A Case Study of Productivity Improvement by using IE Tools

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ABSTRACT

This paper presents a case study in the development and application of a time study in a engine block manufacturing plant. The organization engages in the production of two product lines: engine blocks, heads of diverse categories. The motivation for this study was the need to tackle the problem of productivity per shift between the employee-association and the management of the company regarding questions of productivity. The two products have similar production processes. The study's most important finding is that the time of producing a unit of product is directly proportional to the number of production stages involved and the time spent at each stage. The study focuses on the MAHINDRA production line. Where stud hole and push rod operation is very important for mounting the cylinder head on cylinder block and how to combine this both operation on one single machine like Mahindra job. So the proposal is made to do these two operations for HINO on BMV 60 by adjustment of special fixture like Mahindra. With this proposed solution a saving of 2 to 3 man power per cycle was obtained. The paper discusses the use of Industrial Engineering tools used for the purpose of productivity improvement.

Keywords: manufacturing, process analysis, efficiency study, time study, management analysis.

The objectives of the study

- MINIMIZE EXCESS MAN POWER
  By proper utilization of work movement and by proper action time planning of work we can minimize the excess man power.
- MINIMIZE THE PRODUCTION TIME
  By applying the tool of Industrial Engineering that is time study we can minimize the production time; by improve the process of production (actual machining cycle time) by Process Engineer with the help of Industrial Engineer we can minimize the production time.
- IMPROVE THE PRODUCION METHODE
  By observation of production cycle or by observation of production work method with the help of actual working associates we can improve the production work methods.
- EFFORT MINIMIZATION
  By using of proper material handling equipments and by using proper work movement methods we can minimize the effort of associate.
- IMPROVEMENT OF ERGONOMICS
  Improve the relation between associate and machine using proper ergonomically consideration.
- IMPROVE THE RELATION BETWEEN ASSOCIATES AND MANAGEMENT
  By launching the suggestion schemes related to any kind of departmental improvement we can minimize the gap of communication between management and associates side.

INTRODUCTION

Research on time study incorporates a range of concerns, including its definition and management. Although research on work measurement has evolved in a scientific and rigorous fashion, based on early works of Gilbert and others, the quantitative mathematical modeling of production activities in terms of time study has not evolved in a similarly rigorous fashion. In recent years, the manufacturing organization used as the case example in this work has realized that scientific approaches could be developed to aid dispute settlement between the employees' association of the company and management regarding issues of productivity. In order to achieve this, the company was motivated to approach a management consultant. This paper is an attempt to present the methodology used in solving productivity issues at this company. The company concentrates on the manufacture of two fast-moving items – engine blocks and cylinder heads. The operations are housed in a large factory floor consisting of several manufacturing machines, each of which costs an equivalent of several lakhs.

An important problem faced in the production system is that of determining the time it takes to produce a unit of product. In order to thoroughly analyze the problem, the production processes for each of product is analyzed. Engine block production activities could be broken down into various steps: loading of block head on conveyors, milling, drilling, boring, honing, finishing and packing.

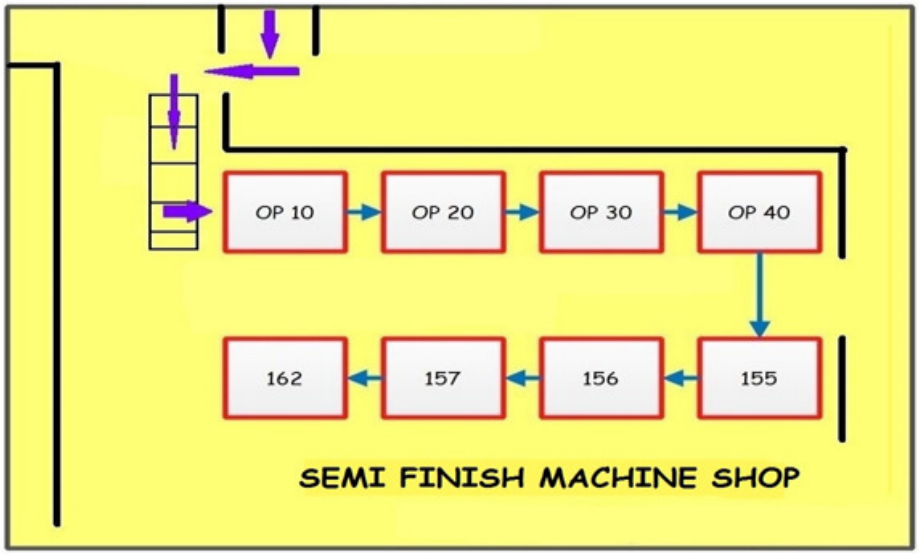


Figure 1: The Production line for MAHINDRA and HINO.

WORK STUDY:

Work study forms the basis for work system design. The purpose of work design is to identify the most effective means of achieving necessary functions. Historically, this work-study aims at improving the existing and proposed ways of doing work and establishing standard times for work performance. Work is an activity in which one exerts physical and mental effort to accomplish a given task or perform a duty.

