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A Review on Productivity Improvement in Manufacturing Industry Using Industrial Engineering Technique

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Abstract- Productivity is an attitude of mind. It is a mentality of progress of the constant improvement of that which exists. It is certainty of being able to do better than yesterday and continuously. It is constant adoption of economic and social life to changing conditions. It is continual effort to apply new techniques and methods. It is faith in human progress". In the words of Peter Drucker productivity means a balance between all factors of production that will give the maximum output with the smallest effort1. On the other hand, according to International Labor Organization productivity is the ratio between the volumes of output as measured by production indicates and the corresponding volume of Labor input' as measured by production indices and the corresponding volume of Labor input as measured by employment indices.

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 layouts 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. PRODUCTIVITY IMPROVEMENT

Productivity improvement is to do the right things better and make it a part of continuous process. Productivity is the ratio between output and input. It is quantitative relationship between what we produce and what we have spent to produce.

Productivity is nothing but reduction in wastage of resources like men, material, machine, time, space, capital etc. It can be expressed as human efforts to produce more and more with less and less inputs of resources so that there will be maximum distribution of benefits among maximum number of people. Productivity denotes relationship between output and one or all associated inputs.

European Productivity Council states that "Productivity is an attitude of mind. It is a mentality of progress of the constant improvement of that which exists. It is certainty of being able to do better than yesterday and continuously. It is constant adoption of economic and social life to changing conditions.

It is continual effort to apply new techniques and methods. It is faith in human progress". In the words of Peter Drucker productivity means a balance between all factors of production that will give the maximum output with the smallest effort1.

On the other hand, according to International Labor Organization productivity is the ratio between the volumes of output as measured by production indicates and the corresponding volume of Labor input' as measured by production indices and the corresponding volume of Labor input as measured by employment indices2.

This definition applies to an enterprise, industry or an economy as a whole.

The following examples of each type of productivity may make improved or higher productivity meaning clearer.

1. Improved Productivity of Land:
If by using better seed, better methods of cultivation and more fertilizer, the yield of corn from a particular hectare of land can be increased from 4 quintals to 6quintals, the productivity of that land, in the agricultural sense is increased (improved) by 50 percent.

The productivity of land used for industrial purposes is said to have been increased if the output of goods or services within that area of land is increased by whatever means.

2. Improved Productivity of Materials:
A skilled tailor is able to cut 12 suits from a bale of cloth where an unskilled Labor is able to cut only 10 suits from a bale of cloth, then the productivity of the bale used by skilled worker is 16.6 percent greater than unskilled Labor.

3. Improved Productivity of Machines:
A machine tool is producing 90 pieces per working day (i.e. 8 hours). Considering that through the use of improved cutting tools, the output is increased to 120 pieces, and then the productivity of that machine will be increased by 33.33 percent.

4. Improved Productivity of Men (Labor):
The worker is producing 32 plates per hour. Considering that with the improved methods of work, he will be able to produce 42 plates per hour, then productivity of worker will be improved by 31.25 percent.

Thus it can be said that more output results in to higher productivity or improvement from same amount of resources which means lower money costs and higher net money returns per unit of output.

Another productivity concept known as Japanese Holistic View of Productivity explains productivity as a comprehensive holistic phenomenon encompassing all elements required to improve products/ services (output).

Productivity in the Future must be concern itself with seeking affluence of a kind which will provide people with material wealth as well as spiritual satisfaction. Also the outputs particularly in the form of physical pollution must be controlled in the context of increasing concern of society for clean environment and sustainable development.

To improve productivity products must be designed to satisfy customer need with optimum consumption of resources without generation of waste in the manufacturing process. The following Figure 1.1 represents clearly Japanese Holistic View of Productivity.

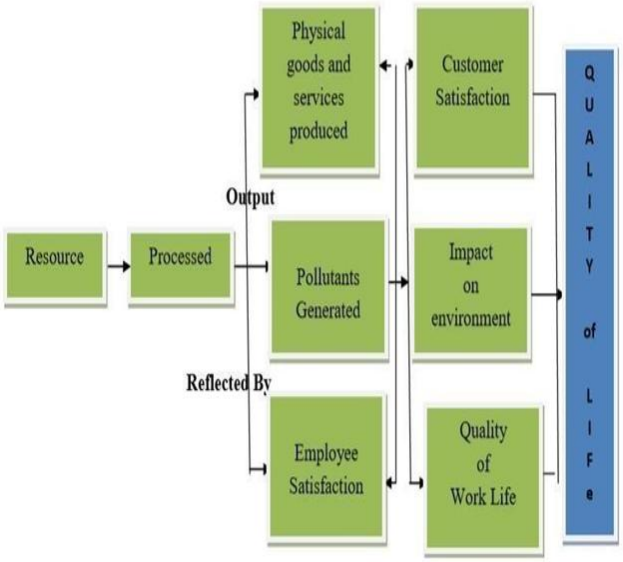

Fig 1. Japanese Holistic View of Productivity Concept.

