International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Productivity Improvement by Time Study Analysis Moderate Scale Industry – Manufacturing of Cutting Tools

Vatsal Singh[1], Sharwari Nalawade[2], Ashish Dhongde[3], Saumdeep Bera[4]

[1,2,3,4]*Student, MIT Academy of Engineering, Alandi, Pune, Maharashtra, INDIA.*

Abstract - *The productivity of any organization can be improved by optimizing the work processes and time. Improving productivity implies making the best possible use of the available resources and obtaining maximum output from them. Maximum productivity is the trademark of a successful organization. The purpose of this research is to improve productivity in a medium scale industry. Research of a medium scale industry which manufactures cutting tools is carried. Time and motion study have been used to propose solutions for increasing productivity in the industry. The objective is to identify problems occurring in the industry which cause losses in time and effort and propose methods to manage the work effectively. To undertake a detailed study of the industry tools like flow process charts, process charts, travel charts, etc. were used. The activity performed by the group helped to reduce the material wastage occurring in the industry and the processes could be optimized easily.*

Key Words: **Industry, Operations, Productivity, Time Study, Tools**

1. INTRODUCTION

ILO defines time study as a work measurement technique for recording the times and rates of working for the elements of a specified job carried out under specified conditions, and for analysing the data to obtain the time necessary for carrying out the job at a defined level of performance. Time study is the technique of establishing an allowed time standard to perform a given task, based upon measurement of work content of the prescribed method, with due allowance for fatigue and personal and unavoidable delays. According to Meyers (2002), time standards can be defined as "the time required to produce a product at a work station with the three conditions: (1) a qualified, well-trained operator, (2) working at a normal pace, and (3) doing a specific task."

Time and Motion studies are a core set of tools which are used by the managers in the industrial sector to enhance the performance or the operational efficiency. The main task is divided into subtasks and a standard time is set for every task. Observations of the production line of the industry are conducted and then the delay is calculated in each task. The delay in each task results in a total delay in the manufacturing of main product. Thus, the main aim of this study is to check where time is lost.

The project is undertaken in G M Tools, M. I. D. C. Bhosari, who are manufacturers of cutting tools used for manufacturing of various machinery. Assessment was done through direct observation, questionnaire and investigating the operators.

Observing the current manufacturing process, it is found that improvements can be made in the layout, worker monitoring system, work distribution. Some machines can be brought in-house but it may involve a huge capital investment initially.

Each subtask required to manufacture a cutting tool was studied. Time observations were taken for them and analysis of observations helped us to identify the wastage and problems.

2. Research Method

With the intention to obtain primary data, the survey of the industry was carried by interacting with the owner, professionals and employees in the industry. Study of the manufacturing processes right from procuring the raw material to the finished product ready to go in the market were noted.

As cutting tools involve varied types, selection of one cutting tool to be studied and observing the general layout was the first step. The flow of materials and processes was studied to identify potential areas for improvement.

2.1 Selection of Product

The industry manufactures various cutting tools like drill bits, milling cutters, blades, etc. The basic procedure involved in manufacturing of the cutting tools was almost similar, but the difference comes into play in manufacturing at some stages because of its specific cutting application. A milling cutter was selected for the study as it involved numerous operations in manufacturing which helped to get a detailed and thorough idea of all the manufacturing operations as well as milling cutters are widely used in the mechanical industry for fabrication.

2.2 Recording the Facts

Collection of the required data is a very crucial part of the study. The factual data was recorded using time study in order to analyse the time required for each procedure. Ideal time or standard time was considered and then time required for each process was recorded. The time was compared to calculate where wastage of time took place. A time study observation sheet was used to record the time.

Before making the time study sheet, a detailed survey of the industry and its operation was undertaken, and all the operations were listed. All the activities of the workers involving work related and non-work-related activities were recorded in order to separate the productive time, non-productive time and time wasted.

The activities of the worker involved:

- Transportation of material or job from one place to other for further operation
- Snack break and tea break
- Lunch time
- Studying of the job or draft before operating the machine

Fig -1: A cutting tool used in the Industry

The manufacturing operations consist:

- Turning
- Milling
- Hardening
- Gashing
- Brazing
- VMC operations
- CNC operations
- Creation of form
- Manual inspection
- Roughing
- Grinding
- Checking
- Finishing
- Marking

Considering all the operations required in manufacturing a milling cutter, a time study was carried. The standard time required to manufacture a milling cutter is 30 hrs considering delays, but it is observed that extra time is required in most of the cases due to some reasons like unavailability of materials, labour or delay in machining.

