

Reducing to Excess Manpower & NVA Activities by Time Study Method at Edible Oil Industry

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Abstract: Productivity is being the most important thing in the manufacturing world. This paper highlights a methodology developed for minimization of non-value added activities (NVA) and minimization of fatigue in manufacturing line by using Time Study method revealed the excessive movements of operators and workers. Work study in productivity improvement could be done in two approaches; which are method study and time study. Thus, this research will use process mapping as the method study. All this initiated by performing work study on the manual operators and workers activities. This case study was conducted at a Edible oil company. From this study, NVA activities, the standard time, utilization and recommendation for man power planning could be established. The necessary changes were suggested in workplace to minimize the stress creating unproductive movements. These results could be used for optimization of time at the company. So, the paper, it is believed, would be great help to those working in the area of efficiency improvement in manufacturing industry.

Keywords: NVA, S top watch, Standard Time, Time Study

1. Introduction

Time study is the most widely used work measurement technique that employs a decimal minute stopwatch to record and determine the time required by a qualified and well-trained person working at a normal pace to do a specific task under specified conditions. Time Study system that is used primarily in industrial setting to set the standard time in which a worker should perform a task. This techniques is based on measuring the work content of the task when performed by the prescribed method, with the allowance for fatigue and for persona land avoidable delays. Systematic observation, analysis, and measurement of the separate steps in the performance of a specified job for the purpose of establishing a standard time for each performance, improving procedures, and increasing productivity called also motion and time study, motion study ,time study. It is the most versatile and the most widely used techniques of work measurement. Value-added management is powerful tool which can help businesses reduce costs. Evidence from the US and from Europe suggests that in many organizations at least 40% of costs can be eliminated without any deterioration in the value provided to customers. Using a value-added management approach, non-value-added activities are identified and programs implemented to eliminate them. Thus, the Industrial Engineering technique is used to achieve:

1. The minimization of the number of the workstation.
2. The minimization of cycle time.
3. The minimization of variability.
4. The maximization of workload smoothness.

Time Study work of Frederick Winslow Taylor with the Motion Study work of Frank and Lillian Gilbreth work gave rise to industrial engineering, time studies, and incentive standards, and a continuous pursuit of efficiency, not only in the plants but in the offices as well. A time study is a business efficiency technique, In 1881, Frederick Winslow Taylor introduced Time study at the Midvale plant. The profession of time study was founded on the success of this project, which also formed the basis of Taylor's subsequent theories of

management science. Essentially, Taylor suggested that production efficiency in a shop or factory could be greatly enhanced by close observation of the individual worker and elimination of waste time and motion in his operation.

2. Literature Review

2.1 Introduction

"Manual manufacturing lines technology has made a significant contribution to the development of American industry in the twentieth century". This phrase emphasizes the importance of manufacturing line especially in several sectors such as Automobiles, FMCG, Consumer appliances and those sectors that produced product in large quantity. This indicates the success factors depend on the efficiency of manpower and manufacturing line. Along manufacturing lines, various operations can be done either manually, automatically or in an integrated manner. Automation operations are done for high volume quantities with edition features on the workstation. However, manufacturing line and manpower utilization suffered one major problem, a Non value added activities (NVA). This phenomenon is defined as the stage which causes the entire process to slow down and wastage of time for productivity. This can be due to improper scheduling, improper work balancing for example is defined as distribution of workload and workers are not equal along the working place.

2.2 Productivity

Productivity may be defined as a ratio of the output of an effort under investigation to the input (labor, materials, machines etc.) required to producing the output. Productivity is a function of effort. It can be calculated by the number output of effort divided by the input productivity is measured so as to detect and avoid lapses in productivity, to maintain worthwhile levels, or to improve less productive activities. The basic intent is to assess, then improve productivity. The formula of total productivity is normally written as follows:

Volume 7 Issue 4, April 2018

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Total productivity = Output quantity / Input quantity.

2.3 Work Study

The definition of Work Study as given in the British Standard Glossary is as follows; "Work Study is a generic term for those techniques, particularly method study and work measurement, which are used in the examination of human work in all its contexts, and which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement'. This has to do with Productivity Improvement, but also improvement of Quality and Safety.

2.3.1 Objectives of work study

- 1) It helps in the optimum use of plant, equipment, manpower and material.
- 2) It helps in establishing the standard of performance.
- 3) It helps in developing efficient work methods.
- 4) It helps in establishing the most efficient and effective utilization of human effort.
- 5) It helps in synchronizing various resources like men and machine.
- 6) It helps in the evaluation of human work.
- 7) It helps in efforts towards productivity improvement.
- 8) It helps in the elimination of wasteful efforts, useless material handling etc.

