UNIT - 4

QUALITY CONTROL

INTRODUCTION

In any business organization, profit is the ultimate goal. To achieve this, there are several approaches. Profit may be maximized by cutting costs for the same selling price per unit. If it is a monopolistic business, without giving much of importance to the cost reduction programs, the price may be fixed suitably to earn sufficient profit. But, to survive in a competitive business environment, goods and services produced by a firm should have the minimum required quality. Extra quality means extra cost. So, the level of quality should be decided in relation to other factors such that the product is well absorbed in the market. In all these cases, to have repeated sales and thereby increased sales revenue, basic quality is considered to be one of the supportive factors.

Quality is a measure of how closely a good or service conforms to specified standard. Quality standards may be any one or a combination of attributes and variables of the product being manufactured. The attributes will include performance, reliability, appearance, commitment to delivery time, etc., variables may be some measurement variables like, length, width, height, diameter, surface finish, etc.

Most of the above characteristics are related to products. Similarly, some of the quality characteristics of services are meeting promised due dates, safety, comfort, security, less waiting time and so forth. So, the various dimensions of quality are performance, features, reliability, conformance, durability, serviceability, aesthetics, perceived quality, safety, comfort, security, commitment to due dates, less waiting time, etc.

QUALITY

Different meaning could be attached to the word quality under different circumstances. The word quality does not mean the quality of manufactured product only. It may refer to the quality of the process (*i.e.*, men, material, and machines) and even that of management. Where the quality manufactured product referred as or defined as “Quality of product as the degree in which it fulfills the requirement of the customer. It is not absolute but it judged or realized by comparing it with some standards”.

Quality begins with the design of a product in accordance with the customer specification further it involved the established measurement standards, the use of proper material, selection of suitable manufacturing process etc., quality is a relative term and it is generally used with reference to the end use of the product.

Crosby defined as “Quality is conformance to requirement or specifications”. Juran defined as “Quality is fitness for use”. “The Quality of a product or service is the fitness

of that product or service for meeting or exceeding its intended use as required by the customer."

Fundamental Factors Affecting Quality

The nine fundamental factors **(9 M's)**, which are affecting the quality of products and services, are: markets, money, management, men, motivation, materials, machines and mechanization. Modern information methods and mounting product requirements.

1. ***Market:*** Because of technology advancement, we could see many new products to satisfy customer wants. At the same time, the customer wants are also changing dynamically. So, it is the role of companies to identify needs and then meet it with existing technologies or by developing new technologies.
2. ***Money:*** The increased global competition necessitates huge outlays for new equipments and process. This should be rewarded by improved productivity. This is possible by minimizing quality costs associated with the maintenance and improvements of quality level.
3. ***Management:*** Because of the increased complex structure of business organization, the quality related responsibilities lie with persons at different levels in the organization.
4. ***Men:*** The rapid growth in technical knowledge leads to development of human resource with different specialization. This necessitates some groups like, system engineering group to integrate the idea of full specialization.
5. ***Motivation:*** If we fix the responsibility of achieving quality with each individual in the organization with proper motivation techniques, there will not be any problem in producing the designed quality products.
6. ***Materials:*** Selection of proper materials to meet the desired tolerance limit is also an important consideration. Quality attributes like, surface finish, strength, diameter etc., can be obtained by proper selection of material.
7. ***Machines and mechanization:*** In order to have quality products which will lead to higher productivity of any organization, we need to use advanced machines and mechanize various operations.
8. ***Modern information methods:*** The modern information methods help in storing and retrieving needed data for manufacturing, marketing and servicing.
9. ***Mounting product requirements:*** Product diversification to meet customers taste leads to intricacy in design, manufacturing and quality standards. Hence, companies should plan adequate system to tackle all these requirements.

CONTROL CHARTS

The process through which the standards are established and met with standards is called control. This process consists of observing our activity performance, comparing the performance with some standard and then taking action if the observed performance is significantly too different from the standards.

