INTRODUCTION TO TQM

INTRODUCTION

- ☐ A core definition of total quality management (TQM) describes a management approach to long–term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.
- ☐ Total Quality Management TQM, also known as total productive maintenance, describes a management approach to long-term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.
- ☐ Total quality management (TQM) consists of organization-wide efforts to install and make permanent a climate in which an organization continuously improves its ability to deliver high-quality products and services to customers. While there is no widely agreed-upon approach, TQM efforts typically draw heavily on the previously developed tools and techniques of quality control. TQM enjoyed widespread attention during the late 1980s and early 1990s before being overshadowed by ISO 9000, Lean manufacturing, and Six Sigma.

TQM DEFINITION:

Total Quality Management is defined as a strategy for improving business performance through the commitment and involvement of all employees to fully satisfying agreed customer requirements, at the optimum overall costs, through the continuous improvement of the products and services, business processes and people involved.

The concept of Total Quality Management can be expressed as "Achieving success through delighting the customers". Customers here may include the internal user, the external customer or end-user, together with the other stakeholders, i.e.

- shareholders
- employees
- suppliers

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 is the integration of all functions and processes within an organization in order to achieve continuous improvement of the quality of goods and services. The goal is customer satisfaction.
"No doubt, humans are always deficient"

------ (Al-Quran)

Total　　　　　**:** Made up of the whole
Quality　　　　**:** Degree of excellence a product or service provides
Management　　: Act, Art or Manner of planning, controlling, directing…
Therefore, TQM is the art of managing the whole to achieve excellence.

FEATURES OF TQM:

- **Customer-oriented** - TQM focuses on customer satisfaction through creation of better quality products and services at lower costs.

- **Employee involvement and empowerment** - Teams focus on quality improvement projects and employees are empowered to serve customers well.
- **Organization-wide** - TQM involves every department or division.
- **Continuous improvement** - Quality improvement is a never-ending journey.
- **Strategic focus** - Quality is viewed as a strategic, competitive weapon.
- **Process management** - TQM adopts the concept of prevention through process management.
- **Change in corporate culture** - TQM involves the creation of a work culture that is conducive to quality improvement.

THE CONCEPT OF TQM

Total quality management is based on a number of ideas. It means thinking about quality in terms of all functions of the enterprise, a start-to-finish process that integrates interrelated functions at all levels. It is a systems approach that considers every interaction between the various elements of the organization. Thus, the overall effectiveness of the system is higher than the sum of the individual outputs from the subsystems.

The sub- systems include all the organizational functions in the life cycle of a product, such as:
- ✔ Design
- ✔ Planning
- ✔ Production
- ✔ Distribution
- ✔ Field service.

The management subsystems also require integration, including:
- ✔ Strategy with a customer focus,
- ✔ The tools of quality, and
- ✔ Employee involvement (the linking process that integrates the whole).

PRINCIPLES OF TQM/TQM BASIC CONCEPTS:

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.

BENEFITS OF TQM:

TQM has numerous benefits. It enables organizations to:
- Attain higher profitability and increased market share
- Improve customer satisfaction
- Improve organizational productivity
- Improve employee morale and job satisfaction
- Create a positive work culture
- Undertake systematic problem solving and decision making through project teams
- Improve teamwork
- Create a climate conducive to continuous improvement

QUALITY AND BUSINESS PERFORMANCE

"The application of a quality management system in managing a process to achieve maximum customer satisfaction at the lowest overall cost to the organization while continuing to improve the process."

Quality management has four parts: quality planning, quality assurance (defect prevention), quality control (which includes product inspection and other elements, such as competence), and quality improvement.

ATTITUDE AND INVOLVEMENT OF TOP MANAGEMENT

Top management must demonstrate an attitude to balancing the following two dimensions.
• They must balance the need for structural dimension (e.g., hierarchy, budget, plans, controls, procedures)
• Also the behavioral or personnel dimension.
The commitment and involvement of management need to be demonstrated and visible
- TQM is the way of managing for the future, and is far wider in its application than just assuring product or service quality – it is a way of managing people and business processes to ensure complete customer satisfaction at every stage, internally and externally.
- TQM, combined with effective leadership, results in an organization doing the right things right, first time.
- The core of TQM is the customer-supplier interface, both externally and internally, and at each interface lays a number of processes.
- This core must be surrounded by commitment to quality, communication of the quality message, and recognition of the need to change the culture of the organization to create total quality.
- These are the foundations of TQM, and they are supported by the key management functions of people, processes and systems in the organization.
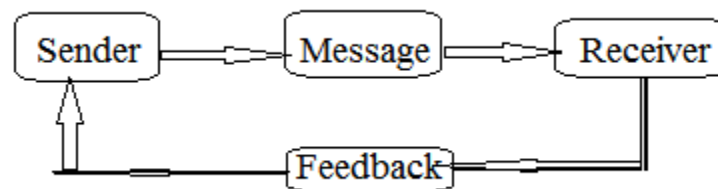
COMMUNICATION

Communication is defined as the exchange of information and understanding between two or more persons or groups.
- Communication is inextricably linked in the quality process, yet some executives find it difficult. to tell others about the plan in a way that will be understood.

