Productivity Improvement of Column Manufacturing Process in Metalfab Hightech Pvt. Ltd. By Motion & Time Study

Arpan S. Dorle[1], Sharvari R. Bhusari[2], Anuj G. Ganar[3], Shubham S. Waghale[4], Prasanjeet Singh[5], Rohit Kotasthane[6], Prof. V. R. Khawale[7]

[1,2,3,4,5,6] *Student, Department of Mechanical Engineering, Dr. Babasaheb Ambedkar College of Engineering and Research, RTMNU, Maharashtra, India*

[7] *Professor, Department of Mechanical Engineering, Dr. Babasaheb Ambedkar College of Engineering and Research, RTMNU, Maharashtra, India*

Abstract- **The objective of this study is to understand and improve the productivity by applying Motion and Time Study in the industry. One of the most widely tackled issue is how to improve efficiency and productivity. Motion and time study technique is the productivity improvement techniques used in many manufacturing companies. Motion and time study is a scientific analysis method designed to determine the best way to execute the repetitive task and to measure the time spent by the average worker to complete a given task in a fixed workplace. Motion and time study offers real challenges in organization involving competent engineers, business administrators, industrial relations personnel, especially trained supervisors. The purpose of this project is to discuss related issues of motion and time study implementation and its influence toward productivity improvement. Data from a study carried out on a sample of manufacturing industries in Metalfab Hightech Pvt. Ltd. Shows that the motion and time study implementation contributes positively towards achieving productivity.**

Index Terms- Productivity Improvement, Motion and Time Study, and Manufacturing Organizations.

1. INTRODUCTION

In the world of competitive business every manufacturer wants to earn maximum profit with minimum inputs. Constant improvement in the product is required for the survival of the industry in the global competition. Setting the time standard for different product is vital success of any manufacturing. The emphasis on product quality, innovative designs, competitive pricing and efficient delivery continues to be important. The manufacturing sector is facing the challenges of technological advancement and the continuing need to move towards higher added value and these are driven by the demand for knowledge workers to improve productivity.

Development of the knowledge-based economy will contribute towards broadening the economic base with the shift of the production possibility frontier. They include the continuing investment in technology, innovation, management best practices, high specialization, as well as workers education, skills and experience.
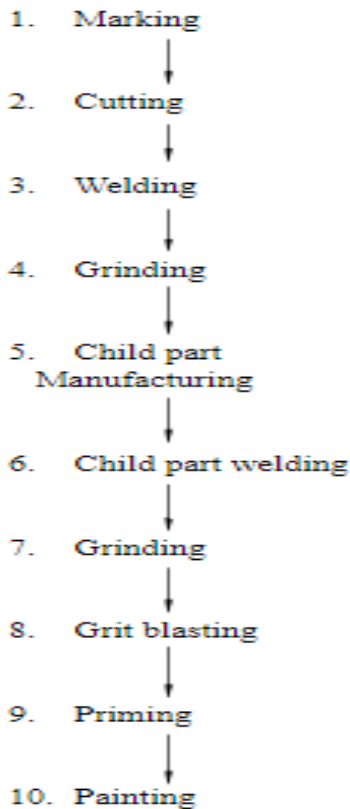
The manufacturing sector needs to improve productivity through upgrading of production technology. Technology can help to improve overall productivity in different ways through the reduction in production cycle time and costs and better production and process control. Manufacturing firms must achieve a degree of innovative capability in managing production operations, processes and capital equipment. They need to develop and adopt good management systems and practices such as Motion and Time Study, Total Productivity Maintenance, Total Quality Management, Just-In-Time Methodology, Supply Chain Management, etc.

Considering the inclination towards a customer-focused environment while facing fierce majority of manufacturers are implementing work study methods help to eliminate wastes and increase proficiencies rather than depending on conventional processes and procedures. It is a way by which one can reduce the cost of manufacturing and increase productivity,

which also increases annual profitability of the industry. Work Study is systematic methodology of carrying out different activities such as to improve the efficient use of resources and to set up standards of performance & quality for the activities to be carried out.

