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. But, to survive in a competitive business environment, goods and services produced by a firm should have the minimum required quality.

Quality

Quality has many definitions. Quality can be defined in many ways, depending on who is defining it and to what product or service it is related.

The definition of quality by the American National Standards Institute (ANSI) and the American Society for Quality Control (ASQC) is "the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs."

Variables and Attributes

Quality characteristics fall into two broad classes: variables and attributes. Characteristics that are measurable and are expressed on a numerical scale are called **variables** like, length, width, height, diameter, surface finish, etc.

A quality characteristic that cannot be measured on a numerical scale is expressed as an **attribute.** The attributes will include performance, reliability, appearance, etc.

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: The customer wants are 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: As competition has increased, profit margins have decreased. Companies have to spend heavily on new equipment's and processes. To absorb these costs productivity has to the increased, which means reworks and scrap has to be kept to the minimum. Quality costs have to be kept low which mean cost saving due to quality improvement has to be kept in prime focus.
3. Management: 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.

5. Motivation: The increased complexity of the product means that every employee has to give his best if quality is to be maintained. This requires that quality realization among employees are high. This can be achieved only through continuous education and motivation of the work force. Motivation, therefore, needs to be on the top of the agenda for any management team of an organization.
6. Materials: Due to high material costs engineers have to constantly keep coming up with ways to bring down the cost of material used. They also need to come up with new alternate materials that can replace costlier older material.
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: The demand to cut costs is forcing companies to use newer machines, which will deliver better quality and product using lesser cycle times. Further the machines need to deliver higher quantities also to keep production costs low. This means maintaining of these machines also becomes critical as any and only down time of these machines leads to increased costs.
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.

Dimensions of Quality

The quality of a product can be described and evaluated in several ways. It is often very important to differentiate these different dimensions of quality

1. Performance

Will the product do the intended job? .For example, how well a car handles etc.

2. Features

(What does the product do?) Usually, customers associate high quality with products that have added features—that is, those that have features beyond the basic performance of the competition. Features are the “extra” items added to the basic features, such as stereo CD or a leather interior in a car.

3. Reliability

(How often does the product fail?) Complex products, such as many appliances, automobiles, or airplanes, will usually require some repair over their service life. For example, you should expect that an automobile will require occasional repair, but if the car requires frequent repair, we say that it is unreliable.

4. Conformance

Conformance is the degree to which a product meets pre-established standards.

5. Durability

(How long does the product last?). This is the effective service life of the product. Customers obviously want products that perform satisfactorily over a long period of time i.e. its life span before replacement.

6. Serviceability

(How easy is it to repair the product?) There are many industries in which the customer's view of quality is directly influenced by how quickly and economically a repair or routine maintenance activity can be accomplished.

7. Aesthetics

(What does the product look like?) This is the visual appeal of the product, often taking into account factors such as style, color, shape, packaging alternatives, tactile characteristics, and other sensory features.

8. Safety

Safety refers to assurance that the customer will not suffer injury or harm from the product. It is an especially important consideration for automobiles.

9. Perceived Quality

(What is the reputation of the company or its product?) In many cases, customers rely on the past reputation of the company concerning quality of its products.

10. Conformance to Standards

(Is the product made exactly as the designer intended?)

We usually think of a high-quality product as one that exactly meets the requirements placed on it.

Other Perceptions

A customer relative to the cost of the product weighs these quality characteristics. In general, consumers will pay for the level of quality they can afford. If they feel they are getting what they paid for, they tend to be satisfied with the quality of the product.

One way to understand quality as a consumer-driven concept is to consider the example of eating at a restaurant. How will you judge the quality of the restaurant? Most people apply such criteria as the following:

Service, response time, food preparation, environment or atmosphere, price.

Quality control

Quality Control (QC) may be defined as the regulatory process through which we measure actual quality performance.

Benefits of Quality Control

1. Improving the quality of products and services.
2. Increasing the productivity of manufacturing processes.
3. Reducing manufacturing and corporate costs.
4. Determining and improving the marketability of products and services.
5. Reducing consumer prices of products and services.
6. Improving and/or assuring on time deliveries and availability.
7. Assisting in the management of an enterprise.

