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Study on Productivity Improvement in Manufacturing Organization

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Abstract**—***In today's era of advancement, one of the major challenges is to improve the productivity of the manufacturing firm by implementing the advanced methods and technology in their systems. A lot of research is going on the way to find out the factors responsible for improving the productivity. Currently there is not a single book or literature that gives in one place, information about various processes, technologies and techniques that can improve productivity. Information is scattered in many literatures and available under various headings. An attempt has been made here to explore various processes, techniques and technologies they can improve the productivity, because of the advancement in the technologies and processes there will be increase in the customer demand. The main aim is to find the areas of improvement and to make an improvement proposal to meet the increment in the demand. This work focuses on the productivity improvement by using the manufacturing modelling concepts. The identification and analyzing the source, reflects the improvement in the productivity of the system.*

Keywords—Advanced process, Manufacturing techniques, Production process, Productivity improvement, Technologies.

I. INTRODUCTION

Quality improvement has always been a challenging issue for companies as it usually gives additional costs to producers. In this regard, one of their main concerns is to choose improvement works so that high quality products can be manufactured with substantial cost savings. It has been practically shown that productivity actually increases as quality improves. Humans have always shown keen interest in the possibilities of improving their standard of living. With this interest, it is only natural that from time to time questions about the ability of our industries to deliver the required output remain. Since productivity is the major determinant of competition and profitability, extensive analysis is not needed to reveal that productivity is the backbone of a nation's economic progress. In countries where productivity is high, the standard of living is also high. As international competition continues, there is growing concern about the stagnation in productivity and the long-term impact that it can have on each firm and the ability of each firm to compete in world markets. Therefore, increasing productivity should be the challenge of a corporation, and it tries its best to make all managers achieve their rising levels. Productivity is generally defined as the ratio of total output to total input. It measures the efficiency with which a production activity converts input into output. Obviously, this conversion process involves many inputs and outputs and many complex activities. Most people would agree that a significant increase in productivity over the long term cannot be caused by increasing work efforts alone, especially when the trend in industrialized societies of the world is towards rising labour costs.

Real growth can come through capital investment in new and improved machines, equipment and facilities. It is also being emphasized that improving productivity does not work hard, but is to work in a better way. And productivity should not only apply to physical production processes, but also to all other aspects of human effort. There is a lot of work aimed at determining the principle factors that affect productivity. In order to systematically analyse the complex concept of productivity improvement, this paper turns the issue into an approach to efficiency and effective approach. The former refers to productivity improvement through internal collaboration without consuming additional inputs while the latter requires additional investment in equipment or labour to increase productivity levels.

The growth of a country's economy comes from the growth of its manufacturing industries. Manufacturing firms are currently undergoing very strong competition. Now-a-days industries are using various manufacturing systems, these are dedicated manufacturing systems, cellular manufacturing systems and flexible manufacturing systems. The production of the manufacturing system depends on various factors. These factors include production rate, product quality, and system flexibility. The rate of production depends on the productivity of the system, while quality is related to the conformance of the product

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produced with the available quality standards. System flexibility depends on the accountability of the system in relation to changes in product or product specification therefore these factors are considered as performance parameters to measure the overall performance of the manufacturing system. As stated above, productivity is considered an important factor or measure the performance of a manufacturing system.

This study focuses on productivity improvement using the manufacturing modeling concept, improving the productivity ratio will give the manufacturing firm strength and stability in the working environment there. The current problem addressed by industries is lack of productivity (output). Industries need suitable and measurable methods and models with process flows by which productivity ratios will improve. This is the main root cause and affects the entire system of its productivity which leads to an increase in the cost of each floor.

To improve the quality of a product, it needs to reduce its deviation from its nominal value due to noise factors. Offline quality control is one of the main Counters for this purpose which can be implemented in three stages, namely: System Design, Parameter Design and Tolerance Design. Between these steps, tolerance analysis is a valuable tool to reduce manufacturing costs by improving producibility. Tolerance analysis of manufactured parts assemblies is an essential part of successful product development. In the recent decade, several authors have presented various useful methods of selecting design tolerance by employing either the manufacturing cost function or the quality loss function and / or a combination of both.