2 METHODOLOGY

This study refers to the application of Motion and Time study techniques for optimizing time and improving overall productivity of column manufacturing processes in Metalfab Hightech Pvt. Ltd., MIDC, Hingna Road, Nagpur. The concept is to study and analyse process through motion and time study and provide necessary solutions to the problems. The following steps were followed

Observe the process: The column manufacturing process is observed which involves the following processes:

1. Marking
2. Cutting
3. Welding
4. Grinding
5. Child part Manufacturing
6. Child part welding
7. Grinding
8. Grit blasting
9. Priming
10. Painting

Data collection:
The following data was collected with the help of stop watch. The data includes the average time and productivity for each process.

Table 1. Data Collection

Sr.	Processes		Time (sec)/ Productivity (%)			Avg time (sec)	Est. Time (sec)
1.	Marking	T	1028	973	1001	1001	900
		P	87.5	92.9	89.9		
2.	Cutting	T	4712	4324	4983	4673	3600
		P	76.4	83.2	72.2		
3.	Lifting and moving	T	1213	1086	1321	1207	900
		P	74.2	82.8	68.1		
4.	Welding the box	T	7166	7299	7583	7350	5400
		P	75.3	73.9	71.2		
5.	Grinding	T	4723	4896	4312	4443	3600
		P	76.2	73.5	83.4		
6.	Alignment check	T	815	1006	912	911	600
		P	73.6	59.4	65.7		
7.	Child part cutting	T	5163	5888	4863	5305	3600
		P	69.7	61.1	74		
8.	Drilling holes in child parts	T	4316	4002	3982	4106	3000
		P	69.5	74.9	75.3		
9.	Child part welding	T	6626	6783	6192	6534	4800
		P	72.4	70.7	77.5		
10.	Angle check	T	1493	1326	1488	1436	1200
		P	80.3	90.4	80.6		
11.	Grinding	T	3824	4029	3654	3836	2400
		P	62.7	59.5	65.6		
12.	Lifting and moving to blast shop	T	2762	2326	2591	2560	1800
		P	65.1	77.3	69.4		
13.	Grit blasting	T	13332	13021	13463	13272	9000
		P	67.5	69.1	66.8		
14.	Priming	T	9542	9079	9732	9451	7200
		P	75.4	79.3	73.9		
15.	Painting	T	14111	16239	15323	15224	10800

*P refers to productivity

*T refers to time

Finding the potential causes for time increment through motion and time study:

On analyzing the processes and collecting the data following causes were identified that decreased the productivity up to a certain extent

1. Use of oxy gas cutter causes time increment due to the guide rail and flame intensity adjustment.
2. The welding rod used is of grade EN6011 which is a fast freeze electrode i.e. the weld puddle changes from liquid to solid rapidly and is deep penetration electrode so it often get stuck to metal.
3. After painting, pinholes are observed on the surface. For removing these pinholes scrubbing with the help of emery paper is done.

Generating ideas and action plan to overcome the problems:

1. Using plasma arc cutter machine readily available in the shop can reduce time up to a certain extent since its cutting speed and penetration rates are higher.
2. EN7018 can be used as an alternative electrode to EN6011.
3. To reduce the occurrence of the pinholes the job can either be preheated or retardants must be added to the paint before coating.

Implementation:

On implementing the above solutions following data was obtained:

Sr	Processes		Time (sec)/Productivity (%)		New Avg	Earlier Avg	Est. Time (sec)	Inc. In %P
1.	Cutting	T	3935	3771	3853	4673	3600	22.2
		P	91.4	95.4	93.4	77.1		
2.	Welding the box	T	7012	6891	6951	7350	5400	5.7
		P	77.01	78.3	77.6	73.4		
3.	Child part cutting	T	4428	4129	4278	5305	3600	24
		P	81.3	87.1	84.1	67.8		
4.	Child part welding	T	5837	6013	5925	6534	4800	10.4
		P	82.2	79.8	81.1	73.4		
5.	Painting	T	13254	13985	13620	15224	10800	13.2
		P	81.4	77.2	81.4	70.9		

3. CALCULATIONS

As per the data collected following calculations of productivity using time study were made:

Productivity = (Estimated Time/ Average time) x100%

Before implementation of solution: Actual time required for manufacturing process