- Constant communication and employees buy-in are crucial to a successful TQM initiative.

Communication Model

The vehicles for communicating about quality are selected components of TQM system:
- ✔ Training and development for both managers and employees.
- ✔ Participation at all levels in establishing benchmarks and measures of process quality.
- ✔ Empowerment of employees.
- ✔ Quality assurance in all organization processes.
- ✔ Human resource management system that facilitates contributions at all levels.

CULTURE

- Culture is a pattern of beliefs and values that provides the members of an organization's rules of behavior or accepted norms for conducting operations.

- It is philosophies, ideologies, values, assumptions, beliefs, expectations, attitudes, and norms that knit an organization together and are shared by the employees.

- Corporate culture is a company's value system and its collection of guiding principles
- Cultural values often seen in mission and vision statements
- Culture reflected by management policies and actions

A quality culture is An organizational value system that results in an environment that is conducive to the establishment and continual improvement of Quality.

Levels of Culture

1. **Artifacts:** Aspects of an organization's culture that you see, hear, and feel.
2. **Beliefs:** The understanding of how objects and ideas relate to each other.
3. **Values:** The stable, long-lasting beliefs about what is important.
4. **Assumptions:** The taken-for-granted notions of how something should be in an organization.

Culture changes for TQM

QUALITY ELEMENT	OLD CULTURE	TQM CULTURE
Definition	Product oriented	Customer oriented
Priorities	Second to service and cost	Equal to service and cost
Decisions	Short term	Long term
Emphasis	Detection	Prevention

Errors	Operations	System
Responsibility	Quality Control	Everyone
Problem Solving	Managers	Teams
Procurement	Price	Life cycle costs, Partnership
Manager's Role	Plan, assign, control, enforce, facilitate, mentor	Delegate, coach,

MANAGEMENT SYSTEM

Management System refers to how decisions are made, communicated, and carried out at all levels; mechanisms for leadership development, self-examination, and improvement. Effectiveness of leadership system depends in part on its organizational structure.

Quality management system is vehicles for change and should be designed to integrate all areas, not only the quality assurance department. They are directed toward achievement and commitment to purpose through four universal processes:

1. The specialization of task responsibilities through structure.

2. The provision of information systems that enable employees to know what they need to do in order to achieve goals.
3. The necessary achievement to result through action plans and projects.
4. Control through the establishment of benchmarks, standards, and feedback.

QUALITY

- ☐ Predictable degree of uniformity and dependability at low cost and suited to the market.
- ☐ Fitness for use.
- ☐ Conformance to requirements.
- ☐ Minimum loss imparted by a product to society from the time the product is shipped.
- ☐ A way of managing tile.
- ☐ Correcting and preventing loss, not living with loss.
- ☐ The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs.

– ISO

Quantification of quality

$$Q = P / E$$

P = Performance
E = Expectations
Q = Quality

DIMENSION OF QUALITY

Quality has 2 dimensions. These dimensions are product and service quality.

Dimensions of product quality:
- **Performance:** primary product characteristics, e.g. picture brightness in TV.

- **Features:** secondary characteristics, added features, e.g. remote control, picture-in-picture.
- **Usability:** ease of use with minimum training.
- **Conformance:** meeting specifications, industry standards,. (E.g. ISI specs. emission norms).
- **Reliability:** consistency of performance over a specified time period under specified conditions.
- **Durability:** extent of useful life, sturdiness.
- **Maintainability/Serviceability:** ease of attending to maintenance, repairs.
- **Efficiency:** ratio of output to input. E.g. mileage, braking distance, processing time.
- **Aesthetics:** sensory characteristics, e.g. appearance, exterior finish, texture, color, shape, etc.
- **Reputation:** subjective assessment based of past performance, brand image, industry ranking.
- **Safety:** in items like pressure cookers, electrical items, toys, cranes, etc.

Dimensions of service quality:
- **Time:** how much time a customer must wait / undergo service.
- **Timeliness:** whether service will be performed when promised.
- **Completeness:** whether all items in the order are included.
- **Consistency:** consistent service every time, and for every customer. Reliability of service.
- **Accessibility/Convenience:** ease of obtaining the service.
- **Accuracy:** absence of mistakes.
- **Responsiveness:** quick response, resolution of unexpected problems.
- **Courtesy:** cheerful, friendly service.
- **Competency/Expertise:** In professions like doctors, lawyers, mechanics, etc.