The control process involves a universal sequence of steps as follows:

1. Choose the control object
2. Choose a unit of measure
3. Set the standard value
4. Choose a sensing device which can measure
5. Measure actual performance
6. Interpret the difference between actual and standard
7. Taking action.

Need for Controlling Quality

In the absence of quality, the following will result:

1. No yardstick for comparing the quality of goods/services.
2. Difficulty in maintaining consistency in quality.
3. Dissatisfied customers due to increased maintenance and operating costs of products/services.
4. Increased rework cost while manufacturing products/providing services.
5. Reduced life time of the products/services.
6. Reduced flexibility with respect to usage of standard spare parts.
7. Hence, controlling quality is an essential activity.

In all production processes, we need to monitor the extent to which our products meet specifications. In the most general terms, there are two "enemies" of product quality:

- deviations from target specifications
- excessive variability around target specifications

Control Chart

Also called: statistical process control

The control chart is a graph used to study how a process changes over time. Data are plotted in time order. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit. These lines are determined from historical data. By comparing current data to these lines, you can draw conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation).

Control charts for variable data are used in pairs. The top chart monitors the average, or the centering of the distribution of data from the process. The bottom chart monitors the range, or the width of the distribution. If your data were shots in target practice, the average is where the shots are clustering, and the range is how tightly they are clustered. Control charts for attribute data are used singly.

When to Use a Control Chart

- When controlling ongoing processes by finding and correcting problems as they occur.
- When predicting the expected range of outcomes from a process.
- When determining whether a process is stable (in statistical control).
- When analyzing patterns of process variation from special causes (non-routine events) or common causes (built into the process).
- When determining whether your quality improvement project should aim to prevent specific problems or to make fundamental changes to the process.

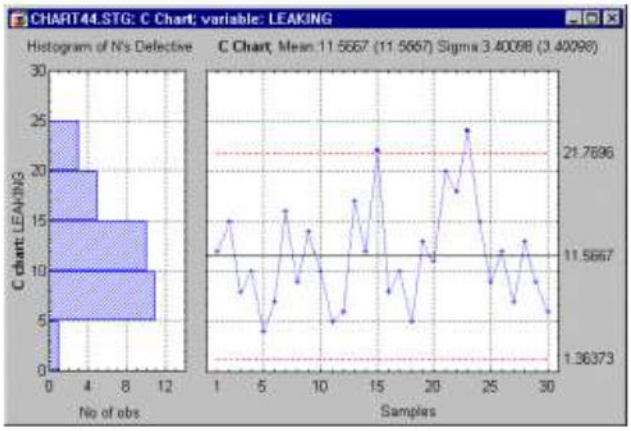
Common Types of Charts

The types of charts are often classified according to the type of quality characteristic that they are supposed to monitor: there are quality control charts for *variables* and control charts for *attributes*. Specifically, the following charts are commonly constructed for controlling variables:

- **X-bar chart.** In this chart, the sample *means* are plotted in order to control the mean value of a variable (e.g., size of piston rings, strength of materials, etc.).
- **R chart.** In this chart, the sample *ranges* are plotted in order to control the variability of a variable.
- **S chart.** In this chart, the sample *standard deviations* are plotted in order to control the variability of a variable.
- **S**2 chart.** In this chart, the sample *variances* are plotted in order to control the variability of a variable.

For controlling quality characteristics that represent *attributes* of the product, the following charts are commonly constructed:

- **C chart.** In this chart (see example below), we plot the *number of defectives* (per batch, per day, per machine, per 100 feet of pipe, etc.). This chart assumes that defects of the quality attribute are *rare*, and the control limits in this chart are computed based on the *Poisson*distribution (distribution of rare events).