Task: An amount of work that is assigned to a worker or for which a worker is responsible.

Work Element: A series of work activities that are logically grouped together because they have a unified function in the task

Examples: Reaching for an object, Grasping the object, Moving the object, Walking, Eye movement

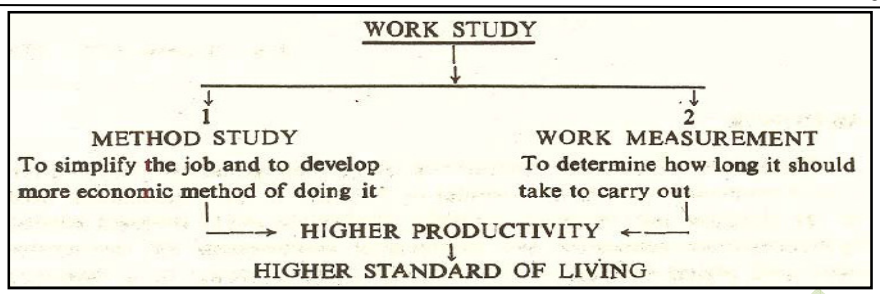


Fig 3. Structure of work study

METHOD STUDY:

METHOD STUDY PROCEDURE

Method-study concerned with "the way in which work is done (i.e., method)". It is used to simplify the way to accomplish a work and to improve the method of production. Method-study results in a more effective use of material, plant, equipment and manpower. Method study is essentially concerned with finding better ways of doing things. It adds value and increase the efficiency by eliminating unnecessary operations, avoidable delays and other forms of waste.

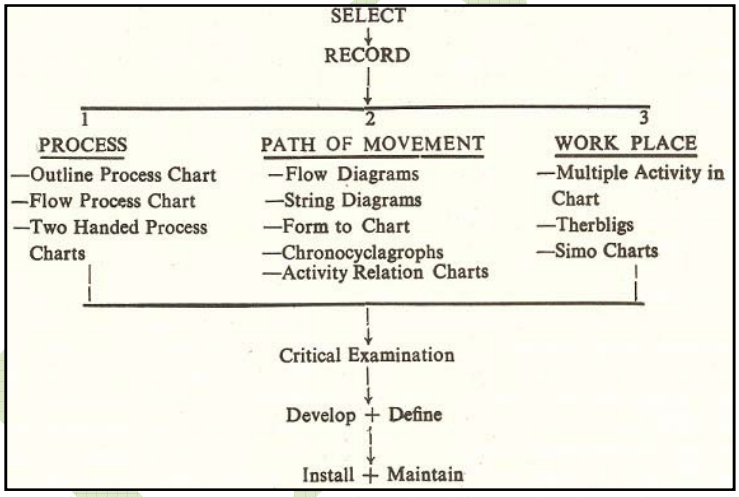


Fig 4. Steps or procedure involved in methods study

WORK MEASUREMENT

Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out specified jobs at a defined level of performance or at a defined rate of working qualified worker is one who has acquired the skill, knowledge and other attributes to carry out the work in hand to satisfactory standards of quantity, quality and safety. Defined rate of working is the amount of work that can be produced by a qualified worker/employee when working at normal space and effectively utilizing his time and where work is not restricted by process limitation.

TECHNIQUE OF WORK MEASUREMENT:

- Time study: short cycle repetitive jobs
- Work sampling: Long cycle jobs
- Predetermined motion time standards: manual operations confined to one work centre.

TIME STUDY

Time study is also called work measurement. It is essential for both planning and control of operations. According to British Standard Institute time study has been defined as "The application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance." Time study is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute

stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task and it is often used when:

- There are repetitive work cycles of short to long duration,
- Wide variety of dissimilar work is performed, or
- Process control elements constitute a part of the cycle.

The Industrial Engineering Terminology Standard defines time study as "a work measurement technique consisting of careful time measurement of the task with a time measuring instrument, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable or machine delays, rest to overcome fatigue, and personal need.

METHODOLOGY AND READINGS

ACTUAL TIME STUDY TAKEN IN THE COMPANY FOR HINO MOTORS

OPEATIONS BEFORE MACHINING

Sr. No	Operation	Time Required (Sec)	Time Proposed (Sec.)
1	Raw material Unloading	60	20
2	Inspection Scrap part putting time if any (60)	30	30
3	Number Punching (Manual)	90	10
4	Job loading on conveyer	90	0
	Total cycle Timing	270	60

Operation		**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**	**Avg.**	**Avg. Taken**
Raw material Unloading	0 Sec.	19	20	18	21	20	21	22	21	20	20	**20.2**	**20**

Table no. 1&2 Time required earlier.