EVOLUTION OF QUALITY

Time	Events
Prior to the 20th century	Quality is an art Demands overcome potential production An era of workmanship
F.Taylor 1900s	The scientific approach to management resulting in rationalization of work and its break down leads to greater need for standardization, inspection and supervision
Shewart 1930s	Statistical beginnings and study of quality control. In parallel, studies by R A Fisher on experimental design; the beginning of control charts at western Electric in USA
Late 1930s	Quality standards and approaches are introduced in France and Japan. Beginning of SQC, reliability and maintenance engineering
1942	Seminal work by Deming at the ministry of war in USA on quality control and sampling Working group setup by Juran and Dodge on SQC in US army Concepts of acceptance sampling devised
1944	Daodge and Deming carried out seminal research on acceptance sampling

1945	Founding of the Japan standard association
1946	Founding of the ASQC
1950	Visit of Deming in Japan at the invitation of K Ishikawa
1951	Quality assurance increasingly accepted
1954	TQC in Japan ; Book published 1956
1957	Founding of European organization for the control of quality
1961	The Martin Co in USA introduces the zero defects approach while developing and producing Pershing Missiles. Quality motivation is starting in the US and integrated programmes begun
1962	Quality circles are started in Japan

QUALITY CONTROL

A definition of quality control is:
- The process of inspecting products to ensure that they meet the required quality standards
- This method checks the quality of completed products for faults. Quality inspectors measure or test every product, samples from each batch, or random samples – as appropriate to the kind of product produced.
- The main objective of quality control is to ensure that the business is achieving the standards it sets for itself.

QUALITY ASSURANCE

A definition of quality assurance is:
- The processes that ensure production quality meets the requirements of customers
- This is an approach that aims to achieve quality by organizing every process to get the product 'right first time' and prevent mistakes ever happening. This is also known as a 'zero defect' approach.
- In quality assurance, there is more emphasis on 'self checking', rather than checking by inspectors.

Quality Assurance	Quality Control
A medium to long-term process; cannot be implemented quickly	Can be implemented at short-notice
Focus on processes – how things are made or delivered	Focus on outputs – work-in-progress and finished goods
Achieved by improving production processes	Achieved by sampling & checking (inspection)
Targeted at the whole organization	Targeted at production activities
Emphasizes the customer	Emphasizes required standards
Quality is built into the product	Defect products are inspected out

QUALITY CONTROL

Quality Control is a systematic control of various factors that affect the quality of the product. The various factors include material, tools, machines, type of labour, working conditions, measuring instruments, etc.

Quality Control can be defined as the entire collection of activities which ensures that the operation will produce the optimum Quality products at minimum cost.

Quality Control is: "An effective system for integrating the quality development, Quality maintenance and Quality improvement efforts of the various groups in an organization, so as to enable production and services at the most economical levels which allow full customer satisfaction"

In short, we can say that quality control is a technique of management for achieving required standards of products.

Objectives of quality control
- ✔ To decide about the standard of quality of a product that is easily acceptable to the customer and at the same time this standard should be economical to maintain.

- ✔ To take different measures to improve the standard of quality of product.

- ✔ To take various steps to solve any kind of deviations in the quality of the product during manufacturing.

Advantages of quality control
- ✔ Quality of product is improved which in turn increases sales.

- ✔ Scrap rejection and rework are minimized thus reducing wastage. So the cost of manufacturing reduces.

- ✔ Good quality product improves reputation.

- ✔ Inspection cost reduces to a great extent.

- ✔ Uniformity in quality can be achieved.

- ✔ Improvement in manufacturer and consumer relations.

STATISTICAL QUALITY CONTROL

S.Q.C is a quality control system employing the statistical techniques to control quality by performing inspection, testing and analysis to conclude whether the quality of the product is as per the laid quality standards.

Using statistical techniques, S.Q.C. collects and analyses data in assessing and controlling product quality. The technique of S.Q.C. was though developed in **1924** by **Dr.WalterA.Shewartan** American scientist; it got recognition in industry only in the second world war. The technique permits a more fundamental control.

"Statistical quality control can be simply defined as an economic & effective system of maintaining & improving the quality of outputs throughout the whole operating process of specification, production & inspection based on continuous testing with random samples.**"** **-YA LUN CHOU**

"Statistical quality control should be viewed as a kit of tools which may influence decisions to the functions of specification, production or inspection.**"**   **-EUGENE L. GRANT**

SQC: Three broad categories

- ● **Descriptive statistics:** Statistics used to describe quality characteristics and relationships.

- **Statistical process control (SPC):** A statistical tool that involves inspecting a random sample of the output from a process and deciding whether the process is producing products with characteristics that fall within a predetermined range.
- **Acceptance sampling:** the process of randomly inspecting a sample of goods and deciding whether to accept the entire lot based on the results.

Benefits of Statistical Quality Control

The benefits of the Statistical Quality Control are as follows:

