

A Review on Application of Statistical Quality Control Tools in the Manufacturing Industry

M.Tech. Scholar Shubham Madke, Professor Dr. P.L. Verma, Associate Professor Sanjay Jain

Department of Mechanical Engineering, SATI, Vidisha India
smadke7@gmail.com, vermapl@rediffmail.com, sanjaysati_vds@yahoo.co.in,

Abstract-In this paper, a review of the systematic use of statistical quality control tools is presented. The main aim of this paper is to provide an easy introduction of statistical quality control tools and to improve the quality level of manufacturing processes by applying it. Quality control tools are the means for collecting data, analysing data, identifying root causes, and measuring the results. These tools are related to numerical data processing. All of these tools together can provide great process tracking and analysis that can be very helpful for quality improvements. These tools make quality improvements easier to see, implement, and track. The work shows continuous use of these tools upgrades the personnel characteristics of the people involved. It enhances their ability to think generate ideas, solve problems, and do proper planning. The development of people improves the internal environment of the organization, which plays a major role in the total Quality Culture.

Key words-Statistical quality control tools, Seven Quality Control Tools, Productivity, Manufacturing

I. INTRODUCTION

The art of meeting customer specifications, which today is termed as “quality”. Quality is the symbol of human civilization, and with the progress of human civilization, quality control will play an incomparable role in the business. It can be said that if there is no quality control, there is no economic benefit.

In the current world of continually increasing global competition it is imperative for all manufacturing and service organizations to improve the quality of their products. In today highly competitive scenario the markets are becoming global and economic conditions are changing fast. Customers are more quality conscious and demand for high quality product at competitive prices with product variety and reduced lead time. It is a data-driven quality strategy used to improve processes. It is an integral part of a Six Sigma initiative, but in general can be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives such as lean.

Broadly speaking, quality control refers to an organization’s efforts to prevent or correct defects in its goods or services or to improve them in some way. Some organizations use the term quality control to refer only to error detection, whereas quality assurance refers to both the prevention and the detection of quality problems. Organizations must have a department or employee devoted to identifying defects and promoting high quality. In these cases, the supervisor can benefit from the expertise of quality-control personnel. Ultimately, however, the organization expects its supervisors to take

responsibility for the quality of work in their departments. In general, when supervisors look for high-quality performance to reinforce or improvements to make, they can focus on two areas: the product itself or the process of making and delivering the product.

II. QUALITY CONTROL

Because of the negative consequences of poor quality, organizations try to prevent and correct such problems through various approaches to quality control. Broadly speaking, quality control refers to an organization’s efforts to prevent or correct defects in its goods or services or to improve them in some way. Some organizations use the term quality control to refer only to error detection, whereas quality assurance refers to both the prevention and the detection of quality problems. Organizations must have a department or employee devoted to identifying defects and promoting high quality. In these cases, the supervisor can benefit from the expertise of quality-control personnel.

1. Product Quality Control

An organization that focuses on ways to improve the product itself is using product quality control. Computer technology can greatly improve product quality control.

2. Process Control

An organization might also consider how to do things in a way that leads to better quality. This focus is called process control. The spur gear manufacturing company might conduct periodic checks to make sure its employees understand good techniques for setting up the machines. A broad approach to process control involves creating an

organizational climate that encourages quality. Process control techniques can be very effective. At Accurate Gauge and Manufacturing, process control is an important part of the company's efforts to plan for quality and correct the causes of defects in the precision parts it manufactures for heavy equipment and commercial and automotive vehicles.

Quality teams meet weekly to prevent problems, but some process improvements are responses to problems. Even when a failure occurred in a product line the company was preparing to phase out, engineering manager led efforts to correct the process by setting up procedures for operators to check the parts were being produced. In addition to impressing the customer with this extreme commitment to quality, the effort established a process that became the standard procedure for making other defect-free parts.

III. LITERATURE REVIEW

Jitendra A. Panchiwala [1] presented Brief study and his understanding about Quality and Productivity improvement in small scale foundry industry. In this paper he is aimed to review the research work made by several researchers and an attempt to get technical solution for minimizing various casting defects and improve the entire process of casting manufacturing. he conclude from several research work that modern method of casting component using various software and simulation techniques is really a boon for the industrial sector. To complete globally, foundry men have to move ahead from the slogan of "satisfying customer" and adopt and ruinously endeavour for "customer delight". Meeting customers' demands will not be sufficient. Requirements will be to exceeding them through quality and productivity improvement. After preferring paper he select some of tools and techniques for future work like SPC are quite expensive to implement in small scale industries but this method gives better results than any other techniques.

Shyam H. Bambharoliya [2] reviews some selected factors to reducing rejection rate in small scale machining unit using seven Quality Control Tools. This paper aims to identify the problems related to different products and probable solutions based on that problem. Use of seven QC Tools is best way to reduce rejection and defect of product after analysing of manufacturing process. Another advantage is increasing customer satisfaction by use of seven QC Tools in today competitive market.

Varsha M. Magar [3] investigates in this paper about the systematic use of seven tools. The main aim of this paper is about to provide an easy introduction of seven QC tools and to improve the quality level of manufacturing processes by applying it. QC tools are the means for

collecting data, analysing data, identifying root causes and measuring the results.

