Time Study Techniques in Manufacturing for Enhancing Productivity
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Abstract— The most widely tackled issue is how to improve efficiency and productivity. Time study technique is one of the productivity improvement techniques used in many manufacturing companies. Motion and time study is defined as a scientific analysis method designed to determine the best way to execute the repetitive task and to measure the time spent by an average worker to complete a given task in a fixed workplace. In manufacturing industries, assembly line is also another major area to be taken into consideration for increasing productivity. Throughout the study, the aim is to propose a new system to the related company to increase their productivity. The purpose of this paper is to discuss related issues of time study implementation and assembly line balancing and its influence toward productivity improvement.

Key words: Time study, Productivity, Cycle time, Boring

I. INTRODUCTION

Productivity improvement is one of the core strategies towards manufacturing excellence and it also is necessary to achieve good financial and operational performance. It enhances customer satisfaction and reduce time and cost to develop, produce and deliver products and service. Productivity has a positive and significant relationship to performance measurement for process utilization, process output, product costs, and work-in-process inventory levels and on-time delivery. Improvement can be in the form of elimination/ correction (repair) of ineffective processing, simplifying the process, optimizing the system, reducing variation, maximizing throughput, reducing cost, improving quality or responsiveness and reducing set-up time.

The systematic application of method study, and time study to improve productivity, reduce costs and improve profits. To execute all of these efficiently time study is one of the crucial operation need to perform. This paper focuses on developing a time study for a reputed furniture industry. The objective is to establish a time standards for carrying out specified job and thus helping the company in scheduling.

One problem of time study is the Hawthorne Effect where it is found that employees change their behavior when they know that their being measured. Work Study has conducted in many sectors. One of the hallmarks of leading-edge organizations – be they public or private – has been the successful application of performance measurement to gain insight into, and make judgments about, the organization, and the effectiveness and efficiency of its programmers, processes, and people[2]. To improve productivity and efficiency this technique has been widely used. It is suggested that these techniques are applicable to libraries and librarians and will become increasingly useful as the problems of increased work loads become more severe. The research based on industry, there we are going to work on time study analysis by using stop watch technique. In the furniture Industry we worked on Multiple Boring Machine. Our objective is to reduce the lead time of work process by applying time analysis. For this purpose we are using Time study stop watch method. The target is given to the operator to carry out 1000 stroke per shift. This is the same target for each day of each shift. Our work is there it is possible to reduce the lead time and increase productivity by the use of stop watch time study method and we were work on it.

II. LITERATURE REVIEW

Stopwatch time study measures how long it takes an average worker to complete a task at a normal pace. A “normal” operator is defined as a qualified, thoroughly experienced operator who is working under conditions as they customarily prevail at the work station, at a pace that is neither fast nor slow, but representative of an average. The actual time taken by the above average operation must be increased, and the time taken by the below average must be reduced to the value representative of normal performance.

Performance rating is a technique for equitably determining the time required to perform a task by the normal operator after the observed values of the operation under study have been recorded (Nakayama, 2002) Hence, when a work is measured with the stop watch device it is known as stop watch time study method.

Stop watch time study method is a technique of establishing an allowed time standard to perform a given task with the help of stop watch along with due allowance.

When a stop watch is used as a work measurement technique to record times and rates of working for the element of specified job carried out under specified conditions and for analyzing the data so as to obtain the time necessary to carry a specified job at specified level of performance is referred to as stop watch time study method. Frederick W. Taylor started to develop time study in 1881 when he started measuring time at a machine shop at home with stopwatch and clipboard. That was the beginning of time study. Even Taylor used stopwatch, as basic tool for recording time, present 101 tools hasn’t changed much. Today besides standard tools of time study, stopwatch and clipboard, we use digital stopwatches, computers, barcodes and accustudy software(Izetbegovic, 2007)104 or repetitive jobs, jobs with longer cycle time, to check correctness of existing time, comparison of two methods etc.

The development in multiple boring machine is to increase of the number of holes each line can bore. In the past we had 21 holes on our larger single line drill. To make the machine more efficient and able to cycle one time for an upper and lower cabinet side we increased the number of spindles per head to 23. On our larger double row system/line boring machines, we increased the number of spindles from 21-23-25-27 to increase productivity on the closet thru boring application.
III. MULTIPLE BORING MACHINE

In machining, boring is the process of enlarging a hole that has already been drilled (or cast), by means of a single-point cutting tool (or of a boring head containing several such tools), for example as in boring a gun barrel or an engine cylinder. ... The first boring machine tool was invented by John Wilkinson in 1775.

The multiple boring machines have been designed for simultaneous drilling of up to 23 holes in plates at angle of 0 to 90°. Machines that are better set up for quick changeovers for short runs and quicker set up time, such as pneumatic flip stops that can be preset and pneumatically engage and disengage once set at the touch of a button, allow for utilizing the machines potential with almost no down time for machine set up. We also have fence turret stops that again can be preset for predetermined fence positions so you can move the back fence to a set position, change it and come back exactly to the previous position and continue on where you left of with (virtually) no error in moving the fence back by reading just scale.