- ✔ It provides a means of detecting error at inspection.
- ✔ It leads to more uniform quality of production.
- ✔ It improves the relationship with the customer.
- ✔ It reduces inspection costs.
- ✔ It reduces the number of rejects and saves the cost of material.
- ✔ It provides a basis for attainable specifications.
- ✔ It points out the bottlenecks and trouble spots.
- ✔ It provides a means of determining the capability of the manufacturing process.
- ✔ It promotes the understanding and appreciation of quality control.
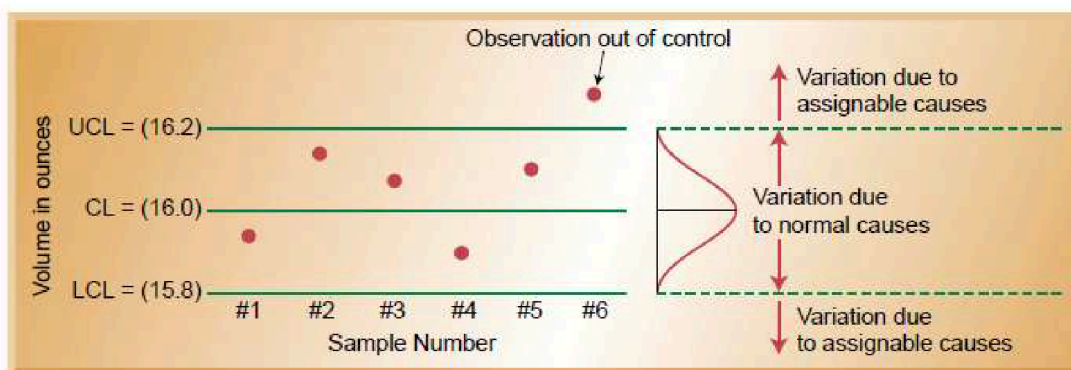
CONTROL CHARTS

A control chart (also called process chart or quality control chart) is a graph that shows whether a sample of data falls within the common or normal range of variation. The common range of variation is defined by the use of control chart limits.

Control chart is:

- ✔ A device which specifies the state of statistical control,
- ✔ A device for attaining statistical control,
- ✔ A device to judge whether statistical control has been attained or not.

We say that a process is out of control when a plot of data reveals that one or more samples fall outside the control limits.

- ✔ The **Center Line (CL)** of the control chart is the mean, or average.
- ✔ The **Upper Control Limit (UCL)** is the maximum acceptable variation.
- ✔ The **Lower Control Limit (LCL)** is the minimum acceptable variation.

Purpose and advantages:

1. A control charts indicates whether the process is in control or out of control.
2. It determines process variability and detects unusual variations taking place in a process.
3. It ensures product quality level.
4. It warns in time, and if the process is rectified at that time, scrap or percentage rejection can be reduced.
5. It provides information about the selection of process and setting of tolerance limits.
6. Control charts build up the reputation of the organization through customer's satisfaction.

TYPES OF CONTROL CHARTS

1. **CONTROL CHART FOR VARIABLE**: A product characteristic that can be measured and has continuum of values (e.g., eight, weight, or volume).

   ✔ x-bar chart
   ✔ Range (R) chart

MEAN (X-BAR) CHARTS

A mean control chart is often referred to as an *x-bar chart.* It is used to monitor changes in the mean of a process. To construct a mean chart we first need to construct the center line of the chart. To do this we take multiple samples and compute their means. Usually these samples are small, with about four or five observations. Each sample has its own mean. The center line of the chart is then computed as the mean of all sample means, where the number of samples is:

1. It shows changes in process average and is affected by changes in process variability.

2. It is a chart for the measure of central tendency.

3. It shows erratic or cyclic shifts in the process.

4. It detects steady progress changes, like tool wear.

5. It is the most commonly used variables chart.

6. When used along with R chart:

   ✔ It tells when to leave the process alone and when to chase and go for the causes leading to variation;

   ✔ It secures information in establishing or modifying processes, specifications or inspection procedures;

   ✔ It controls the quality of incoming material.

RANGE (R) CHARTS

These are another type of control chart for variables. Whereas x-bar charts measure shift in the central tendency of the process, range charts monitor the dispersion or variability of the process. The method for developing and using R-charts are the same as that for x-bar charts. The center line of the control chart is the average range, and the upper and lower control limits are computed. The R chart is used to monitor process variability when sample sizes are small (n<10), or to simplify the calculations made by process operators. This chart is called the R chart because the statistic being plotted is the sample range.

1. It controls general variability of the process and is affected by changes in process variability.

1. It is a chart for measure of spread.

2. It is generally used along with X-bar chart.

2. CONTROL CHART FOR ATTRIBUTE: A product characteristic tha has a discrete value and can be counted.

    ✔   P-chart
    ✔   C-chart

P-CHARTS

P-charts are used to measure the proportion of items in a sample that are defective. Examples are the proportion of broken cookies in a batch and the proportion of cars produced with a misaligned fender. P-charts are appropriate when both the number of defectives measured and the size of the total sample can be counted. A proportion can then be computed and used as the statistic of measurement.

1. It can be a fraction defective chart.

2. Each item is classified as good (non-defective) or bad (defective).

3. This chart is used to control the general quality of the component parts and it checks if the fluctuations in product quality (level) are due to chance alone.

C-CHARTS

C-charts count the actual number of defects. For example, we can count the number of complaints from customers in a month, the number of bacteria on a Petri dish, or the number of barnacles on the bottom of a boat. However, we cannot compute the proportion of complaints from customers, the proportion of bacteria on a Petri dish, or the proportion of barnacles on the bottom of a boat.