Seven tools for quality control

The seven quality control tools are simple statistical tools used for problem solving. The seven quality control tools are:

1. Pareto charts
2. Check sheets
3. Cause and effect diagram
4. Scatter diagrams
5. Histogram
6. Graphs or flow charts
7. Control charts

1. Pareto charts

Pareto Diagram is a tool that arranges items in the order of the magnitude of their contribution, thereby identifying a few items exerting maximum influence. Pareto charts help prioritize by arranging them in decreasing order of importance. The origin of the tool lies in the observation by an Italian economist Vilfredo Pareto. Pareto principle known as the 80/20 rule which states that, for many events, roughly 80% of the effects come from 20% of the causes

Example: The Fig. 1 shows a Pareto chart of reasons for poor quality. Poor design will be the major reason, as indicated by 64%. Thus, this is the problem that the manufacturing unit should address first.

A — Poor Design, B — Defective Parts, C — Operator Error, D — Wrong Dimensions
E — Surface Abrasion, F — Machine Calibrations, G — Defective Material

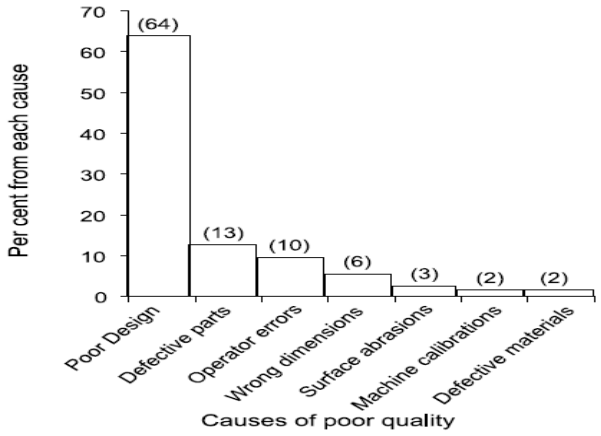

Figure 1: Pareto chart

2. Check sheets

Data collection through the use of a checklist is often the first step in analysis of quality problem. A checklist is a form used to record the frequency of occurrence of certain product or service characteristics related to quality, Figure 2.

Example: The table is a check sheet for TV set related problems.

Component replaced by lab

TV SET MODEL 1013	
Integrated Circuits	
Capacitors	
Resistors	
Transformers	
Commands	
CRT	

Figure 2: Checklist

3. Cause and effect diagram

It is sometimes called as Fish-bone diagram. It is first developed by Kaorv Ishikawa in 1943 and is sometimes called as Ishikawa diagram. This diagram helps identify possible reasons for a process to go out of control as well as possible effects on the process. Figure 3.

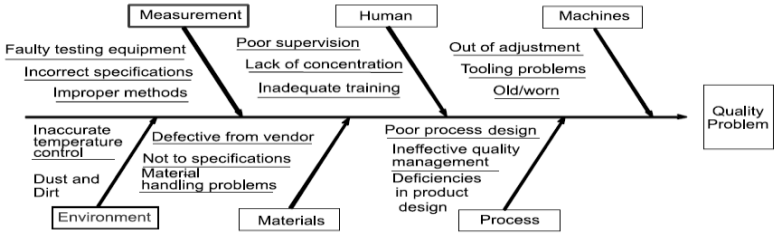

Figure 3: Fishbone diagram

4-Scatter diagrams (scatter plots)

It often indicates the relationship between two variables. They are often used as follow-ups to a cause and effect analysis to determine whether a stated cause truly does impact the quality characteristics. The way the points lie scattered in the quadrant gives a good indication of the relationship between the two variables, Figure 4.

