

# Productivity Improvement in Manufacturing Industry Using Industrial Engineering Technique

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**Abstract-** In today's increasingly competitive world, it is important to constantly improve, be it a manufacturing or service industry. Quality with quantity is a main characteristic which helps a company stay in the competition. Technology has taken leaps of development lately and this has brought about an increase in the customer demands. The main aim is to study the current capacity, analyze it to find areas of improvement and make an improvement proposal to meet the forecasted increase in demand. This thesis presents the current performance of outputs and capacity of the plant calculated using continuous data collected in shop floor. In each workstation the processing time is different and the longest time consumption workstation will be identified as a bottleneck workstation. The identified bottle neck station will be analyzed to reduce the processing time which increases production rate.

**Keywords-** Productivity improvement, quality control tools.

## I. INTRODUCTION

Survival of any industry in today's environment especially manufacturing industry not only depends on response time but also quality of the product produced. In this respect, seven quality control tools can be utilized as a method or process to reduce the manufacturing costs, production time and increasing the production line productivity. Productivity can be defined as a ratio between output and input. Productivity improvement is a critical success factor and the foundation of profitability [1].

Productivity measurement is a long-term measurement. Any changes in dynamic potential show a growth or reduction of figures over a long period [2]. Industrial Engineering in the other hand concerned with the design, improvement, and installation of the integrated system of men, materials, and equipment. It draws upon specialized knowledge and skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design, to specify, predict and evaluate the result to be obtained from such a system [3].

Today, quality plays an important role as it leads to increasing number of product sold and also increment of company profit. Productivity, quality, and cost of operation relatively depended to each other. By improving the productivity, the quality also must be improved and hence lower the reject rates or defects [4]. Industrial engineering is an engineering profession that is concerned with the optimization of complex processes, systems, or organizations by developing, improving and implementing integrated systems of people, money, knowledge, information, equipment, energy and materials. [1]

Industrial engineers use specialized knowledge and skills in the mathematical, physical and social sciences, together with the principles and methods of engineering analysis and design, to specify, predict, and evaluate the results obtained from systems and processes. [1] From these results, they are able to create new systems, processes or situations for the useful coordination of Labor, materials and machines and also improve the quality and productivity of systems, physical or social. [2][3].

Traditionally, a major aspect of industrial engineering was planning the layout of factories and designing assembly lines and other manufacturing paradigms. And now, in lean manufacturing systems, industrial engineers work to eliminate wastes of time, money, materials, energy, and other resources.

## II. RESEARCH METHODOLOGY

Forging is the process of deformation of metal in hot or cold condition under the application of compressive force. Forging is one of the oldest manufacturing process through which metal parts of various shapes can be manufactured. Automobile components like crankshaft, gears, yoke, piston, connecting rod, shaft etc. are produced by forging process. To get the final product, the raw material in the form of steel bar has to undergo a series of processes in forging press shop. We have carried out study in the forging company which wants to raise GM to Manpower ratio by reducing the manpower.

The press shop layout and production lines are planned considering number of forging press and press capacity.

Part families have been formed on the basis of forging press on which they are forged.

The press shop is divided into 3 key sections: Cutting department, forging department and post forging department. Following is the process flow in the press shop:



Fig 1. Process Flow in Press shop.

Process flow (Fig.1.1) is described briefly as follows:

- The steel bars are cut into billets on circular saw cutting machines and horizontal band saw machines.
- These cut billets are fed into Induction Billet heater in which they attain the temperature of 1100-1200° C due to which billets become forgeable.
- Through conveyor and chute, hot billets are fed into forging press which is operated by forger. The flash is removed through trimming press.

- The parts produced after press is sent to Heat treatment furnace in which the micro structural properties are altered.
- Inshot blasting machine, scales formed after Heat treatment is removed using steel shots.
- Then crack detection is done by magnetic particle inspection.
- Final inspection involves visual inspection and gauging. Then parts are dipped into oil and then packaged in pallets.

The cutting department was selected as management was more concerned due to excessive manpower deployment. The raw material is provided to cutting department. It arrives in the form of bundles of steel bars of length around 5000mm. The diameter of steel bars is different for each product variety. The number of bars in bundles varies because the raw material is purchased on the basis of weight (metric ton). There are 38 storage racks on which the raw material is stored. If there is no space available for storing the raw material, then such material is stored at the back side yard of press shop.

Sr. No.	Description	Distance(m)	Time	Symbol				
				○	➡	⌋	■	▼
1	Check oil level							
2	To oil barrel location							
3	Fill the mist oil into machine							
4	To the raw material storage rack							
5	Identify the raw material location of required grade							
6	To the crane location							
7	Move the crane to the desired location							
8	Adjust the crane rope to hold the bundle, Insert							
9	Move the raw material to cutting machine using							
10	Remove the wire to separate the bars from bundle							

Fig 2. Process Flow Chart– mantype.