2.4 Work Measurement

Work Measurement Study is a general term used to describe the systematic application of industrial engineering techniques to establish the work content and time it should take to complete a task or series of tasks. Work measurement is a productivity improvement tool. Work measurement helps to uncover non-value added areas of waste, inconsistency, and non-standardization that exist in the workplace. Work measurement studies uncover ways to make work easier, and to produce products or services more quickly and economically.

2.4.1 Work is measured for four reasons

- 1) To discover and eliminate lost or ineffective time.
- 2) To establish standard times for performance measurement.
- 3) To measure performance against realistic expectations.
- 4) To set operating goals and objectives

2.4.2 Work Measurement Techniques

The following are the principal techniques by which work measurement is carried out:

- 1) Time study
- 2) Activity sampling
- 3) Predetermined motion time systems
- 4) Synthesis from standard data
- 5) Estimating
- 6) Analytical estimating
- 7) Comparative estimating
- 8) MOST

2.5 Work Content

The time taken by a worker or a machine to carry out an operation or to produce a given quantity of a certain product may be considered as made up in the following manner:

Total Time of Job = Basic work content + work content added by poor product design or materials utilization + work content added by in-efficient methods or operation + in-effective time resulting from human resources contribution.

Work content means, of course, the amount of work "contained in" a given product or a process measured in "work-hours" or "machine hours". Work-hour is the labor of one person for one hour. A machine-hour is the running of a machine or piece of a plant for one hour.

2.5.1 The work content is increased by the following:

- 1) Work content added by poor design or specification of product or its parts, or improper utilization of materials.
- 2) Work content added by inefficient methods of manufacture or operation.
- 3) Work content resulting mainly from the contribution of human resource.

2.6 Value Added & Non-value Added Activities

In manufacturing line, there are only two types of activities that exist, which are termed as the Value Added Activities and Non-Value Activities.

2.6.1 Value Added:

The amount paid by a customer for the activities of the worker during the assembly is known as VA.

2.6.2 Non-value Added:

The amount doesn't paid by the customer, for the activities of the worker during the assembly is known as NVA.

3. Methodology

It can be applied to any type of work for which a method can be defined and described. Time study was designed to be much easier than other work quantification techniques because of its simpler structure. It is a progressive technique. The technique is thoroughly proven, highly respected and used around the world. Time Study is a powerful analytical tool to measure every minute spent on a task.

3.1 The Purpose of Work Measurement

Method study is the principal technique for reducing the work involved, primarily by eliminating unnecessary movement on the part of material or operatives and by substituting good methods for poor ones. Work measurement is concerned with investigating, reducing and subsequently eliminating ineffective time that is time during which no effective work is being performed, whatever the cause. Work measurement, as the name suggests, provides management with a means of measuring the time taken in the performance of an operation

or series of operations in such a way that ineffective time is shown up and can be separated from effective time.

3.2. The Uses of Work Measurement

Revealing existing causes of ineffective time through study, important though it is, is perhaps less important in the long term than the setting of sound time standards, since these will continue to apply as long as the work to which they refer continues to be done. In the process of setting standards it may be necessary to use work measurement:

- 1) To compare the efficiency of alternative methods. Other conditions being equal, the method which takes the least time will be the best method.
- 2) To balance the work of members of teams, in association with multiple activity charts, so that, as nearly as possible, each member has a task taking an equal time to perform.
- 3) To determine, in association with man and machine multiple activity charts, the number of machines an operative can run.
- 4) To provide information on which the planning and scheduling of production can be based, including the plant and labour requirements for carrying out the programme of work and the utilization of available capacity.
- 5) To provide information on which estimates for tenders, selling prices and delivery promises can be based.
- 6) To set standards of machine utilization and labour performance which can be used for any of the above purposes and as a basis for incentive schemes.
- 7) To provide information for labour-cost control and to enable standard costs to be fixed and maintained.

It is thus clear that work measurement provides the basic information necessary for all the activities of organizing and controlling the work of an enterprise in which the time element plays a part. Its uses in connection with these activities will be more clearly seen when we have shown how the standard time is obtained.