Chart Type	Upper Control Limit	Lower Control Limit
x-bar (with Range)	$\bar{\bar{x}} + A_2 \bar{R}$	$\bar{\bar{x}} - A_2 \bar{R}$
Range	$D_4 \bar{R}$	$D_3 \bar{R}$
p	$\bar{p} + 3\sqrt{\dfrac{\bar{p}(1-\bar{p})}{n}}$	$\bar{p} - 3\sqrt{\dfrac{\bar{p}(1-\bar{p})}{n}}$
c	$\bar{c} + 3\sqrt{\bar{c}}$	$\bar{c} - 3\sqrt{\bar{c}}$

ACCEPTANCE SAMPLING

- Acceptance Sampling is a method used to accept or reject product based on a random sample of the product.
- The purpose of acceptance sampling is to sentence lots (accept or reject) rather than to estimate the quality of a lot.
- Acceptance sampling plans do not improve quality. The nature of sampling is such that acceptance sampling will accept some lots and reject others even though they are of the same quality.
- The most effective use of acceptance sampling is as an auditing tool to help ensure that the output of a process meets requirements.

In general, acceptance sampling is employed when one or several of the following hold:

✔ Testing is destructive;
✔ The cost of 100% inspection is very high; and
✔ 100% inspection takes too long.

Acceptance Sampling is a Statistical quality control technique, where a random sample is taken from a lot, and upon the results of the sample taken the lot will either be rejected or accepted.

- Accept Lot
  - Ready for customers
- Reject Lot
  - Not suitable for customers

Purposes

✔ Determine the quality level of an incoming shipment or, at the end production
✔ Ensure that the quality level is within the level that has been predetermined

ACCEPTANCE SAMPLING

TAKE SAMPLE

INSPECT SAMPLE
Type title here

DECISION

| ACCEPT LOT | REJECT LOT | SAMPLE AGAIN |

Advantages

✔ Less handling damage
✔ Fewer inspectors to put on payroll

DECISION

✔ 100% inspe[RETURN LOT TO SUPPLIER]h   100% INSPECTION
✔ 100% testing would take to long

Disadvantages

✔ Risk included in chance of bad lot "acceptance" and good lot "rejection"
✔ Sample taken provides less information than 100% inspection
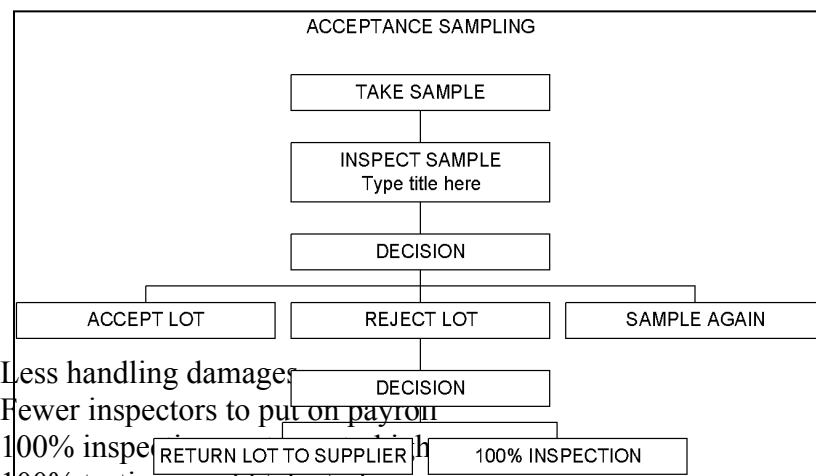
CUSTOMER FOCUS AND SATISFACTION

DEFINITION AND TYPES OF CUSTOMER

The customer is the end user or the person who consumes the product or gets benefit from the services.

Types of customers:

There are two distinct types of customers:
- ☐ External Customers
- ☐ Internal Customers

External Customers: An external customer can be defined in many ways, such as
- The one who uses the product or services
- The one who purchases the product ore services
- The one who influences the sale of the product or service.
- An external customer exists outside the organization and generally falls into three categories:
  - ✔ Current customers
  - ✔ Prospective customers
  - ✔ Lost customers

Internal Customers: An internal customer is just as important. Every function, whether it be engineering, order processing, or production, has an internal customer.
- ✔ Each receives a products or services and in exchange provides a product or service. Each person in a process considered preceding operations.
- ✔ Each worker's goal is to make sure that the quality meets the expectation of the next person, and should satisfy the external customer.