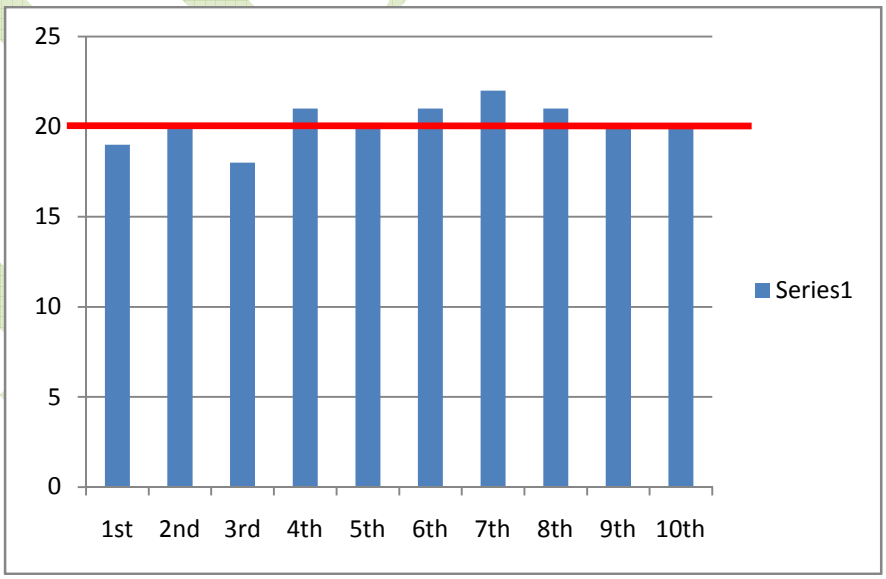


Chart no. 1 for Table no. 2

During raw material unloading the material was manually unloaded and there is lots of manual efforts and time required. And for unloading of single cylinder head they required **60 sec. to 80 sec.** After observation of this unloading process we suggested for hydraulic lifter cum trolley of conveyer height so that they can directly place the job on conveyer. And they reduces there efforts and time **80%.** After implementation of suggested method we taking the time study, get **reduced time 20 sec. from 60 to 80 sec. per cycle.**

Operation	30 Sec.	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Avg.	Avg. Taken
Inspection Scrap part putting time if any (60 sec.)		29	30	30	29	29	29	30	30	30	31	29.7	30

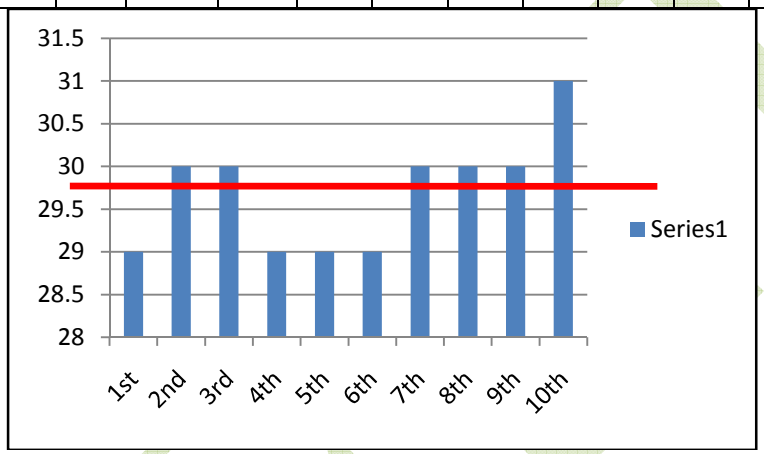


Chart no.2 and Table no.3

The operation Inspection is the necessary operation in all the processes to neglect any defect before the machining. Now it takes **30 sec.** to inspect and after some observation, time readings and discussion with shop floor supervisor and associates; We conclude that this existing time is correct time to inspect the job that is **30 sec.**

Operation	90 Sec.	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Avg.	Avg. Taken
Number punching (manual)		10	9	10	9	8	10	10	9	10	10	9.5	10

