International Journal of Innovative Research in Engineering and Management (IJIREM)
ISSN: 2350-0557, Volume-9, Special Issue-8, August-2022
Innovative Projects 2022
Organized by Presidency University, Bangalore, India

Analysis of Quality Control: Methods, and Improvement Strategies

Dr. Akhila Udupa
Associate Professor,
Master In Business Administration (General Management), Presidency University, Bangalore, India,
Email Id:Akhila.Udupa@Presidencyuniversity.In

ABSTRACT:

Quality control entails testing units to see whether they meet the standards for the final product. The testing is done to assess whether any remedial measures are required in the production process. Good quality control assists businesses in meeting customer needs for improved goods. Product and process management places a strong emphasis on quality control, which looks to make sure that goods adhere to predetermined standards of quality. To demonstrate the importance of quality control in enhancing product quality, customer happiness, and overall organisational success, this research covers the essential components of quality control, including its aims, techniques, and instruments.

KEYWORDS:

Control, Inspection, ,Statistical, Quality, Management.

I. INTRODUCTION

Profit is the ultimate objective of any commercial firm. There are various ways that may be used to accomplish this. Profit may be increased by lowering costs while maintaining the same selling price per unit. If it is a monopoly firm, the price may be set appropriately to produce a sufficient profit without putting much emphasis on costcutting efforts. Nonetheless, in order to compete in a competitive economic climate, a firm's goods and services must meet the bare minimum of quality.Additional quality comes at an additional expense. As a result, the degree of quality should be determined in connection to other criteria in order for the product to be properly absorbed in the market. In all of these circumstances, fundamental quality is regarded as one of the supportive aspects for repeat purchases and hence greater sales income. Quality is a measure of how well a product or service adheres to a set of specifications.

Quality standards can be any one or a combination of the product's qualities and factors. The features will include performance, dependability, appearance, dedication to delivery time, and so on. The variables may include length, breadth, height, diameter, surface quality, and so on[1], [2].The majority of the following qualities are productrelated. Similarly, fulfilling promised deadlines, safety, comfort, security, decreased waiting time, and so on are examples of service quality attributes. Hence, the numerous aspects of quality are performance, features, dependability, compliance, durability, maintainability, aesthetics, perceived quality, safety, comfort, security, adherence to deadlines, reduced waiting time, and so on.

Quality

Under various situations, the term quality might have a varied connotation. The term quality does not just refer to the quality of a manufactured product. It may relate to the process's i.e., workers, materials, and equipment or even management's quality. If the quality produced product is referred to or described as Quality of product as the degree to which it satisfies the customer's requirements. It is not absolute, but it may be measured or realised by comparing it to certain criteria.Quality begins with the design of a

product in accordance with the customer specification, followed by the use of established measurement standards, the use of appropriate materials, the selection of a suitable manufacturing process, and so on. Quality is a relative term that is generally used with reference to the end use of the product.According to Crosby, quality is compliance to demand or standards. Quality is suitability for use, Juran defined. The quality of a product or service is its suitability for fulfilling or exceeding its intended usage as needed by the client.

Fundamental Factors Affecting Quality

Markets, money, management, personnel, motivation, materials, machines, and mechanisation are the nine main variables 9 M's that influence the quality of products and services.Current information techniques and product mounting needs.

1. Market: As technology advances, we may see numerous new items to meet client demands. At the same time, client preferences are shifting dynamically.As a result, it is the responsibility of businesses to identify requirements and then address them using current technologies or by inventing new technologies.

2. Money: Increased global competitiveness needs large investments in new equipment and processes. Improved productivity should be rewarded for this. This is attainable through reducing quality expenditures associated with quality maintenance and improvement.

3. Management: As corporate organisations become more complex, qualityrelated tasks fall to people at various levels within the firm.

4. Men: The fast expansion of technological knowledge leads to the creation of human resources with various specialisations. This requires some organisations, such as the system engineering group, to include the concept of complete specialisation.

5. Motivation: If we assign the responsibility for achieving quality to each employee in the company and use appropriate incentive strategies, there will be no issue providing the specified quality goods.

6. Materials: Choosing the right materials to satisfy the necessary tolerance limit is also critical. Surface polish, strength, diameter, and other quality features may be acquired by suitable material selection.

7. Machinery and Mechanisation: In order to have highquality goods that contribute to increased productivity in any firm, we must employ modern machines and automate numerous procedures.

8. Modern Information Techniques: Modern information methods aid in the storage and retrieval of data required for production, marketing, and service.

9. Product Specifications For Mounting: Product variety to match client preferences leads to more complexity in design, production, and quality requirements. As a result, businesses must devise an adequate system to meet all of these needs.