The goal of this study is to develop the model proposed by Mordinaftchelliet. Al (2015) for an assembled product with M assembly components and suitable alternatives to tolerances, as well as introducing a riskless approach to take improvement actions, resulting in minimal total cost. Here, the term "risk-free" indicates that producers should not incur additional costs by undertaking the improvement works. To overcome the difficulties of simultaneous choices of improved operation and tolerance, a series of algorithms are proposed that help save large amounts of computers by sorting out too many unnecessary evaluations. In quality engineering, parameter design is used to achieve the desired level of quality and economic tolerance design is used to allocate optimal tolerances to components so as to minimize the total cost. However, it is worth thinking about greater productivity during the allocation of tolerances to components by taking some improvement actions. The question could also be generated that "will the standard of some component be improved by this (lower total cost quite earlier cost?"). In this regard, Moradinaftchaliet. Al (2015) has introduced a new approach to allocate tolerance to a component, resulting in a minimum total cost by performing improvement work. Through their method, the fixed relationship between the standard deviation and tolerance of the component is first relaxed and then other sources of variability are entered into the total cost model to implement the correction functions. The reason for this is that the manufacturing cost function reflects the cost to the manufacturer by tightening the natural tolerance based on controlling only some sources of variability and not all tangible sources.

Geetaet. al. (2015) have implemented a genetic algorithm to determine the best product sequence of scheduling and to assign tolerance of components based on three elements: manufacturing cost, quality loss and machine idle time cost. However, none of these authors considered the effect of improvement on productivity. Furthermore, all these studies considered a fixed relationship between standard deviation and tolerance, which, in fact, indicates a fixed value for the process capability index. Walter and Wartack (2013) developed an optimization method for tolerance-cost-optimization of a system in motion, which considers two main features of a system in speed during its use. Liu et. al. (2013) used an analytical method in a model involving two types of constraints, namely assembly tolerance constraint and lack of process accuracy to achieve optimal tolerance based on manufacturing cost and quality loss. Rao et. al. (2011) proposed a concurrent approach to determine tolerance at minimum total cost using three evolutionary methods, i.e., genetic algorithms, differential evolution and particle swarm optimization. Chen et al. (2013) constructed an optimal tolerance based on assembly deformation and quality loss with one application in the aircraft industry. Muthu et al. (2009) applied two meta-heuristics techniques, i.e. genetic algorithm and particle swarm, to consider both manufacturing cost and quality loss functions to allocate tolerance to components so as to reduce the total cost. They further conclude that the results obtained by these techniques outperform the results obtained by classical optimization approaches in terms of overall cost reduction for the overall slick clutch assembly problem.

Wu et al. (2009) considered non-explicitly constrained tolerance allocation problems to reduce the ratio between construction costs and risk (the probability of respecting geometric requirements). Peng and others. (2008) used a combined model to balance manufacturing costs and quality losses to achieve synchronously optimal allocation of design and process tolerances to each component for mechanical assemblies involving interrelated amplitude chains. Garth and Hancock (2000) developed a tolerance-based methodology for improving complex, multiple process systems that contain a large number of variables. Fang et al. (2001)

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proposed a Stochastic Integer Programming (SIP) for simultaneous tolerance and selection based on suppliers' quality loss function and process capability indices.

Graph Related with Results and Actions (GRAZ) is based on a conceptual reference model that uses two graphical tools and a structural approach. In this conceptual representation model, a construction system is decomposed into three sub-systems: 1) Turning physical system into raw material. 2) managing the decision system and / or controlling the physical system. 3) Supporting informational information system. (Carrie and Mackintosh 1997; Chen, Valspire, Doomints 1997; Dumints 1985).