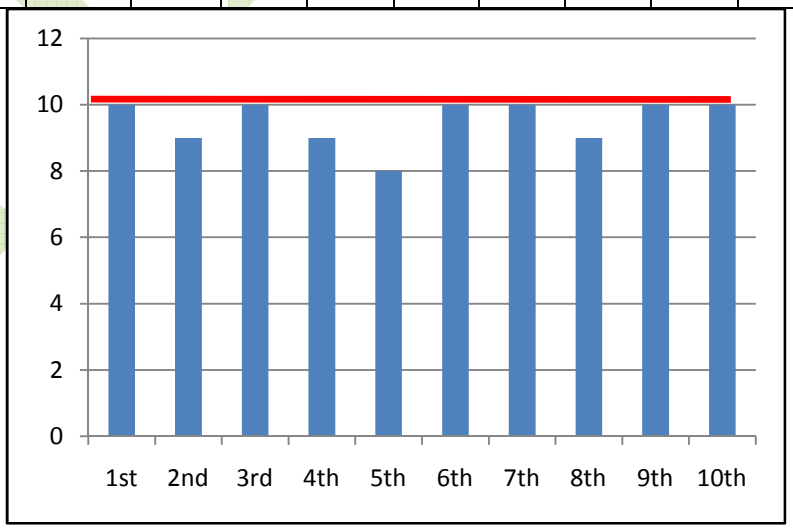


Chart no.3 and Table no.4

Before starting the machining on the job they have to identify the job with the manual number punching. For manual number punching they have to arrange the job manually in proper direction, for that they need more efforts and more time to do this action. For this we observed that they need **90 sec.** to do this action. Here we think about the effort minimization of associates in material handling and number punching. We search the solution for number punching automation and we found the one company who is only gives the solution of punching technology. That is **Marks Pryor Marking Tech. Pvt. Ltd. Pune.** After contacting the company they provide the pneumatic number punching machine solution. And we proposed this machine solution to management of KFIL for punching operation. For the number punching operation they need **2 associates** per shift. After some discussion with management of purchase department of machine shop staff they finalize the machine for number punching.

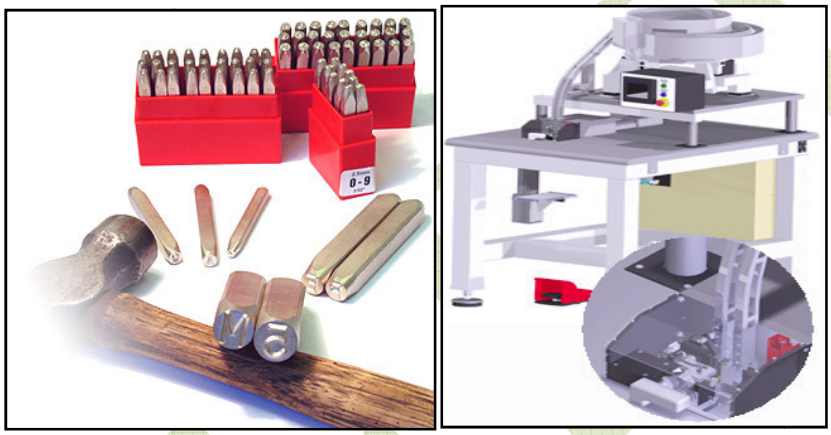


Fig. no.5 punching machine

In next 1 month dated 26 Nov, 20132 the actual machine is installed in the shop. Then we take the time study for the number punching operation and we get the huge reduction in time that is **90 sec to 10 sec.** And for this only one associate is required. So we saved the 1 associate man powers.

Operation	90 Sec.	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Avg.	Avg. Taken
Job loading on conveyer		0	0	0	0	0	0	1	0	0	1	0.2	0

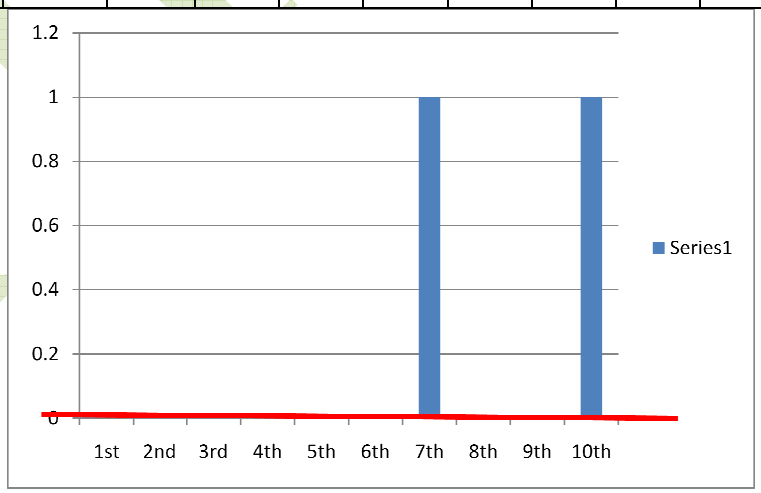


Chart no.4 and Table no.5

Before starting the machining KFIL is unload the raw material by manual and lifter is not used so that time require unloading and loading that material on conveyer is **90 sec**. After we study, we suggest lifter of the height of conveyer that's why time required for unloading and loading is total minimize that is **0 sec.**

Sr. No.	Activity On OP 10	Existing Time in Seconds	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Proposed Avg. Taken
1	**Preparation to work (at the start)**	10	9	8	9	7	6	5	5	6	7	5	**7**
2	**Job cleaning (previous)**	15	15	14	15	14	15	14	13	15	14	15	**15**
3	**Job unloading (from crane)**	45	30	32	35	35	39	40	31	29	35	40	**35**
4	**Job Loading**	60	41	40	45	43	42	49	50	42	41	45	**45**
5	**Table cleaning**	10	4	5	5	5	4	6	4	4	5	5	**5**
6	**Job cleaning (new)**	15	11	10	12	10	9	8	9	10	11	11	**10**
7	**Job Positioning**	20	11	12	10	9	9	8	11	10	11	10	**10**
8	**Fixture adjustment**	5	5	6	4	6	5	5	5	4	6	5	**5**
9	**Machine Start**	5	2	3	2	2	1	2	3	3	2	1	**2**
10	**Machining for HINO Heads**	300	300	300	300	300	300	300	300	300	300	300	**300**
		485											434

Table no. 6 Proposed avg time.