Internal vs External Customers
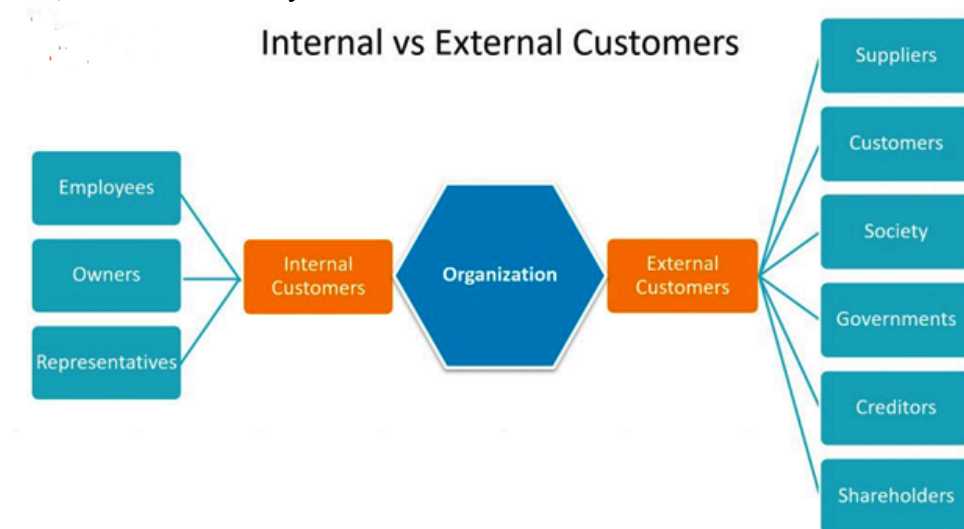
INTERNAL CUSTOMER CONFLICT

Definition: Disagreement between individuals or groups within an organization that may have an impact on the overall functioning of the organization.
- Internal conflict is personal to the person involved. This type of conflict takes place within the person.
- It can surface when a person's values or morals are tested or otherwise compromised.
- Internal conflict can greatly impact the person's performance level.

Example of Internal Customers Conflict
- ✔ What products or services are produced?
- ✔ Who uses these products and services?
- ✔ Who do employees call, write to, or answer questions for?
- ✔ Who supplies inputs to the process?

Causes for Conflicts
- ✔ Managerial Expectations
- ✔ Breakdown in Communication
- ✔ Misunderstanding the Information
- ✔ Lack of Accountability

WHAT IS THE RELATION OF PROCESS VS IT'S CUSTOMER?

The process is defined as a set of interconnected activities that result in a product or a service to be offered to a customer. Thus, their relation is of critical importance. The result of one activity (the process) directly affects the other entity (the customer).

For example, all the customer complaints are analogous to process variation. If variation that is non-conformance to the quality standards occurs, it will ultimately affect the quality of the end product or service. Therefore it is important to keep a strong check on this aspect.

PROCESS VS CUSTOMER
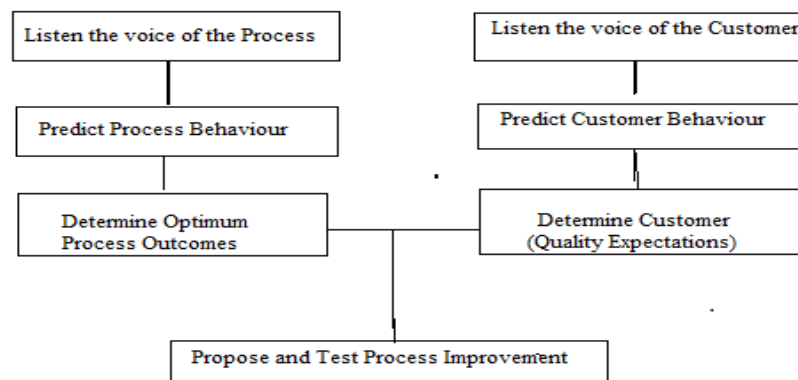
QUALITY FOCUS
- 'Satisfaction is an attitude: Loyalty is a Behavior'.
- Loyal customers spend more, are willing to pay higher prices, refer new clients, and are less costly to do business with.
- Common theme is to integrate many individuals / group efforts that may have their own priority.
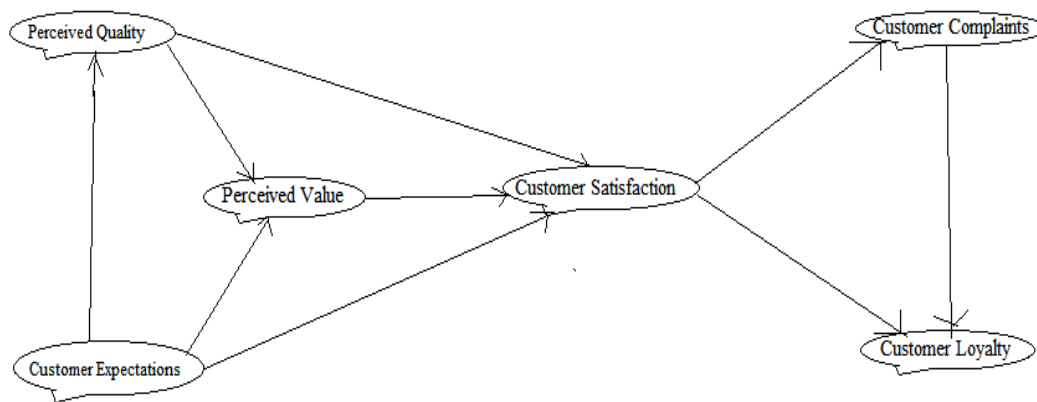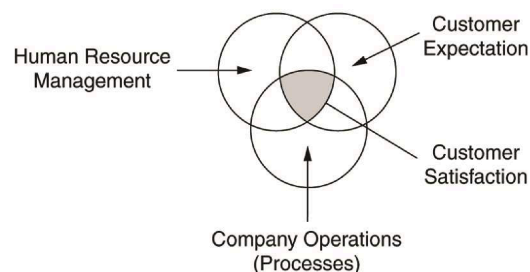
CUSTOMER SATISFACTION

It refers to the measure of how products and defined as the number of customers, or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals.