= 980 mins

= 16 hours 20mins

Allowances included: Personal needs (5%) = 49 mins

Retardants (5%) = 49 mins

Rest (5%) = 49 mins

Henceforth,

Actual time after adding allowances = 980 + (49 x 3)

= 1127 mins

Total time taken to complete the process = 1355 mins

Allowances included:

Personal needs (5%) = 67.75mins

Retardants (5%) = 67.75 mins

Rest (5%) = 67.75 mins

Total time after adding allowances

=1355 + (67.75 x3)

= 1588.25 mins

Productivity = (1127/ 1588.25) = 70.9%

After implementation of solution:

Total time taken to complete the process

= 1289 mins

Total time after adding allowances

= 1289 + (3 x 64.45)

= 1482.35 mins

Productivity = (1127/1428.35) = 78.9%

% Increase in productivity =

$$\frac{\text{New Productivity} - \text{Old Productivity}}{\text{Old Productivity}}$$

% Increase in productivity = (78.9 − 70.9)/70.9

= 11.2%

4. RESULT

According to the calculations following results were obtained;

The time and productivity comparison based on pre and post implementation of solution is shown in chart 1.
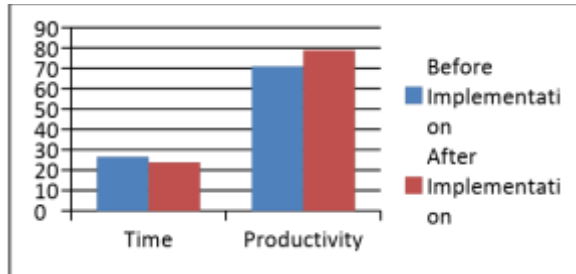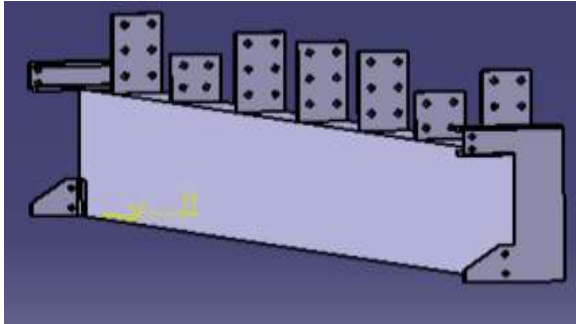
Chart -1: Time and productivity comparison

Fig -1: CATIA image of column (final product)

As per the data collected and calculations made, The total time was significantly brought down to 1482.35 mins which earlier was 1588.25 mins. The overall time productivity of the process increased by 11.2%.

5. CONCLUSIONS

The study signifies that there are many benefits that may be obtained by implementing motion and time study in order to enhance productivity of the company, job efficiency, quality improvement and reduce the operation time for the particular part. It also concluded that the success of implementation of the motion and time study involves various factors such as experienced management committee, departmental cooperation, efficient planning and control.

REFERENCES

[1] Mohd Razali Muhmad & Wan Hasrulnizzam Wan Mahmood, National conference on management of technology Entrepreneurship, Productivity improvement through motion and time study

[2] Marcel van Assen, Opx-instituut, Process management proficiency.

[3] Md. Haider Ali Biswas and Ahad Ali, Yugoslav Journal of operation research, Production and process management: an optimal control approach

[4] Time Motion Study in Determination of Time Standard": 3rd Engineering Conference on Advancement in Mechanical and Manufacturing for Sustainable Environment April 14-16, 2010, Kuching, and Sarawak, Malaysia

[5] "Effect of Cost Control and Cost Reduction Techniques in Organizational Performance": International Business and Management Vol. 14, No. 3,2017, pp. 19-26 DOI:10.3968/9686

[6] "Process Planning - New Process Plans For Agile Manufacturing": Department of Mechanical Engineering Sidi Mohammed Ben Abdellah University, Route d'imouzzer, BP. 2202, Fès, Morocco

[7] Teian K (1992), guiding continuous improvement through Employee suggestions, productivity press, Portland, USA.

[8] Dr. O.P. Khanna, "Industrial engineering and management", Dhanpatrai publications pvt. Ltd., (2008).

[9] MartandTelsang," Industrial engineering and production management", S. Chand and Company pvt. Ltd, (2008)