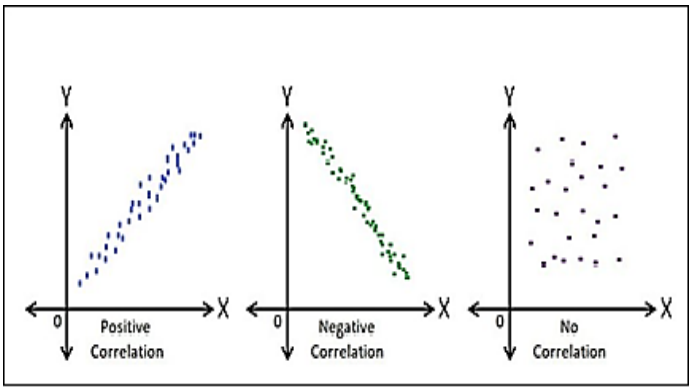

Figure 4: Scatter plots and correlation examples

5. Histogram (or) bar charts

A bar chart is a series of bare representing the frequency of occurrence of data characteristics, the bar height indicates the number of times a particular quality characteristic was observed, Figure 5.

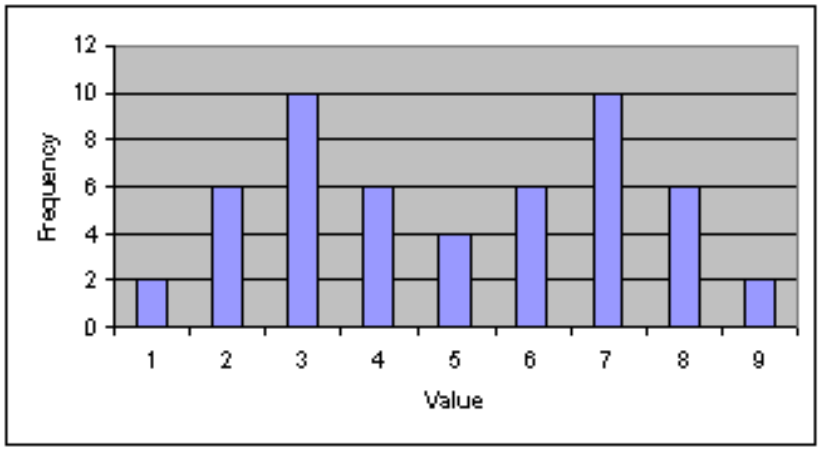

Figure 5: Bar chart

6. Flow charts and graphs

Flow chart shows the sequence of events in a process, Figure 6.

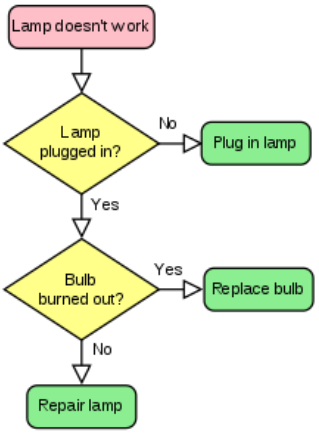

Figure 6: Flow chart

Graphs of various types are used for pictorial representation of data. Pictorial representation enables the user or viewer to quickly grasp the meaning of the data. Different graphical representation of data are chosen depending on the purpose of the analysis and preference of the audience.

7. Control charts

The charts are made by plotting in sequence the measured values of samples taken from a process. Characteristic such as the thickness of a sample from a production line are plotted. The center line on a control chart represents the average value of characteristics being plotted. Two limits known as the upper control limit (UCL) and lower control limit (LCL) are also shown on control charts. These limits are constructed so that if the process is operating under a stable system of chance causes, the problem of an observation falling outside these limits is quite small. Figure 7 shows a generalized representation of a control chart.

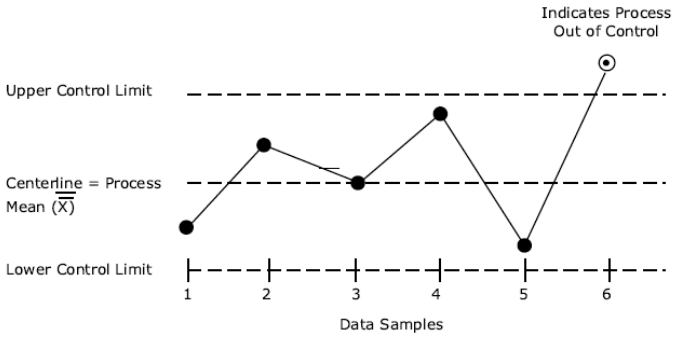

Figure7: Control charts