Customer satisfaction is not an objective statistics but more of a feeling or attitude. If a customer is happy with a product or a service it has hired or purchase they will pay their bills promptly, which greatly improves cash flow-the lifeblood of any organization. Customers that are satisfied will increase in number, buy more, and buy more frequently.

Customer Satisfaction – Three Parts System

DETERMINANTS OF CUSTOMER SATISFACTION

Key Indicators for Physical Products
- ✔ Reliability
- ✔ Aesthetics
- ✔ Adaptability
- ✔ Usability
- ✔ Functionality
- ✔ Appropriateness

Key Indicators for Services
- ✔ Friendliness/courteousness of employees
- ✔ Safety/risk of service
- ✔ Billing/invoicing procedure
- ✔ Responsiveness to requests
- ✔ Appearance of physical facilities
- ✔ Approachability of the service provider

✔ Willingness to listen to customer
✔ Honesty and an ability to communicate in clear language

External Customer Satisfaction:

An external customer is one who isn't a part of an organization, rather is one who receives service or product from the organization.

External customer satisfaction shows the extent to which the organization;

✔ Uses methods for determining and monitoring external customer's perceived quality and value.
✔ Uses customer feedback to improve product/service quality.
✔ Handles complaints, resolves them, and uses complaint information for quality improvement and prevention of recurrence of problems.
✔ Measures performance against customer targets.
✔ Compares its customer satisfaction results with that of main competitors.

Internal Customer Satisfaction:

An internal customer can be anyone within an organization. It could be another department, another branch or even a co-worker. Every single person in the organization has an effect on the external customers. Internal co-operation needs to be stimulated to enhance organizational performance. A summary of steps to improve Internal Customer Satisfaction is given below

✔ Treat employees as you would treat your customers
✔ Share your vision
✔ Surpass their expectations
✔ Take feedback and suggestions
✔ Show appreciation for good work

THE ROLE OF MARKETING AND SALES:

Marketing and sales are function charged with gathering customer input but in many firms the people in these function are unfamiliar with quality improvement. Shortcomings in marketing as identified by critics include:

✔ Partnering arrangement with dealers and distribution channels
✔ Focusing on the physical characteristics of products and overlooking the related services
✔ Losing a sense of customer price sensitivity
✔ Not measuring or certifying suppliers such as advertisers
✔ Failing to perform cost/benefit analyses on promotion costs
✔ Losing markets to generics and house brands

The **role of marketing** and sales is to *identify, satisfy, and retain customers*.

Before you can create anything of value,

☐ You must **identify** a want or need that you can address, as well as the prospective customers who possess this want or need.
☐ You work to **satisfy** these customers by delivering a product or service that addresses these needs at the time customers want it. Key to customer satisfaction is making sure everyone feels they

benefit from the exchange. Your customer is happy with the value they get for what they pay. You are happy with the payment you receive in exchange for what you provide.

☐ Effective marketing doesn't stop there. It also needs to **retain** customers by creating new opportunities to win customer loyalty and business.
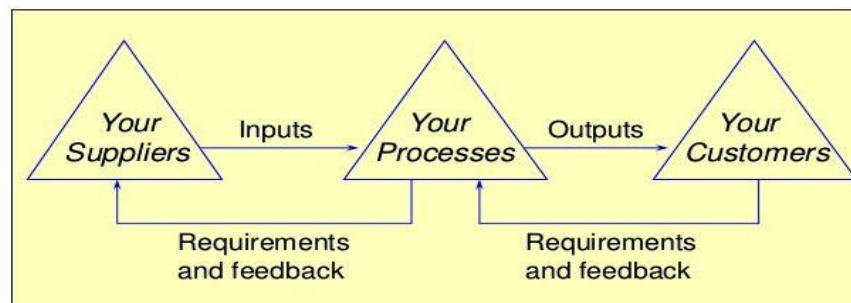
THE ROLE OF MARKETING AND SALES

BUYER SUPPLIER RELATIONSHIPS:

Deming suggested that a long term relationship between the buyer and supplier is necessary for economy. Several guidelines will help both the supplier and buyer benefits from a long term partnering relationship:

✔ Implementation of TQM by both supplier & customer.
✔ Long term commitment to TQM & to partnering relationship between the parties.
✔ Reduction in supplier base.
✔ Get supplier involved in early stages of Research, Development & Design.
✔ Benchmarking.

Spectrum of Buyer-Supplier Relationships

Antagonistic
- Parties work actively against the needs of the other
- Neither party takes responsibility for anything that happens in the relationship

Lose/Lose

Adversarial
- Parties are engaged in competitive struggle
- Parties attempt to capture the maximum value for their side

Win/Lose

Cooperative
- Parties realize the benefit of working together
- Closer relations are a result of mutual goals
- Supplier input and involvement begins to increase

Collaborative
- Congruence of goals exists
- Parties work together to satisfy the needs of each other and create new value
- Parties search for creative solutions jointly

Win/Win

BENCHMARKING

Benchmarking is the process of measuring an organization's internal processes then identifying, understanding, and adapting outstanding practices from other organizations considered to be best-in-class.