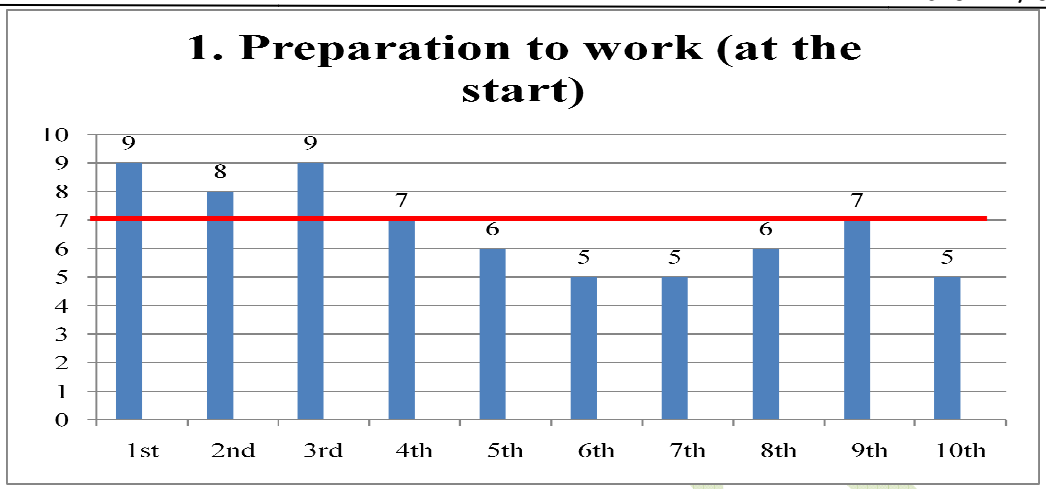
RESULTS

Following is the results and representations of the data collected. After taking the above time study we can save time from 485 sec. to 434 sec. that is **51 sec.**

Existing time – 10 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
9	8	9	7	6	5	5	6	7	5

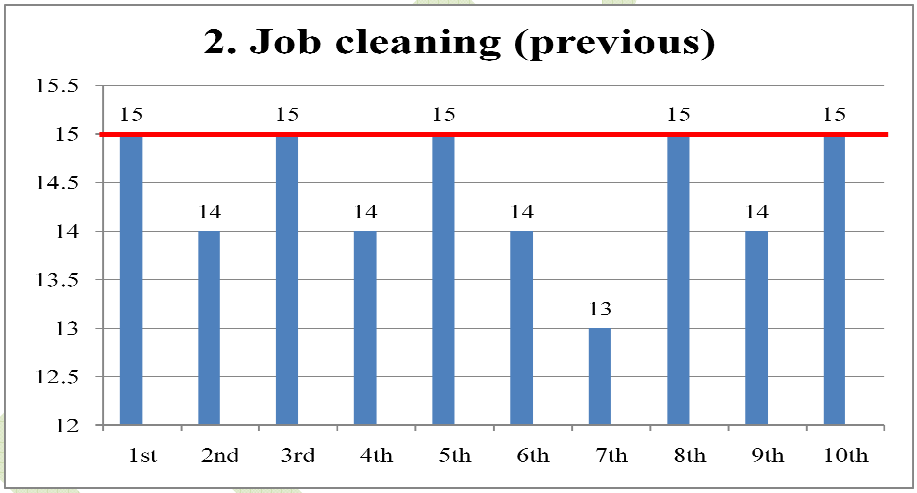
Proposed time – 7 sec.



Existing time – 15 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
15	14	15	14	15	14	13	15	14	15