- **U chart.** In this chart we plot the *rate of defectives*, that is, the number of defectives divided by the number of units inspected (the *n*; e.g., feet of pipe, number of batches). Unlike the C chart, this chart does not require a constant number of units, and it can be used, for example, when the batches (samples) are of different sizes.
- **Np chart.** In this chart, we plot the number of defectives (per batch, per day, per machine) as in the C chart. However, the control limits in this chart are not based on the distribution of rare events, but rather on the binomial distribution. Therefore, this chart should be used if the occurrence of defectives is not rare (e.g., they occur in more than 5% of the units inspected). For example, we may use this chart to control the number of units produced with minor flaws.
- **P chart.** In this chart, we plot the percent of defectives (per batch, per day, per machine, etc.) as in the U chart. However, the control limits in this chart are not based on the distribution of rare events but rather on the binomial distribution (of proportions). Therefore, this chart is most applicable to situations where the occurrence of defectives is not rare (e.g., we expect the percent of defectives to be more than 5% of the total number of units produced)

Taguchi
CRITISM OF TQM

Total Quality Management is a management approach that originated in the 1950s and has steadily become more popular since the early 1980s. Total Quality is a description of the culture, attitude and organization of a company that strives to provide customers with products and services that satisfy their needs. The culture requires quality in all aspects of the company's operations, with processes being done right the first time and defects and waste eradicated from operations.

Total Quality Management, TQM, is a method by which management and employees can become involved in the continuous improvement of the production of goods and services. It is a combination of quality and management tools aimed at increasing business and reducing losses due to wasteful practices.

Some of the companies who have implemented TQM include Ford Motor Company, Phillips Semiconductor, SGL Carbon, Motorola and Toyota Motor Company.[1]

TQM Defined

TQM is a management philosophy that seeks to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc.) to focus on meeting customer needs and organizational objectives.

TQM views an organization as a collection of processes. It maintains that organizations must strive to continuously improve these processes by incorporating the knowledge and experiences of workers. The simple objective of TQM is "Do the right things, right the first time, every time." TQM is infinitely variable and adaptable. Although originally applied to manufacturing operations, and for a number of years only used in that area, TQM is now becoming recognized as a generic management tool, just as applicable in service and public sector organizations. There are a number of evolutionary strands, with different sectors creating their own versions from the common ancestor. TQM is the foundation for activities, which include:

- Commitment by senior management and all employees
- Meeting customer requirements
- Reducing development cycle times
- Just in time/demand flow manufacturing
- Improvement teams
- Reducing product and service costs
- Systems to facilitate improvement
- Line management ownership
- Employee involvement and empowerment
- Recognition and celebration
- Challenging quantified goals and benchmarking
- Focus on processes / improvement plans
- Specific incorporation in strategic planning

- Total Quality Management Principles: The 8 Primary Elements of TQM

Total quality management can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization. Many of these concepts are present in modern Quality Management Systems, the successor to TQM. Here are the 8 principles of total quality management:

1. Customer-focused

The customer ultimately determines the level of quality. No matter what an organization does to foster quality improvement—training employees, integrating quality into the design process, upgrading computers or software, or buying new measuring tools—the customer determines whether the efforts were worthwhile.

2. Total employee involvement

All employees participate in working toward common goals. Total employee commitment can only be obtained after fear has been driven from the workplace, when empowerment has occurred, and management has provided the proper environment. High-performance work systems integrate continuous improvement efforts with normal business operations. Self-managed work teams are one form of empowerment.

3. Process-centered

A fundamental part of TQM is a focus on process thinking. A process is a series of steps that take inputs from suppliers (internal or external) and transforms them into outputs that are delivered to customers (again, either internal or external). The steps required to carry out the process are defined, and performance measures are continuously monitored in order to detect unexpected variation.

4. Integrated system

Although an organization may consist of many different functional specialties often organized into vertically structured departments, it is the horizontal processes interconnecting these functions that are the focus of TQM.

- Micro-processes add up to larger processes, and all processes aggregate into the business processes required for defining and implementing strategy. Everyone must understand the vision, mission, and guiding principles as well as the quality policies, objectives, and critical processes of the organization. Business performance must be monitored and communicated continuously.
- An integrated business system may be modeled after the Baldrige National Quality Program criteria and/or incorporate the ISO 9000 standards. Every organization has a unique work culture, and it is virtually impossible to achieve excellence in its products and services unless a good quality culture has been fostered. Thus, an integrated

system connects business improvement elements in an attempt to continually improve and exceed the expectations of customers, employees, and other stakeholders.