III. PAST STUDIES

Banga et al. (2020) focused on suggesting feasible alternatives to decrease the cycle time and consequently increase the throughput of a batch production system in a sheet metal parts manufacturing firm. Siemens Tecnomatix has been used as the prime software in this research. In this research, simulation is used as the main tool to experiment on the system with various feasible alternatives. After the results of the simulation, the analysis has been presented regarding the extent of achievement of an objective about various methods employed.

Murali et al. (2020) improved productivity of a furniture manufacturing company. Demand forecasts play a crucial role in productivity, improvement and production planning analyzing the problems associated with it and there by tackling over production and shortage. Demand forecasting was analyzed using three (simple moving average method, weighted moving average method, seasonal regression method) different methods in which seasonal regression was found to be more accurate for the current scenario.

This method reduces the deviation of forecast by 17.37% which will result in better visibility thus by improvement in productivity. Preliminary survey showed that there were some processes that lead to overall increase in production lead time and industry is not keen in operating the second shift particularly in painting department, which leads to under-utilization of resources.

This research work opted for an exploratory study using the time study analysis and value stream mapping (VSM) to identify bottleneck processes. Brain storming session was conducted to plot cause and effect and thereby priorities the causes to tackle. Simulation analysis was performed to understand the utilization of man-machine using the current and alternative method. The proposed methods improve the operator utilization to 54% from 29% and output by 50%.

Punna et al. (2020) enlightened the importance of lean techniques implementation in a medium scale belt manufacturing industry. This research study helps to exhibit the existing hidden potential in the selected industry as well as a selection of appropriate techniques for productivity improvements.

Also, it aims to eradicate wastes and non-value added activities at every stage in order to enhance the overall productivity. From the results after implementation of appropriate lean techniques it was found that, the lead time was reduced about 1256 minutes and the overall production was increased by about 9%.

Khot et al. (2020) analyzed the industry producing Brake Drum of Automobile by taking video of complete process and doing time study on this process line using Video Based Timer Pro Software. By using this software value added and non-value added time are estimated As a result of the study, non-value added time causes inefficiency in total production is 7% which is reduced to 2%. Due to this production of Brake Drum is increased by 64 parts

per day. The paper discusses the use of Industrial Engineering tools for the purpose of productivity improvement.

Memon et al. (2019) presented traditional QC tools (flow chart, check sheet, histogram, Pare to chart, cause, and effect diagram, scatter diagram and control chart) implemented in an automobile company to assess and improve the defect reduction level in the assembly line. Chassis and trim lined were selected for data collection to assess and improve the defect level for productivity improvement. It was found from the results that after the successful implementation of the QC tools, the defect level reduced by 90% (from132 to 13 defects) at the chassis line.

Similarly, the defect level was reduced by 80% (from157 to 28 defects) at the trim line. The automobile company implemented only a few of the seven QC tools in their assembly line. It is suggested that the company may need to manage a mechanism for the implementation of all seven QC tools in every section of the company.

Yemane et al. (2019) dealt with modeling of assembly line balancing by combining both manual line balancing techniques with computer simulation to find the optimal solution in these wing line of Almeda textile plc so as to improve productivity. In this research arena software, is employed to model and measure the performance of the existing and proposed sewing line of the federal police trousers sewing line model. For each operation, the researchers have taken 15sampling observations using stopwatch and recorded the result.

All the collected data are statistically analyzed with are an input analyzer for statistical significance and determination of expressions to be used to the simulation modeling; SAM is also calculated for these operations to be used to the manual line balancing.

An existing systems simulation model is developed and run for 160 replications by the researchers to measure the current performance of the system in terms of resource utilization, WIP, and waiting time. The existing systems average utilization is 0.53 with a line efficiency of 42%. This study has developed a new Sewing assembly line model which has increased the system utilization to 0.69 at a line efficiency of 58.42% without incurring additional cost.

Gopala Krishnan et al. (2019) increased productivity through smart maintenance planning by including productivity as one of the objectives of the maintenance organization. Therefore, the goals of the paper are to investigate existing machine criticality assessment and identify components of the criticality assessment tool to increase productivity.

Six different cases were chosen from six different production sites operated by three multi-national manufacturing companies. Data collection was carried out in the form of interviews, focus groups and archival records. More than one source of data was collected in each of the cases. The cases included different production layouts such as machining, assembly and foundry, which ensured data variety.

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