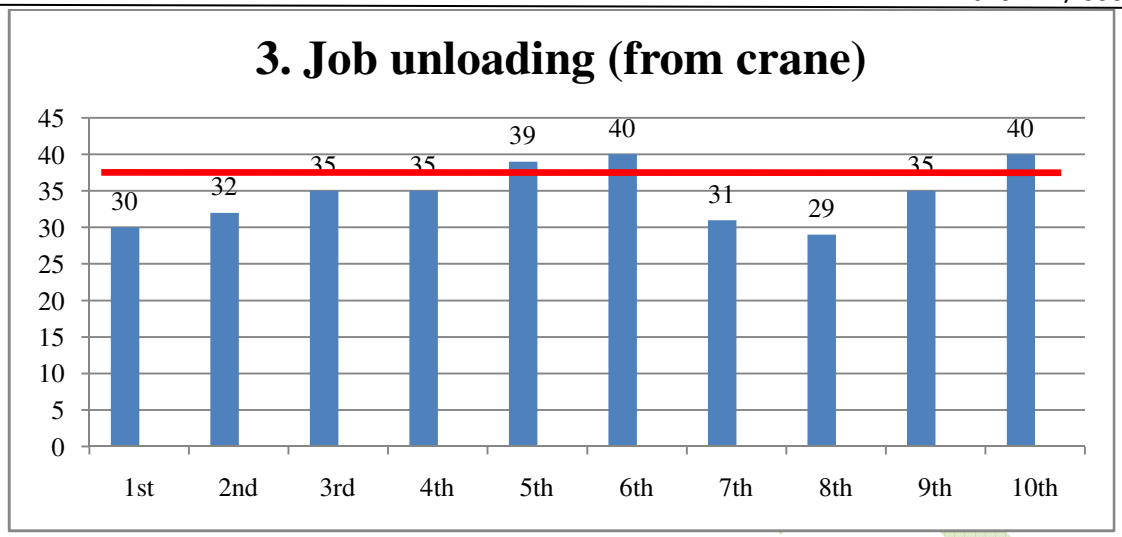
Proposed time –15 sec.



Existing time – 45 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
30	32	35	35	39	40	31	29	35	40

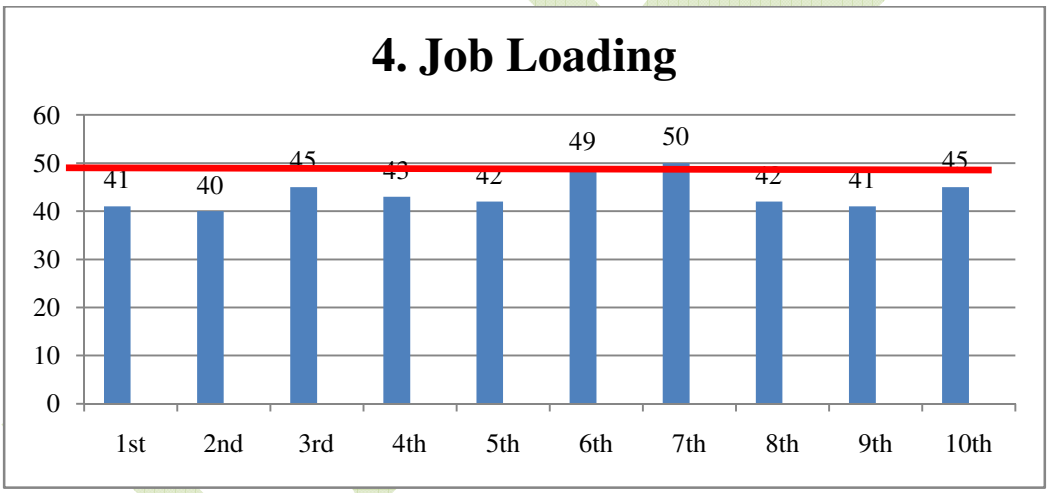
Proposed time –35 sec



Existing time – 60 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
41	40	45	43	42	49	50	42	41	45

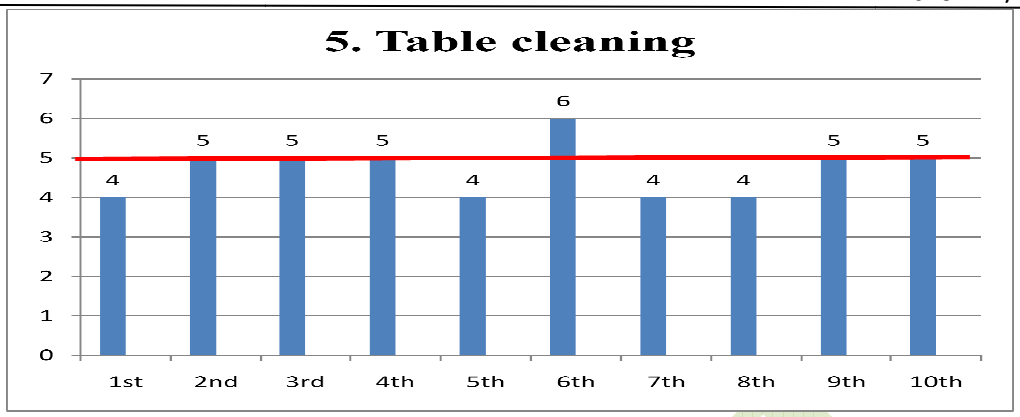
Proposed time –45 sec.