TIME STUDY OBSERVATION SHEET

OPERATION DESCRIPTION : Manufacturing of a milling cutter

El no.	Element Description	1	2	3	4	5	Ideal Time
1	CNC Lathe Turning	10 mins	12mins	14 mins	8 mins	9.5 mins	10 mins
2	CNC Programming	95 mins	75 mins	81 mins	115 mins	130 mins	90 mins
3	Milling	38 mins	30 mins	55 mins	60 mins	40 mins	45 mins
4	Hardening	1 day	1.5 day	2 days	1 day	1 day	1 day
5	Brazing	28 mins	20 mins	34 mins	40 mins	37 mins	30 mins
6	Roughing	15 mins	10 mins	18 mins	24 mins	34 mins	20 mins
7	Grinding	79 mins	56 mins	53 mins	48 mins	63 mins	60 mins
8	Finishing	27 mins	23 mins	26 mins	19 mins	30 mins	25 mins
9	Inspection	48 mins	58 mins	60 mins	53 mins	49 mins	55 mins
10	Cylindrical Grinding	29 mins	25 mins	28 mins	34 mins	36 mins	30 mins
BASIC TIME (approximate)		30 hrs	41 hrs	54 hrs	31 hrs	31 hrs	30 hrs

Fig-2: Time Study Observation Sheet

2.3 Examining the Facts

After collection of information, examining the recorded data, identifying potential areas for improvement is the main task. After identifying the improvement areas, solutions must be designed for the same. The solutions should be proposed by outweighing their pros and cons. While doing so, parameters like feasibility, cost-effectiveness, availability of resources and technology, etc. must be considered.

Potential areas of improvement identified during the study are as follows:

a) Arrangement of machineries as per flow of processes.
b) In-house machinery for hardening and brazing.
c) Reuse of the rejected workpieces.
d) Maintaining a record of the workers' timings.
e) Keeping a check on the market need in advance.
f) Design of a single multiple modular holder.

3. RESULTS AND ANALYSIS

3.1 Arrangement of machineries as per flow of processes

The machinery in the industry are not arranged as the sequence of the process carried out. The first step is turning, which is at the centre of the industry. Due to this arrangement, the raw material has to be transported through another route, thus increasing the travel time.

After the turning operation, form is created in the CNC machine. Next, the workpiece goes to the grinding section which lies before the turning area. After grinding, the piece returns for inspection. Thus, the arrangement seems to be chaotic.

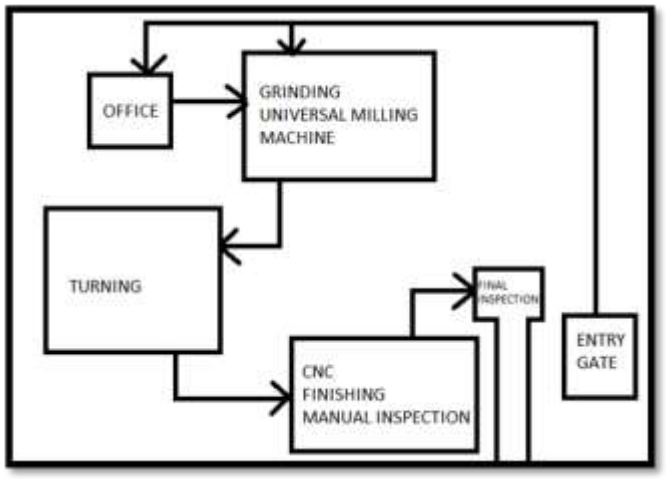

Fig-3: Old Layout of the Industry

The turning section can be shifted to the start so that when the turning operation is finished, the travel of workpiece will take place among the mid and the last sector which involves all the operations. This will reduce the travel time of the workers.

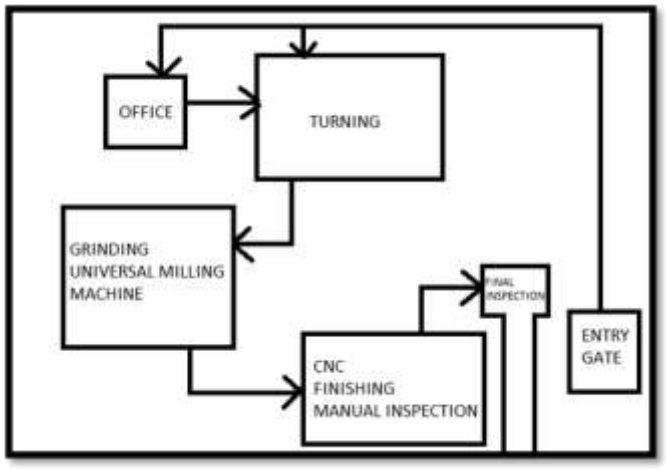

Fig 4: Proposed Layout of the Industry

Another solution, that can be implemented is providing connection between the grinding and CNC finishing sector to avoid the disturbance of machine position as in the first solution.