Control

The process through which standards are set and met is referred to as control. This procedure is evaluating our activity performance, comparing it to some standard, and then taking action if the contains the following deviates considerably from the norms.The control process consists of the following universal steps:

1. Choose the control item.
2. Select a unit of measurement.
3. Determine the standard value
4. Choose a sensor device that can measure
5. Assess real performance

6. Explain the distinction between real and standard.
7. Take the initiative.

Inspection

Inspection is a critical instrument for achieving the quality idea. It is vital to instill confidence in the manufacturer while also aiming for client happiness. Inspection is a necessary tool in today's industrial process. It aids in quality control, lowers production costs, eliminates scrap losses, and identifies the root causes of bad work.The inspection and testing unit is in charge of evaluating the quality of incoming raw materials and components, as well as the finished product or service. It inspects the components at several stages using specified criteria, finding and sorting out damaged or defective products. It also detailed the inspection instruments to be used and the processes to be followed in order to measure relevant quality features.

In the case of variables, inspection merely examines the degree of conformity to a standard. In the case of characteristics, inspection simply distinguishes between the nonconforming and the conforming.Inspection does not reveal why genderqueer units are being manufactured.The most popular means of achieving standardisation, homogeneity, and quality of workmanship is inspection. It is the costeffective method of managing production quality by comparing it to specified standards and requirements. It is a quality control function. If the item does not fall within the acceptable range, it will be rejected, and remedial measures will be implemented to ensure that the goods adhere to the set requirements in the future.

II. DISCUSSION

Floor Inspection

The inspection is carried out at the point of manufacture under this method. It implies that patrolling inspectors verify items in progress at the machine or throughout production time. These inspectors walk from device to device and from one work centre to the next. Inspectors must be quite skilled. This technique of inspection reduces material handling, does not interrupt equipment line layout, quickly locates defects, and conveniently gives field and rectification[3], [4].

Combined Inspection

Combination of two procedures, regardless of whether the inspection method is floor or central. The primary goal is to discover and avoid defects that may not repeat themselves in succeeding operations, to determine whether any corrective action is necessary, and, lastly, to maintain quality cheaply.This system just looks for the primary function that the product is supposed to do. As a result, an electrical motor may be tested for specific speed and load characteristics. It does not show individual part variations but can ensure the aggregate good functioning of all parts placed together. If a big quantity of goods are required at regular periods, both makers and customers can do so. This is often referred to as assembly inspection.

Inspections of The First Piece Or FirstOff

The shift or lot's first component is inspected. This is very useful when using automated machinery. Any differences between the operator and the machine tool may be verified to ensure that the product is within control limits. Except for the necessity for tool precautions and disruption in machine setup, this produces good results provided the user is diligent.

Inspection of Pilot Piece

This is done as soon as a new design or product is created. Product manufacturing is done on the usual shop floor if production is not interrupted. If manufacturing is significantly impacted, the product is created in a pilot facility. This is appropriate for mass production and items with a large number of components, such as vehicles and aero planes, and the design or manufacturing method is modified until adequate performance is achieved or established. The primary goal is to discover and avoid defects that

may not repeat themselves in succeeding operations, to determine whether any corrective action is necessary, and, lastly, to maintain quality cheaply.

Methods of Inspection

There are two inspection procedures. These are as follows: 100% inspection and sample inspection.

1. Complete Inspection

This kind will require detailed examination of quality at each crucial point or step of manufacturing where the test is nondestructive and each component is individually scrutinised.It need a greater number of inspectors, making it a more expensive option. There is no chance of sampling mistake.This is vulnerable to inspection errors caused by weariness, neglect, difficulties in supervising, and so on.As a result, greater impact precision is rare. It is only appropriate when a small number of components are required or a very high level of quality is required. Jet engines, aeroplanes, and medical and scientific equipment are all examples.

2. Inspection of Samples

With this procedure, samples are examined at random. Representative samples are collected from various product patches. If the sample is found to be faulty, the entire batch must be discarded or recovered. Inspection by sampling is less expensive and faster. It necessitates a smaller number of Inspectors. It is prone to sampling mistakes, but the extent of such errors may be calculated.Random or sample examination is preferable in the event of damaging tests. Because of the emergence of automatic devices or equipments that are less vulnerable to chance variables and thus require less inspection, this form of inspection is suited for inspection of items with less accuracy relevance and are less costly. Electrical bulbs, radio bulbs, washing machines, and so forth.

Quality Control

Quality Control QC is a method for maintaining a desired level of quality in a product or service. It is the methodical regulation of numerous aspects that impact the product's quality. It is determined by the materials, tools, machinery, kind of labour, working circumstances, and so on. QC is a wide phrase that includes inspection at many stages, although inspection alone does not constitute QC. In contrast to inspection, the emphasis in quality control activities is on the quality of future output. Quality control focuses on defect avoidance at the source and relies on a good feedback system and corrective action mechanism. Inspection is an important technique in quality control.