Integrated Computer-Aided Manufacturing DEFinition (ZDEFO) is a function modeling language that consists of a hierarchy of diagrams, text, and terminology. The diagram is the major component of an IDEFO model. It presents a construction system as boxes that are organized in a hierarchy. These boxes are associated with arrows, which represent data or object interfaces. The position of the attachment between the arrow and the box indicates the four interface types, namely, input, control, output, and mechanism / resource (Platinum) (Cheng-Leong, Feng, Leng 1999; Ang 1999; Colquhoun, Baines, Crossley 1993). Structured Analysis and Design Technique (SADT) uses many graphical tools including diagrams, actigrams, datagrams, node lists, and data dictionaries. Two types of elements, activities and data, are contained in a diagram. An actogram describes a relationship between elements of activities, and a datagram describes a relationship between data elements. (Santarek and Beusif 1998; Zaytoon, Neil, Mille 1994; Downs, Claire, Coe 1988). Structured Systems Analysis and Design Method (SSADM) provides the interface between method processes and techniques. With SSADM, the system can be broken into modules. A module consists of phases of various activities. It has many functions with inputs and outputs at each stage (Toh 1999, Ashworth 1988).

II. PROBLEM DEFINITION

Products manufactured today, using tools and moulds (stripping, cutting and joining in our case) require excellent accuracy with good surface finish. It depends entirely on the type of machining parameters and the type of machining method used. Thus, precise control of parameters is necessary to optimize quality and improve productivity in manufacturing. Today tool makers manufacture daces and moulds using a wide variety of materials. Thus, machining of various materials in a minimum time and good surface finish is important. Here is where the problem starts i.e. different materials, different parameters and variation in machining time and surface finish.

Problem and its effects:

The current major problem faced by the industry is machining time. Today's industry requires output to maintain product accuracy and surface in minimum time. This is where the problem lies, because of this a huge problem arises. They are as follows:

1. The cost of machining is high.
2. Machining time is longer for the process.
3. Machine working hours are also longer.
4. Since machining hours use more electricity than more.
5. Increasing machining hours increases labour costs.
6. The life of the machine is reduced because it remains in constant use.
7. The efficiency of the machining process is low.
8. High tool wear and tear due to reduction in tool life.
9. Timely delivery cannot occur because machining is slow.
10. It has high heat output due to high equipment contact area.

III. DATA COLLECTION

The purpose of data collection is to provide a basis for analysis, in other words, to transform data into information that is decision-making and useful. However, before collecting data, a data collection plan needs to be developed. In the manufacturing plant, data is collected to identify the bottleneck station and analyse them and eliminate them. The collected data is of direct observation in shop floor.

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IV. METHODOLOGY

Productivity improvement techniques are the methodology chosen to increase the production of capsule manufacturing. The work to be done is given as follows.

- From direct continuous observation.
- From the daily entry book of defects.
- Identifying bottleneck process.
- Analyzing bottleneck process.
- Effect on the overall-process and machines.

The following process shows the entire workflow of the machine.

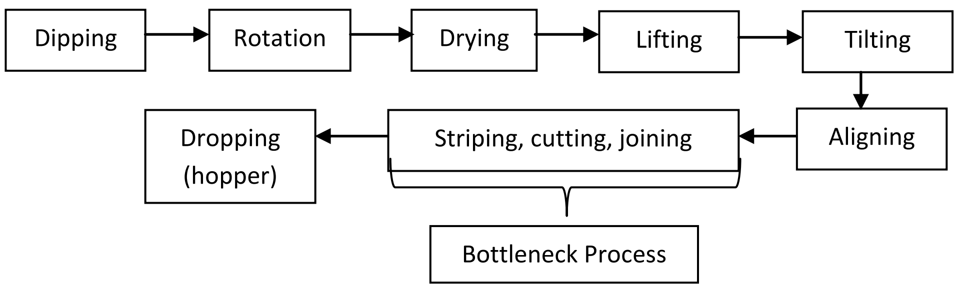

FIGURE 1: The process flow

From the above process, we come to know that the striping, cutting and joining is the main bottleneck area which generate the more defects in the final product. To solve this defect, we have fixed and attached some parts of cleaning stuff like oiling on the source and full body oil distribution and oil greaser section in between the dispatching and dipping section.

V. CASE STUDY

5.1.Introduction of the case study.

This case study reflects the productivity improvement of the desired product, by adjusting the parameters of the production area. The assembly point of the product is in the main auto-head section, where the stripping, cutting, and joining processes actually take place, applying methodology to the system will minimize the elimination of the product and improve the productivity ratio of the process. The main motto behind the case study is that reducing the number of defects on the desired product by not changing its characteristics and implementing the following and implemented process will not have any negative impact on the product.

