then taking information about job and the working condition likely to affect the time study work. We measured the process time of individual welder for that job, by means of stopwatch.

Summary of observations was obtained from time study and standard time is calculated as shown in table. Operation, transportation and delay time of individual workers are mentioned in table. Allowances are already given to the welders and not mentioned in the chart.

Table -1: Summary of Observations

Processes	Time required for welders (Min)			
	Welder A	Welder B	Welder C	Welder D
Operation	84.3	64.78	73.38	68.72
Transportation	5.13	5.13	3.55	16.65
Delay	42.5	62.02	55	46.57

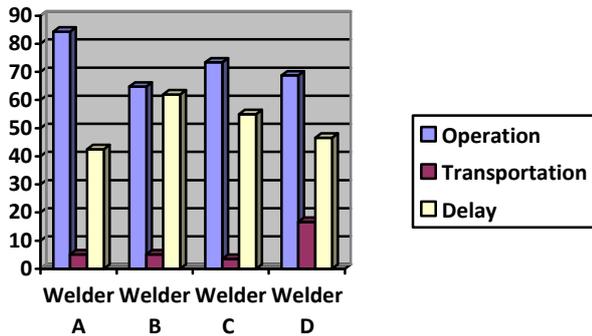


Chart -1: Summary chart

### 3. DISCUSSION ON ANALYSIS

After the analysis of the process and time study done the following are the observations made.

- Since the operation time of welder is of importance, the average delay of welder is approximately 39.05% of total operating time at assembly station.
- Operation time which we have calculated does not contain any allowances for the worker.
- By the observations made during the manual time study, the delay of welder is more.
- The welder has to wait for the parts to be grinded and arrive at the assembly station.
- Sometime welder has to clean the welding equipment and to set the equipment.
- Welder has to wait for the job to get cold for further process since welding cause heating of the job.
- The average transportation of welder at assembly station is around 5.77% of total operating time at assembly station, which includes bringing parts, spraying coolant on welded parts.
- The average operation time of welder at assembly station is approximately 55.18% of total operation time.
- The main aim is to reduce the delay at the assembly station.

### 4. CALCULATION

The total process time and man required for the process is given in above table. All man has 8 hr. working shift, so total working time is multiplication of number of man and working shift time and Rate is ratio of total process time and total working time.

Total working time = No. of men \* Working shift time

Rate = Total process time/Total working time

1) Total working time of Base plate = 10 \* 8 = 80

Rate of base plate = 80/17 = 4.7

Process	Total Process Time (hr.)	No. of workers required	Total Working Time (hr.)	Rate
Base Plate	17	10	80	4.7
Sub-Frame	16	8	64	4.57
Stabilizer	3.5	2	16	5.33
Assembly	18	6	48	2.67
Inspection	4	2	16	4

### 4.1 By Proposed method

As we can see the lowest rate is of assembly process, which is 2.67, so we have done time study of assembly and we came to know that average delay of welders is around 39.05% of total time of required for assembly. If this delay is reduced or if these welders assist in other processes then overall cycle time will be reduced and ultimately no. of components will increase.

Total delay in hours

39.05% of 18 hr = 7.03 hr

If this much time is utilized, and then rate of assembly will be

$4.8 / (18 - 7.03) = 172800 / (64800 - 25308)$

= 4.37 products per day.

If we can reduce delay to around 3 hr. from total assembly time we can get 4 complete products at the end of the day

### 5. Recommendations for Management

- Ergonomics helps in enhancing efficiency by reducing errors, working stress and fatigue of workers which in turn increase productivity.
- Proper management should be there to utilize full potential of workers.
- A good wage system should be there to keep worker motivated.

- Wage system should provide rewards to improve employee motivation and loyalty.

## 6. CONCLUSIONS

Time study and manual observation of the present method of production indicates that, in company, time taken by longest process is reduced by bringing more workers together at that workstation, but at the same time other processes are delayed. By applying work measurement techniques, we have noticed that the work measurement technique helps in proper manpower planning, with help of that company can minimize the delay in the total time of welders. It helps in reducing repetitive activities, which ultimately reduce fatigue of workers. Alongside implementation of proper plant layout helps in effective utilization of men, equipment and space. The purpose of work measurement is to set a standard time of operation, reduce cycle time, which results in increase in no. of products fabricated.

## 7. REFERENCES

- [1] Mr Sujay Biswas, D. A. (2016). "Improving productivity using work study techniques". International Journal of Research in Engineering and Applied Sciences (IJREAS), 49-55.
- [2] Mutombozana Tapiwa, M. K. (n.d.). "The use of work study techniques in optimizing manufacturing plant maintenance processes". International journal of Science and Research (IJSR).
- [3] Telsang, M. (N.D.). Industrial Engineering And Production Management . S. Chand.