5. Strategic and systematic approach

A critical part of the management of quality is the strategic and systematic approach to achieving an organization's vision, mission, and goals. This process, called strategic planning or strategic management, includes the formulation of a strategic plan that integrates quality as a core component.

6. Continual improvement

A major thrust of TQM is continual process improvement. Continual improvement drives an organization to be both analytical and creative in finding ways to become more competitive and more effective at meeting stakeholder expectations.

7. Fact-based decision making

In order to know how well an organization is performing, data on performance measures are necessary. TQM requires that an organization continually collect and analyze data in order to improve decision making accuracy, achieve consensus, and allow prediction based on past history.

8. Communications

During times of organizational change, as well as part of day-to-day operation, effective communications plays a large part in maintaining morale and in motivating employees at all levels. Communications involve strategies, method, and timeliness.

Six Sigma is a relatively new concept as compared to Total Quality Management (TQM). However, when it was conceptualized, it was not intended to be a replacement for TQM. Both Six Sigma and TQM have many similarities and are compatible in varied business environments, including manufacturing and service industries. While TQM has helped many companies in improving the quality of manufactured goods or services rendered, Six Sigma has the potential of delivering even sharper results.

Total Quality Management

Total Quality Management is often associated with the development, deployment, and maintenance of organizational systems that are required for various business processes. It is based on a strategic approach that focuses on maintaining existing quality standards as well as making incremental quality improvements. It can also be described as a cultural initiative as the focus is on establishing a culture of

collaboration among various functional departments within an organization for improving overall quality.

Comparison To Six Sigma

In comparison, Six Sigma is more than just a process improvement program as it is based on concepts that focus on continuous quality improvements for achieving near perfection by restricting the number of possible defects to less than 3.4 defects per million. It is complementary to Statistical Process Control (SPC), which uses statistical methods for monitoring and controlling business processes. Although both SPC and TQM help in improving quality, they often reach a stage after which no further quality improvements can be made. Six Sigma, on the other hand, is different as it focuses on taking quality improvement processes to the next level.

The basic difference between Six Sigma and TQM is the approach. While TQM views quality as conformance to internal requirements, Six Sigma focuses on improving quality by reducing the number of defects. The end result may be the same in both the concepts (i.e. producing better quality products). Six Sigma helps organizations in reducing operational costs by focusing on defect reduction, cycle time reduction, and cost savings. It is different from conventional cost cutting measures that may reduce value and quality. It focuses on identifying and eliminating costs that provide no value to customers such as costs incurred due to waste.

TQM initiatives focus on improving individual operations within unrelated business processes whereas Six Sigma program focus on improving all the operations within a single business process. Six Sigma projects require the skills of professionals that are certified as 'black belts' whereas TQM initiatives are usually a part-time activity that can be managed by non-dedicated managers.

Applications Where Six Sigma Is Better

Six Sigma initiatives are based on a preplanned project charter that outlines the scale of a project, financial targets, anticipated benefits and milestones. In comparison, organizations that have implemented TQM, work without fully knowing what the financial gains might be. Six Sigma is based on DMAIC (Define-Measure-Analyze-Improve-Control) that helps in making precise measurements, identifying exact problems, and providing solutions that can be measured.

Conclusion

Six sigma is also different from TQM in that it is fact based and data driven, result oriented, providing quantifiable and measurable bottom-line results, linked to strategy and related to customer requirements. It is applicable to all common business processes such as administration, sales, marketing and R & D. Although many tools and techniques used in Six Sigma may appear similar to TQM, they are often distinct as in Six Sigma, the focus is on the strategic and systematic application of the tools

on targeted projects at the appropriate time. It is predicted that Six Sigma will outlast TQM as it has the potential of achieving more than TQM.