3.3. Time Study Procedure

The main Process Steps of Carrying out Work Measurement are as follows:

- 1) Obtain and record all available information about the job, the worker and the surrounding conditions likely to affect the execution of the work.
- 2) Record the complete description of the method, break it down into elements.
- 3) Measure with a stopwatch and record the time taken by the worker to perform each element of the operation.
- 4) Assess the rating of the worker.
- 5) Extend the observed time to "basic time" by factorizing the actual time (observed time) by the assessed rating.
- 6) Determine the allowances (e.g. Personal allowances, relaxation allowances, allowances for the working conditions etc) to be made over and above the "basic time" for the operation.
- 7) Apply those allowances on the "basic time".
- 8) Basic time = (Observed time x Performance rating)
- 9) Thus, determine the "standard time" for the operation.

$$10) \text{Standard time} = \text{Basic time} + \text{Allowances}$$

4. Data Analysis

The Company in which I started my project work is Edible oil manufacturing at Ruchi Soya Industries Limited. The company manufactures different types of refined oil and manufactures Oil tin jar like a 15 litre. The plant has different sections of edible oil manufacturing which is supplied to the customers. Using Time study application and work content of each operation are calculated. Some definitions are as follows
Normal time- Normal Time is the time required by a qualified worker, working at a pace that is ordinarily used by workers to complete a task by following a prescribed method and without interruptions. The result of a Time study analysis is normal time.

Actual time- It is the time taken by the operator to do the work.

Idle time- It is time period in which the operator is idle and has no work to do.

Note-

O.T. = Observed Time

S.T. = Standard Time

A.T. = Available Time

Station 1 - It is an area where a Tin jar is produced. The practical analysis of the case study was done by applying the technique on the production lines of Edible oil Company. It was applied on the production line of tin jar manufacturing line which involved a large number of operators and data was taken and properly analyzed.

Table 1: Utilization of helper & sheet cutter

	O.T. (in min)	S.T. (in min)	A.T. (in min)	Idle Time (in min)	Utilization
Helper	195	184.2	420	235.8	43.8%
Sheet Cutter	165	155.9	420	264.1	37.1%

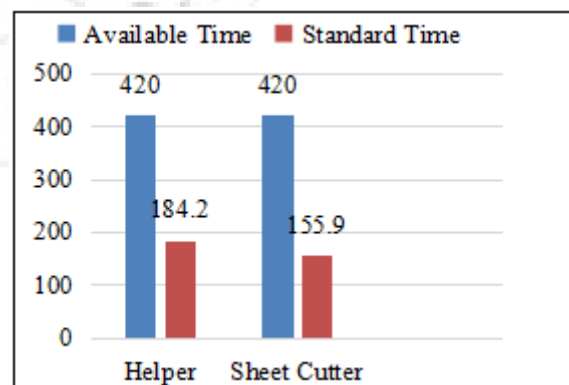


Figure 1: Graphical representation of helper and sheet cutter

The Work of Helper is distributed to Sheet Cutter-

Idle time of Tin sheet cutter = 264.1 min

Standard time of Helper = 184.2min

Now time utilized by Tin sheet cutter = 155.9+184.2= 340.1 min

Utilization of Tin sheet cutter = 340.1/420 = 80%

1 Helper can be reduced from a Shift in a Tin plant Department.

Station 2 - It is an area where a material is shifted from Stores to Tin jar manufacturing area.

Table 2: Utilization of material shifter & dispatch operator

	O.T. (in min)	S.T. (in min)	A.T. (in min)	Idle Time (in min)	Utilization
Material Shifter	376	315.84	420	104.16	75.2%
Dispatch Operator	44	41.976	420	378.024	9.9 %

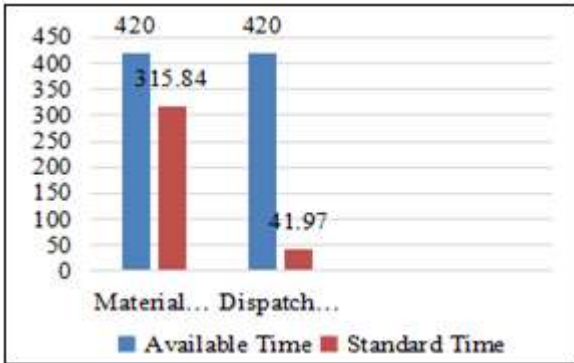


Figure 2: Graphical representation of material shifter and dispatch operator

The Work of Material shifter is distributed to Dispatch operator-

Time required to Shift materials from stores by 2 material Shifter = 315.84 min
 Idle time of Dispatch Operator = 378.024 min
 Total Utilized time by Dispatch Operator = 315.84+41.976 = 357 min
 Utilization of Dispatch Operator = 357/420 = 85%

2. Material Shifter can be reduced from a shift.

Station 3 - It is an area where a Dispatch helper is loaded the truck.