Sanjeev Kadian [4] Present the influence of using Lean Manufacturing Technology to increase the production in scientific equipment's manufacturing industry in this paper. In this case study the scientific equipment's manufacturing company employs part of the "seven basic quality control (QC) tools" to significantly improved the process rejection and rework. By implementing these quality tools as the problem solving techniques the rejection rate was reduced from 7.3% to 4% and Rework rate from 20% to 11.33%.the competitive business in the scientific market has enhanced the company in this study to provide lower cost quality product. Quality improvement program had been designed and been implemented to increase the potential of profit.

Mayank Dev Singh [5] in their paper, "Productivity improvement by using quality control tools- A Case study of chartered Rubber Product", has study about the productivity improvement of the chartered rubber product. They are following various orthodox customs, improper utilization of space & inaccurate arrangement of machineries with respect to one another. Hence they are taking a lot of time for undertaking various tasks and also more human effort is required.

Shantanu kulkarni [6] in their paper, "Quality circle to improve productivity: A case study in a medium scale aluminium coating industry", have study about the QC concept in a coating unit which illustrates how the QCs help in improving the productivity. The factors which are important for the success of the quality circles were also explained here and the study can serve as a guide which would be useful for the small and medium scale industries who are interested in introducing the quality circles.

Sulaman Muhammad [7] in their paper, "Quality Improvement of Fan Manufacturing Industry by using basic seven tools of Quality: A Case Study" investigate about total five type of defect occurring in fan manufacturing process of "Fecto Fan Company". Who are specialized in manufacturing all type of ceiling Fans. There were two sections in plant, manufacturing and assembling. After identifying the problems now the goal was to eliminate all these problems and to ensure flawless manufacturing process.

Shantanu Welekar [8] in their paper, "Quality Circle to improve Productivity", deals with various aspects of Quality Circle and how improvement can be made by adopting practices of Quality Circle in chemical industries. The paper also presents a comparative discussion of various features of Quality Circle, Quality Improvement Group and work Group/project team. The paper describes a case study of QC concept in a chemical

industry which illustrates the effectiveness of QC approach.

Dr. Mahesh M. Bhagwati [9] in their paper, “Cause & Effect Analysis for the Productivity improvement of TORNOS Sigma 20II: A Case Study” the issue of low productivity of TORNOS 20II w.r.t another mentioned products is deal with. In this case study investigated table describes the recommended and actual rate of production. All the major possible causes contributing to the high rate of rejection, as mentioned in case study are found and discussed with the management of an organization.

Ghazi Abu Taher [10] in their paper “Improving Quality and Productivity in Manufacturing process by using Quality Control chart and Statistical Process Control Including Sampling and Six Sigma.” Investigate about to increase the quality and productivity of a spur gear manufacturing company. In this case study the main aims to find out the effective way of improving the quality and productivity of a production line in manufacturing industry.

Memon et al. (2019)[11] presented seven traditional QC tools (flow chart, check sheet, histogram, Pareto chart, cause, and effect diagram, scatter diagram and control chart) have been developed and 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% (from 132 to 13 defects) at the chassis line.

Awan et al. (2019)[12] presented the level of adoption of TQM practice in surgical and medical equipment manufacturing industry in Pakistan. A questionnaire based survey was conducted among 200 organizations. The study revealed that 52 percent organizations have implemented TQM, but deficiencies have been found in implementation of required management methods, evaluation of customer satisfaction and application of seven quality control / quality improvement techniques. This does not allow to consider the organizations as perfect TQM organizations.

Abdel-Hamid et al. (2019)[13] presented levels of quality in the construction industry through the use of the seven basic quality control tools. Such tools are extremely crucial tools which are used worldwide in the industries for continual improvement. The seven basic quality tools are Check Sheet, Histogram, Pareto Chart, Fishbone Diagram, Control Chart, Flowchart and Scatter Diagram. They were implemented in various steps of the process in order to define the problems, measure its impacts, find out its root causes and solve these problems to ensure the production of non-defective items. The study shows how

the seven basic tools of quality are very useful and effective in identifying and removal of defects from the manufacturing process.

Memon et al. (2019)[14] presented the study of the 7QC tools applied in an automotive factory in order to reduce paint shop defects. Within four months the production line was inspected, defects were categorized and the 7QC tools were successfully applied, reducing the overall defect rate by 70%. Although every tool was important, the cause and effect diagram was responsible for finding the root causes of the defects.

Shah et al. (2018)[15] presented the area of Quality and Productivity improvement initiatives in the Indian SMEs using various tools and techniques like Lean Manufacturing, TQM, TPM, Six Sigma, Lean Six Sigma, ISO implementation etc. Every manufacturing industry has put in continuous efforts for its survival in the current volatile economy. Industries are trying to implement new and efficient techniques in their manufacturing operations. Some of the established tools are applied, and its realization has been growing among the industries, particularly in manufacturing sector.

Kuendee et al. (2018)[16] presented some of the seven quality control tools (7 QC tools) for reducing delay the delivery problem. The Cause and Effect Diagram was found out the root causes of this problem and the Pareto Chart was used to help ordering the important of delay the delivery problem, it was found that coordination problem was the major cause. Finally, the Matrix Diagram was used to solve the problem for assigning responsibilities by improving the cause of three reasons: 1. work system 2. work equipment and 3. employees.

IV. CONCLUSION

- Seven quality control tools are easy to understand and easy to use.
- These tools lead to reducing rework of product.
- Quality improvement reduces rejection of product.
- Indirectly improves profit of organization.
- Statistical QC is chiefly concerned in making sure that several procedures and working arrangements are in place to provide for effective and efficient statistical processes, to minimize the risk of errors or weaknesses in procedures or systems or in source material
- Seven QC tools are most helpful in troubleshooting issues related to quality.

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