5.2. Process Parameters.

1) Collet/Push-rod Rotation: The collet/Push-rod rotation is the rotational frequency of the collet of the machine, measured in Revolution Per Minute (RPM). The collet rotation speed depends on the size of the product.

2)Cutting Speed (Vc): Cutting speed may be defined as the rate (or speed) at the work-piece surface, irrespective of the machining operation used. The unit used is m/min.

3) Depth of Cut (ap): Cutting speed comes with depth of cut to determine the material removal rate, which is the volume of work-piece material (metal, wood, plastic, etc.) that can be removed per time unit. Its unit is mm.

4) Surface Roughness (Ra): Surface roughness commonly shortened to roughness, is a measure of the finely spaced surface irregularities. It is known as "surface finish". It is measured in Microns (μm).

5) Cotton Felt with Pad: The cotton felt with the pad attached at the position of the stripping, cutting and joining section which is the bottleneck area of the all process, in which the most chances are arises that the defects comes from this area. The cotton felt provides oil to the lubrication part and pad with greaser distribute it to the whole body of the source.

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TABLE 1: DATA COLLECTION

Machine Number	Months			
	August		September	
	No. of Defects	No. of C change	No. of Defects	No. of C change
33.	10	11	119	8
34.	83	19	44	18
35.	60	23	187	17
36.	882	21	511	16
37.	143	27	93	13
Total.	1178	101	954	72
Loss in Kgs.	64.24		99.39	
Sorting %	0.037		0.034	
Overall Defects	3130		2679	

The following table for data collection shows the recorded data of defects in the month of august and September, and the graph shows the defects analysis in graph by which one can easily understand the difference between the two.

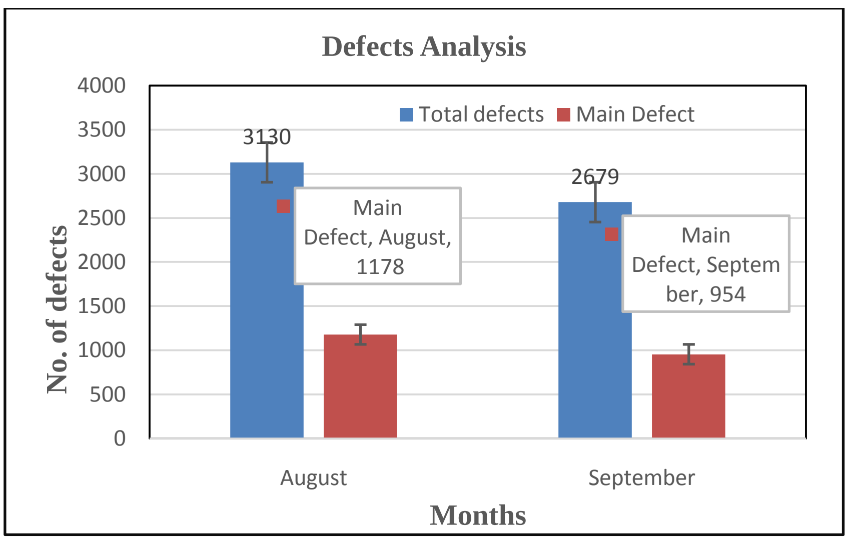

FIGURE 2: Defect analysis of August and September months

VI. CONCLUSION

From the collected data, it has been identified as that the main defects are generating at the stripping, cutting and joining section. The case study arranged in such a way that it eliminate the defects and meets the requirement of the process. By implementing, it can reduce the counts of defects by which there will not be any kind of wastage and reduction of wastages improve the productivity. By implementing the methodology. we found that there is improvement in the quality of the final product and it reduces scrap and rework. Manufacturing defects less product will help to meet the demand. The following are the points which reflects the benefits to the organization.

1. The efficiency of the machine increases.
2. Reduction in defects loss.
3. Machining time reduces.
4. Power consumption reduce.
5. Tool wear & tear reduce.
6. Sampling time reduces.
7. No need of detailed observation.
8. Improves quality of the final product.
9. Productivity is high.
10. Machine life stabilize.

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