Features of Multiple Boring Machine:
1) The machine is constructed of single line horizontal boring unit.
2) The boring unit can be charged from horizontal to vertical drilling with pneumatic setting.
3) Boring unit can be tilted manually for angular drilling.
4) Entire boring cycle can be and conveniently accomplished by pressing on the foot switch pedal.
5) Drill feed speed can be conveniently adjusted on the control pedal.
6) Standard furnished with 21277 spindle boring heads.
7) Two fences provide convenient positioning of the work price.
8) Mechanical digital reed acts are provided for each boring unit providing accurate adjustment.
9) Speed stabilize available providing smooth feeding of the work price.
10) The depth of drilling is control by six boring depth selectors.
11) The rule gauge is equipped with adjust stoppers for repetitive drilling operation.
12) Quick release checks provide convenient charging of boring bits.

IV. TIME STUDY

Time study is define as ‘a work measurement technique for recording the times and rates of working, for the elements of a specific task carried out under the specific conditions and for analyzing the data so that to obtain the time necessary for carrying out the jobs at a defined level of performance. The ratio between output and input is known as productivity. Out put in the form of product or good produce and input in the form of man power, material and machine. Cycle Time is defined as the actual time taken to complete a set of activities (one cycle). Flow chart of the furniture industry shows material motion and it is manual flow process where we are studied. Figure 2 shows the activity and description.

The first step we adopted during the process mapping is to determine how the flow or sequence of steps/activities that is required to complete a process task is maintained during actual working. This information was gathered through the routine interviews (Anonymous, 2001). As we felt it could be of great benefit to the people working in different areas of the company, with the correct information or activities that flow from one department to the other. Flow charting a process did help in organizing the tagging various activities for process mapping. Indeed it was a major task to acquire information on every process/path that takes place to complete a task. The time study Procedure is in figure 1.

![Fig. 1: The schematic representation of time study](image)

Fig. 1: The schematic representation of time study

![Fig. 2:](image)

Fig. 2:

V. RESULT

Average % Productivity Improvement on Multiple Boring Machines

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>Operation before study (y)</th>
<th>Operation after study (x)</th>
<th>% of increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>139</td>
<td>147</td>
<td>5.75%</td>
</tr>
<tr>
<td>2</td>
<td>134</td>
<td>152</td>
<td>13.43%</td>
</tr>
<tr>
<td>3</td>
<td>138</td>
<td>152</td>
<td>10.14%</td>
</tr>
<tr>
<td>4</td>
<td>137</td>
<td>148</td>
<td>8.02%</td>
</tr>
<tr>
<td>5</td>
<td>51</td>
<td>52</td>
<td>1.96%</td>
</tr>
</tbody>
</table>
Table 1: The symbolic representation of activity (Material flow type of Furniture Industry)

<table>
<thead>
<tr>
<th></th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>136</td>
<td>137</td>
<td>128</td>
<td>1000</td>
</tr>
<tr>
<td>Stroke</td>
<td>162</td>
<td>143</td>
<td>147</td>
<td>1103</td>
</tr>
<tr>
<td>Percentage</td>
<td>19.11 %</td>
<td>4.37 %</td>
<td>14.84 %</td>
<td>10.3 %</td>
</tr>
</tbody>
</table>

Average increasing productivity is 10.3%

![Graphical Representation of Productivity Improvement](image)

**Fig. 3:** Graphical Representation of Productivity Improvement

This graph represents the Comparison between Output of Machine Before and After Study. Applying principles of time study the output of the furniture industry is increasing as shown in figure 1. The output before study was 1000 Stroke and the output after time study is 1104 Stroke. After study is carried out it observed that output of the furniture industry increased the Operation of no of strokes. It is help to the organization to increasing in productivity because increment in profit and it is helpful to the growth of the organization. The Productivity is improved by 10% by using Stop Watch Time Study Method.

Production per shift of company before study = 1000 Stroke
Production per shift of company after study = 1104 Stroke

## VI. SUGGESTION

While working on multiple Boring Machine we come to know that in 8 hours there is 1000 no. of strokes where performed in which lot of time was wasted for making boring in special product. This we have suggested not to bore special products on this machine due to which the total no. of strokes where increased by 1104 strokes in 8 hours.

The special products where are in less number thus we have suggested them make a boring operation in it by hand boring machine which is less costly. We have suggested this because by performing special products on multi boring it consumes more time for setting the machine for different products. Thus it has been Manipulated this way.

## VII. CONCLUSION

This paper identified how simple methods can be used to improve work and work process in the industry. The project identified the current methods using time study stop Watch method, flow process charts and how long each component takes. By making simple changes to the process, it can reduce the time taken for each component to improve the flow and speed up the process. Importantly, the costs and benefits of increased production rate have also been calculated which predict by making those changes that output can be increased dramatically.

Time Study revealed that it has an immense influence over factory planning. The product order usually differs in terms of quantity, material requirement, due date, processing variations, processing time difference and set up time variations. So if the industry seeks to foretell that whether they can meet up customer demand within days or not then this time study will be awfully supportive to them. If the company desires to receive orders from random clients then this study will assist them to check whether they can receive those orders or not. The intension of scheduling is to use of resources in a time frame. Planning department can use this study for trial and error schedule development to get an idea of what different arrangement would involve. Thus a tentative surgery schedule may reveal in sufficient allowance for surgery that takes longer than expected and can be revised accordingly. This study can be used to maintain and ensuring the desired rate of output, time management of work shifts and overtime, material handling management, reliability in case of supply delivery, proper inventory management and proper utilization of time and space, to reduce bottleneck, over processing and over production.

## REFERENCES