Existing time – 10 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
4	5	5	5	4	6	4	4	5	5

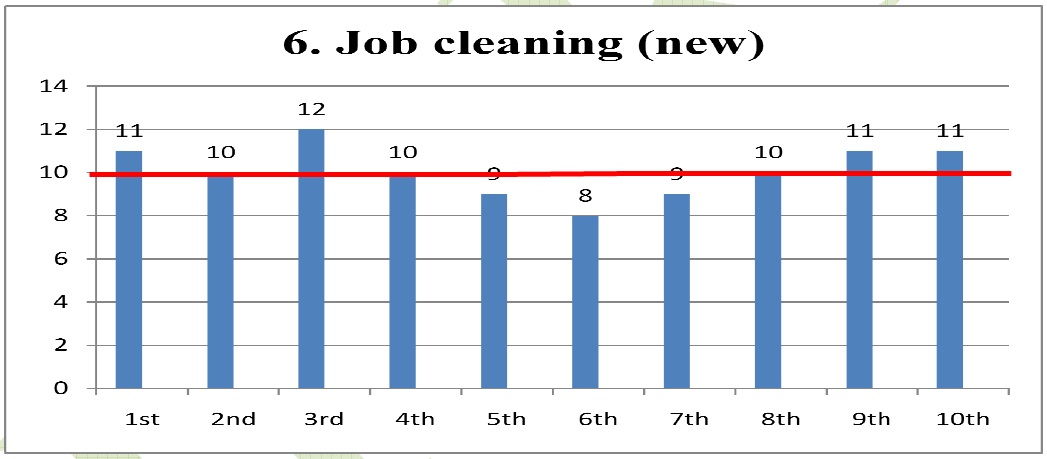
Proposed time – 5 sec.



Existing time – 15 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
11	10	12	10	9	8	9	10	11	11

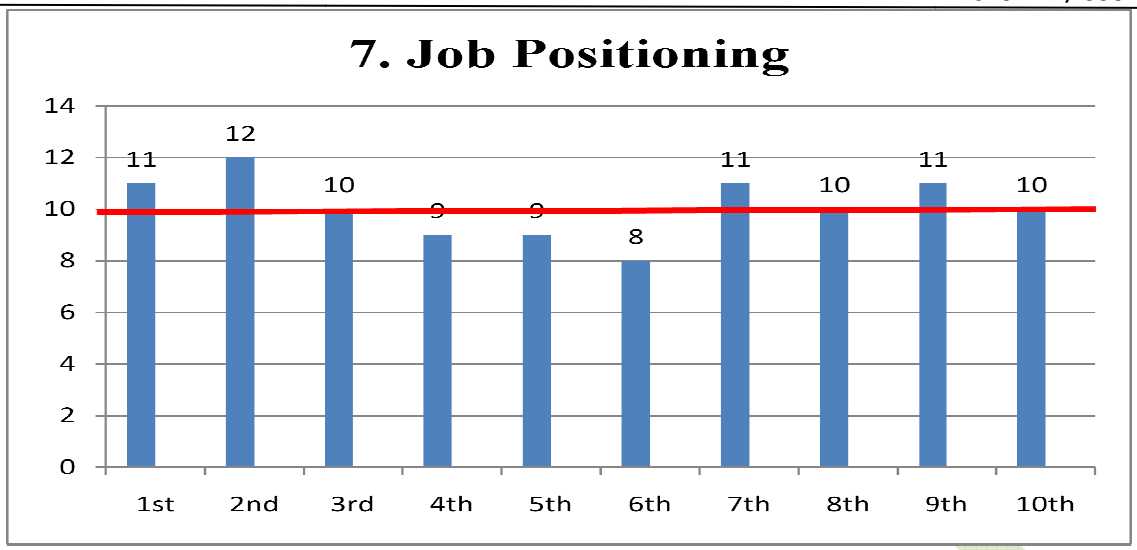
Proposed time – 10 sec



Existing time – 20 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
11	12	10	9	9	8	11	10	11	10

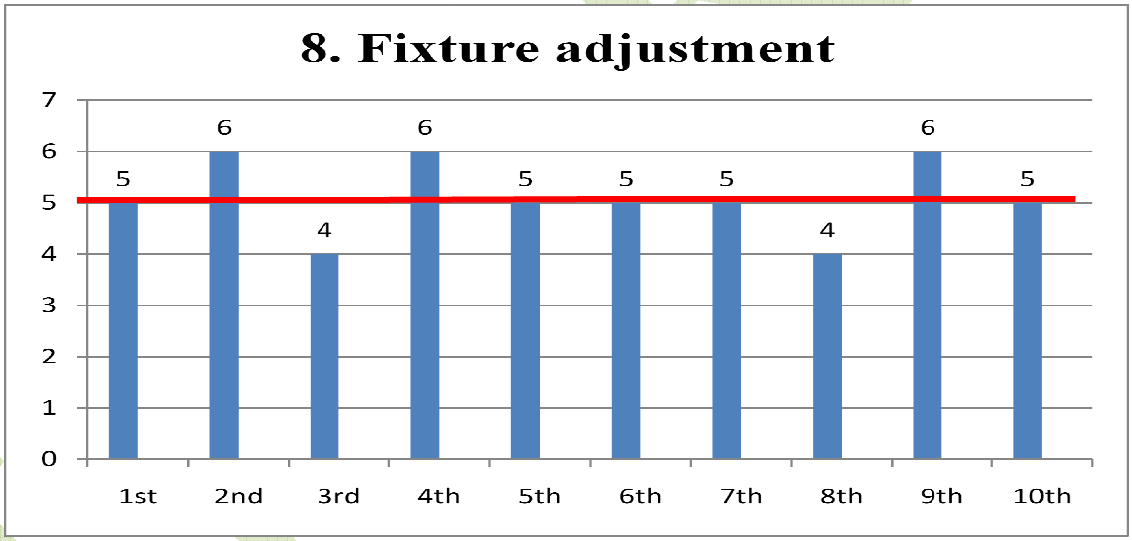
Proposed time – 10 sec.