3.2 In-house machinery for hardening and brazing

Hardening and brazing are the outsourced operations involved in the entire process. From time study sheet, it is seen that hardening process requires one day as it is an outsourced operation. There may be delay of additional days if the hardening industry has another workload. To avoid such delays, save money in production as well as transportation, in house machinery should be used. The installation has high initial cost, but it will prove beneficial in the long run.

3.3 Reuse of the rejected workpieces

It was observed that when an extra error of 10-15 micron occurs in manufacturing despite giving tolerances, the job is directly thrown to scrap. Instead, it can be used in some other way rather than directly throwing it away. It can be used by other companies or college students undertaking projects. The company can supply them and earn more than scrap.

Fig 5: Industry Setup

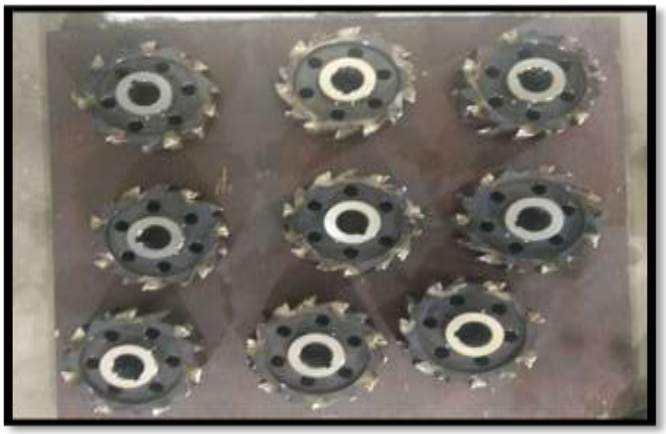

Fig 6: Workpiece after Manufacturing

3.4 Maintaining a record of the workers' timings

Despite giving ample time for lunch break and snack break, they go early for the break and come late. Similarly, while leaving for home, they go earlier than the fixed time. Due to this the production process becomes slow.

To avoid such delays, the workers must be monitored regularly and a record of all the timings can be kept.

3.5 Keeping a check on the market need in advance

The manufacturing starts when the supplier gives the order. The process begins from procurement of material and then the further machining. Instead, if the company keeps a check on the market need and accordingly manufactures products beforehand, the time will be saved.

There is a risk in this proposal as it might lead to wastage of products if the order is not placed. Thus, the market research should be carried interacting with the potential and old customers.

3.6 Design of a single multiple modular holder

For inspection of each cutting tool, a specific holder has been used. Instead of using n number of holders, a single modular holder can be manufactured where it can hold multiple types of tools. This will save space as well as money to manufacture the number of holders.

In the suggested solutions, there are some solutions which can be immediately implemented, and some can be implemented in the long run. Some of the solutions may require some capital investment.

Priority can be given to all the proposed areas of improvement and thus the changes can be made.

Fig 7: Inspection of the Finished Product

4. CONCLUSIONS

As a detailed study of one industry helped us to analyse the potential improvements, every industry should periodically carry out a work and time study so they can maximise their production and use their resources to the fullest.

Workers should be monitored strictly in all industries, but they must also be given certain allowances, so the employee gives his best to the industry. The wasted materials should be effectively managed and reused.

ACKNOWLEDGEMENT

This study was supported by Mr. Sunil Gopinath, Founder, G M Tools. We thank Mr. Venugopal Kulkarni for his guidance and for being our mentor during the study. We thank our colleagues who provided their insights in the study.

REFERENCES

[1] Aakash Jaiswal, Shriram Madhukar Sane and Varsha Karandikar: "Improving Productivity in a Paint Industry using Industrial Engineering Tools and Techniques" , International Journal of Advance Industrial Engineering, 2016.
[2] International Labour Organisation (ILO), "Introduction to Work Study, " Universal Publishing Corp., India. , Third Revised Edition, 1986.
[3] Abdul Talib Bon, Aliza Ariffin, "An Impact Time Motion Study on Small Medium Enterprise Organization"
[4] Ralph M. Barnes (2001). Motion and Time Study – Design and Measurement of Work. Seventh Edition. John Wiley and Sons Inc