### 1. Examine:

ECRS (Eliminate, Combine, Rearrange or Simplify) technique for method improvement was applied. 5W-1H questioning gave the detailing of activity. Through ECRS (Fig. 5), few suggestions to reduce human efforts were given. Man-Machine chart was created to measure idleness of operator. The combination of ECRS and flow process chart gave us the clear picture of losses and VA-NVA analysis. This became the basis for Develop step.

Man Machine Chart for an operator operating 2 machines was prepared. Time scale of 0.5 minutes was selected. Colour codes were selected for machine conditions like Machine setup, Machine idle, Machine working and Machine Cleaning – inspection conditions. Similarly for manual idleness, red colour code was used. Once the bars

loaded on circular saw machine, the auto-cycle is started to the whole bar into number of billets. So man-Machine chart indicated that man utilization is 58% only.

So analysis for an operator to handle three machines was done. Also one horizontal band saw machine to operator was assigned which reduced his idleness. Band saw machines are used to cut the billets from uneven end pieces.

### III. RESULT

The results can be represented in bar chart as follows:

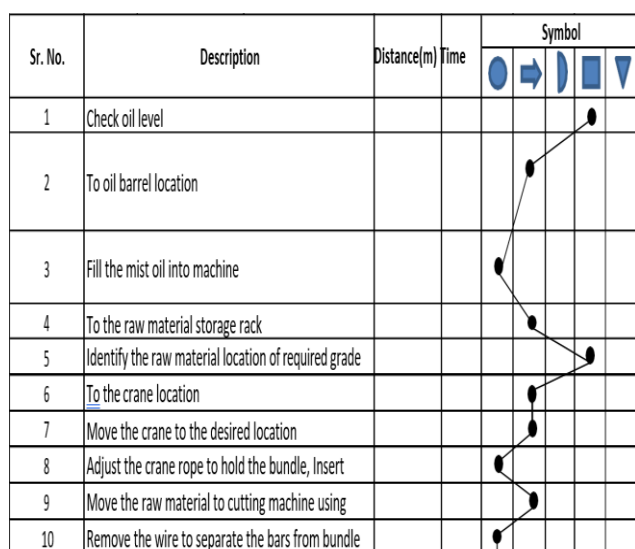


Fig 3. Manpower.

From the above graph it can be seen that the man power per day for circular saw was reduced from 18 to 12 on basis of Man-Machine chart analysis.

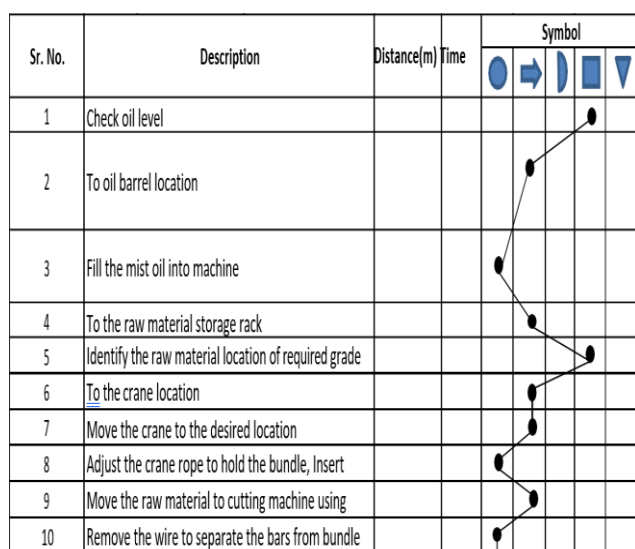


Fig 4. Cost Reduction.

From the above graph it can be seen that before company was paying 54 lakhs which got reduced to 36 lakhs. Annual saving for company is calculated and found to be around Rs. 18 Lakh.

### IV. CONCLUSION

Industrial Engineering techniques such as Man-machine chart, work study, ECRS are necessary for Productivity improvement in manufacturing industry. Company is benefitted in terms of money, manpower and other resources. Below is the list of benefits obtained:

- Reduction in manpower and cost
- Material movement reduction.
- Increase in Operator productivity.
- Proper direction to cutting department through IPO and DWM.
- Awareness for safety increased.

From the collected data it has been identified that the production time is less than the take time for the case study organization hence in order to meet the demand it is important to implement the suitable industrial engineering tools. By implementing, it can reduce the cycle time and work-in-progress. Reduction of waste can also improve productivity. Improving quality at the source will not affect any station, but reduces scrap and rework. Manufacturing defect less product will help to meet the demand.

The study shows that there are many benefits to be obtained by implementing productivity improvement effort. The mainly purpose of the implementation of motion and time study by respondent are increase productivity, job efficiency, quality improvement, reduce operation time per part, compete in local market and fulfilling market demand.

The success of the of implementation motion and time study had been contributed by several success factors such as a stop management commitment, inter departmental cooperation, good planning and control system, company technique capability, effective training, experienced work forces, steady fund inflow and clear product strategy.

Unfortunately, the companies implementing motion and time study face many challenges such as cooperation from workers, followed by in experienced project leader, unavailability of relevant consultant, staff training and lack of inter departmental cooperation.

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