Existing time – 5 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
5	6	4	6	5	5	5	4	6	5

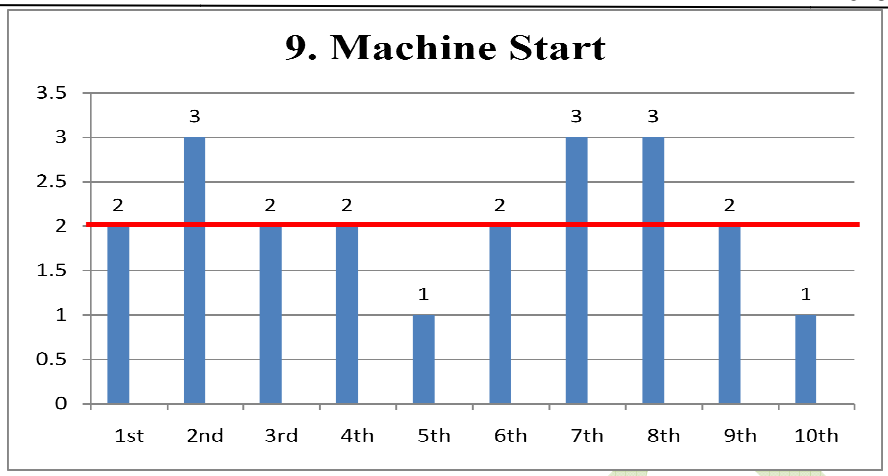
Proposed time – 5 sec.



Existing time – 5 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
2	3	2	2	1	2	3	3	2	1

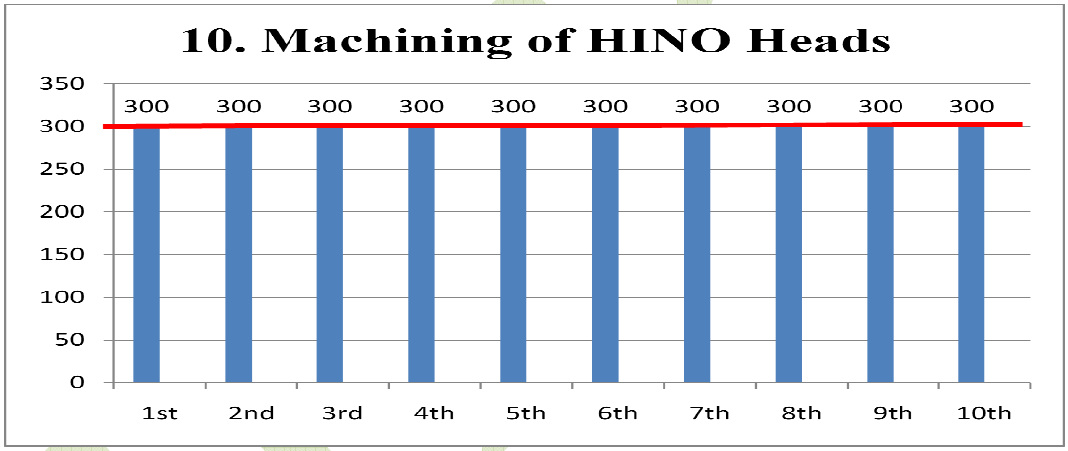
Proposed time – 2 sec.



Existing time – 300 sec.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
300	300	300	300	300	300	300	300	300	300

Proposed time – 300 sec.



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CONCLUSION

This paper has argued for a need by current production managers or work-study engineers to embrace more quantitative approaches in the determination of time standards. Bearing in mind this article may have addressed key issues of concern to managers; we therefore strongly believe that the work would readily have values to practicing engineers. It was observed that the current model is slightly different from previous models in the sense that it incorporates some uncontrollable factors. All of these factors have been considered to have a positive impact on the model. Unfortunately, there seems to be no documentation that has incorporated this into a model. This is an important gap closed by the current study. We have found that it is feasible to apply the model in a real life situation. The study may be very beneficial to practicing managers in the industry since it has captured some aspects that have been ignored till date in the management literature. This therefore, gives more reliable information about the system being studied when compared with previously obtainable information.

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