Table 3: Utilization of helper 1,2&3

	O.T. (in min)	S.T. (in min)	A.T. (in min)	Idle Time (in min)	Utilization
Helper 1	96	91.584	420	328.5	21.78 %
Helper 2	100	95.4	420	324.6	22.71 %
Helper 3	92	87.768	420	332.3	20.88 %

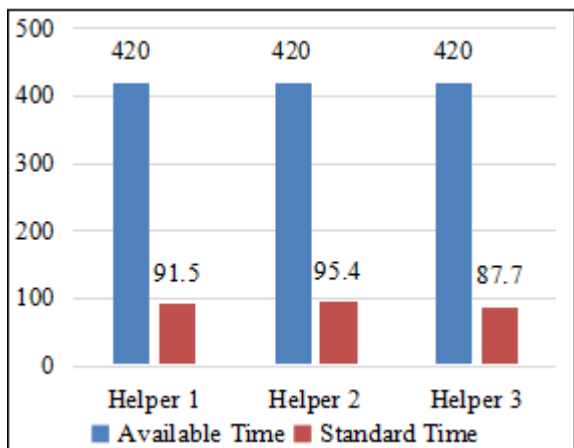


Figure 3: Graphical representation of dispatch helper

The Work of Helper 2 & Helper 3 is distributed to Helper 1-

Idle time of Helper 1 = 328.5 min
 Standard time of Helper 2 & Helper 3 = 95.4 & 87.7
 Now time utilized by Helper 1 = 91.584+95.4+87.7 = 276.6 min

Utilization of Helper 1 = 276.6/420 = 65.85%

2 Helpers can be reduced from Dispatch area.

5. Results

A lot of manpower, time and effort was saved and productivity was increased. A total manpower of 11 is saved per day by implementation of Time study.

5.1 NVA Analysis of Manpower

Table 4.1: Before utilization

	Previous Observed Time (in min)	Available Time (in min)	Previous Idle Time (in min)	Previous Utilization
Tin sheet Cutter	165	420	264.1	37.1%
Dispatch Operator	44	420	378.024	9.9%
Dispatch Helper	96	420	328.5	21.78%

Table 4.2: After utilization (by Time study)

	New Observed Time (in min)	Available Time (in min)	New Idle Time (in min)	New Utilization	NVA Reduce (in min)
Tin sheet Cutter	340.1	420	79.9	81%	184.2
Dispatch Operator	357	420	63	85%	315.024
Dispatch Helper	276.6	420	143.4	65.85%	185.1

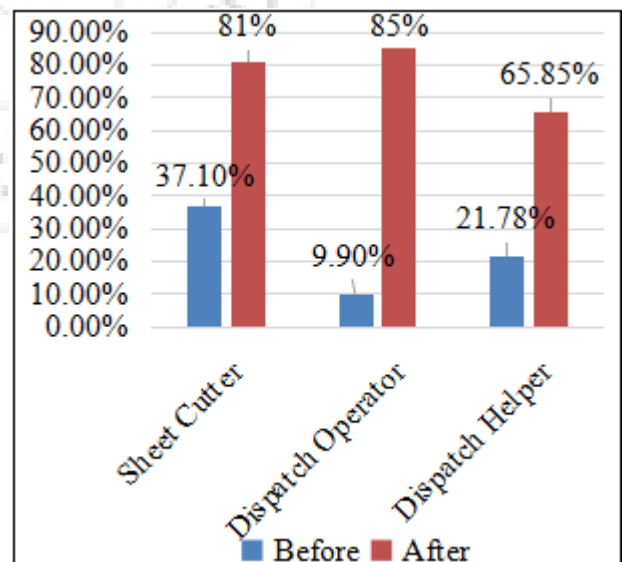


Figure 4: Utilization comparison of Man power

Table 5: Man power deployment table

Manpower	Before	After	Deploy
Tin plant section	15	12	3
Material Shifter	2	0	2
Dispatch section	12	6	6

IN NVA Analysis the total manpower deployment are 11

6. Conclusions

By the result of this study it is clear that NVA is more in total work content, which should be minimum and the VA activity is very low which should be maximum. The percentage is the ratio of total work content of VA or NVA total work content. Thus with the help of Time Study method it is possible to achieve major times reduction in the manufacturing of the products. Time study nearly gives non-machining time reduction of 60 to 65 %. With the help of this method it is also possible to get the production time of the products before its actual manufacturing starts. This helps in the production planning.

The case study was successfully implemented in the industry thereby increasing the productivity and confirming the importance of work measuring techniques like Time study in industries. It is a simple, easy and an efficient technique without any initial investment which gives tremendous results.

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