Quality control is the regulatory process through which we monitor actual quality performance, compare it to standards, and act on the difference, says Juran. According to the ANSI/ASQC standard 1978, quality control is the operational techniques and actions that sustain a quality of product or service that will fulfil specified demands; also the utilisation of such techniques and activities.Quality control, according to Alford and Beatty, is the mechanism by which products are made to measure up to specifications determined from customers, demands, and transformed into sales engineering and manufacturing requirements; it is concerned with making things right rather than discovering and rejecting those made wrong.

Types of Quality Control

QC is not the responsibility of a single department or individual. Any supervisor's principal task is to produce work of acceptable quality. Quality control is separated into three major subareas, which are as follows:

1. **Offline Quality Control:** Its procedures deal with steps to choose and pick controllable product and process characteristics in order to minimise the variation between the product or process output and the standard. A large portion of this effort is completed through product and process design.Offline quality control, statistical process control, and acceptance sampling strategies are all included.Taguchi technique, experimental design concepts, and so on are examples.

2. Statistical process control (SPC): SPC entails comparing the output of a process or a service to a standard and implementing corrective actions if the two differ.It also entails analysing if a method can generate a product that fulfils specified or required specifications. Online SPC involves gathering information on a product, process, or service while it is still operational. During the operational phase, remedial action is done.This is done in real time.

3. Acceptance Sampling Plans: An acceptance sampling plan is a strategy that calculates the quantity of items to sample and the lot's acceptance criteria based on satisfying certain specified parameters such as the risk of rejecting a good lot or accepting a bad lot.

Control Charts

It distinguishes between exceptional and common causes of variation. They are used to continuously monitor and regulate processes. A typical control chart depicts a specified quality feature discovered from a subset of observations as a function of sample size. The sample average, sample range, and sample fraction of nonconforming units are displayed.A control chart's centre line reflects the average value of the attributes being plotted. Control charts also display two limitations known as the upper control limit UCL and lower control limit LCL. These limitations are designed in such a way that the problem of an observation slipping beyond these limits is fairly modest if the process is working under a stable system of random causes (Figure. 1).A control chart depicts the performance of a process from two perspectives. They begin by displaying a snapshot of the process at the time the data is acquired. Second, they depict the process trend through time. Process trends are significant because they aid in determining whether or not an outofcontrol situation occurs. They also aid in detecting changes outside of normal operational limits and determining the source of variations.is a simplified example of a control chart[5], [6].

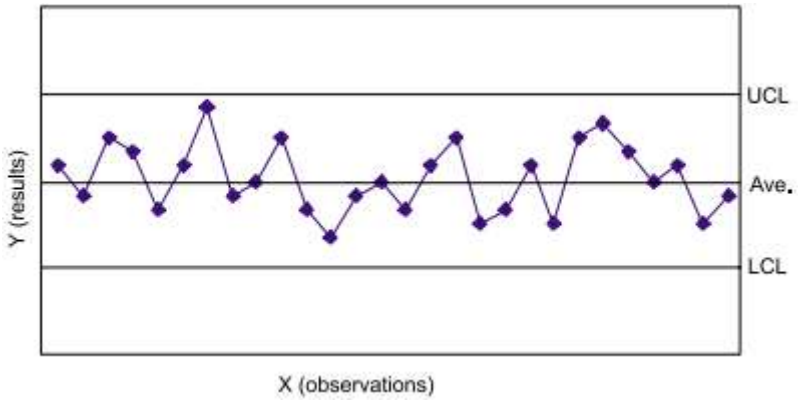

Figure 1: Represent the Control charts [Wisdom job].

Even under the finest of manufacturing conditions, they are difficult to trace and manage. Even if it is possible to trace, it is not cost effective to eradicate. The random factors create just a minor variance in the process. Internal variables induce variation in random causes. Only the overall pattern of variation caused by chance will have a stable statistical distribution normal distribution. Variance within the control boundaries indicates the presence of merely random causes[7]–[9].

Causes That May Be Assigned

These are the factors that contribute to normal fluctuation in manufacturing quality.Variation in assignable causes may always be traced back to a single attribute. These arise as a result of:

1. A lack of operational expertise.
2. Improper maintenance practises.
3. New suppliers.
4. Mistake in jig and fixture setup.
5. Defects in raw materials.

Variance caused by these factors can be managed before the faulty goods are manufactured.Even one assignable reason can result in a significant degree of process variance. The system will not have a steady statistical distribution if the assignable reasons are present. When the actual variation surpasses the control limits, it's an indication that the process's assignable causes are extending, and the process should be studied[10], [11].

III. CONCLUSION

In order to guarantee that goods satisfy required quality standards and consumer expectations, organisations must use quality control. Organisations may minimise faults, raise customer happiness, and strengthen their competitive edge by putting in place efficient quality control procedures. Organisations may enhance their overall performance and product quality by using strategies including inspection, statistical process control, acceptance sampling, and quality assurance, as well as an emphasis on continuous improvement.

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