"Measuring our performance against that of best-in- class companies, determining how the best-in-class achieve those performance levels and using the information as a basis for our own company's targets, strategies and implementation."

For Example, A food delivery service chain was facing a problem of delay in delivery owing to customer complaints and dissatisfaction with the service.

The company prepared a team to conduct process benchmarking for this purpose. The team observed and researched on the strategy of one of its competitors who was taking the market by storm. It found that the competitive brand has installed the GPS trackers in the delivery bikes.

Thus, it can easily track the position of its delivery person and monitor their timing and efficiency.

THE EVOLUTION OF BENCHMARKING

✔ The benchmarking processes may have evolved in the 1950s when W.EDWARDS DEMING taught the idea of quality control to the Japanese.
✔ The method was rarely used in the United States until the early 1980s, when IBM, Motorola and Xerox became the best known example for using benchmarking processes.

TIME	TYPE	DESCRIPTION
First generation	Reverse Engineering	RE is the process of discovering the technological principles of a device, object or system through the analysis of its structure, function & operation
Second generation	Competitive Benchmarking	Continuous process of comparing a firm's practices and performance measures

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		with that of its most successful competitor
Third generation	Process Benchmarking	The initiating firm focuses on its observation and investigation of business processes with a goal of identifying and observing the best practices from one or more benchmarked firms
Forth generation	Strategic Benchmarking	Involves observing how others compete
Fifth generation	Global Benchmarking	Benchmarking with the partners across the globe

TYPES OF BENCHMARKING
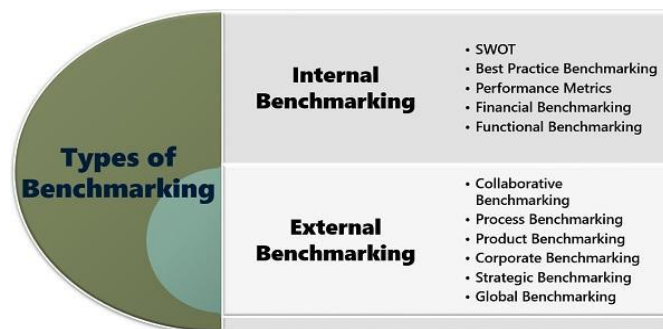
Internal Benchmarking

The internal benchmarking refers to the comparison of the organizational performance internally.Either with its previous performances or with that of its competitors, i.e., the companies belonging to the same industry. Here, the information is usually gathered and circulated within the organization itself.

Following are the various strategies falling under this category:

- **SWOT**: In this benchmarking strategy, the strengths, weaknesses, opportunities and threats of the company are listed out and analyzed by the management.
- **Best Practice Benchmarking**: The management themselves studies and identifies the strategies and practices of the other companies who are the market leaders, to plan the desired course of action.
- **Performance Metrics**: This strategy is based on the statistical metrics derived through the analysis of the client's preference and the comparison made with competitors. The company can find out the loopholes in its performance and work over it.
- **Financial Benchmarking**: The management conducts a comparative study of the financial forecast with the actual results or financial reports to find out the areas of shortcomings and take corrective actions.

- **Functional Benchmarking**: The company compares its performance and products with that of other related industries to innovatively improve its functionality.

External Benchmarking

In external benchmarking, the companies compare their performance with that of its competitors in the industry or across the globe. Usually, by the data collected through associations or third party.

To know about the different external strategies in detail, read below:

- **Collaborative Benchmarking**: To improve the performance standards, the companies belonging to a particular industry collaborate with the industrial associations. These associations provide the benchmarking data on best practices and a comparative analysis of all the companies, to facilitate the improvement of the underperforming companies.
- **Process Benchmarking**: In process benchmarking, the company analyzes the competitor's methods, tasks, techniques of production, means of distribution, etc. It also studies the standard mechanisms of performing a particular function, to modify its ways accordingly.
- **Product Benchmarking**: This strategy focuses on the in-depth analysis of the competitor's product to know its features and composition. The company uses this strategy to improve and redesign its products.
- **Corporate Benchmarking**: The company compares its various departments like finance, production, distribution, marketing, human resource, etc. with those of its competitors to enhance the efficiency of each division.
- **Strategic Benchmarking**: This strategy is usually adopted when the company plans to implement a new policy or idea or modify the existing one. The team compares the company's approach with that of the other successful companies in the industry before bringing it into practice.
- **Global Benchmarking**: It is similar to strategic benchmarking, the only difference is that here the company compares its strategies with those of its other branch or the various competitors spread across the globe, to take corrective actions.

PROCESS OF BENCHMARKING

Benchmarking is not an immediate solution to a problem. Instead, it is a step by step treatment of the problem area. These steps are explained in detail below:

Process of Benchmarking
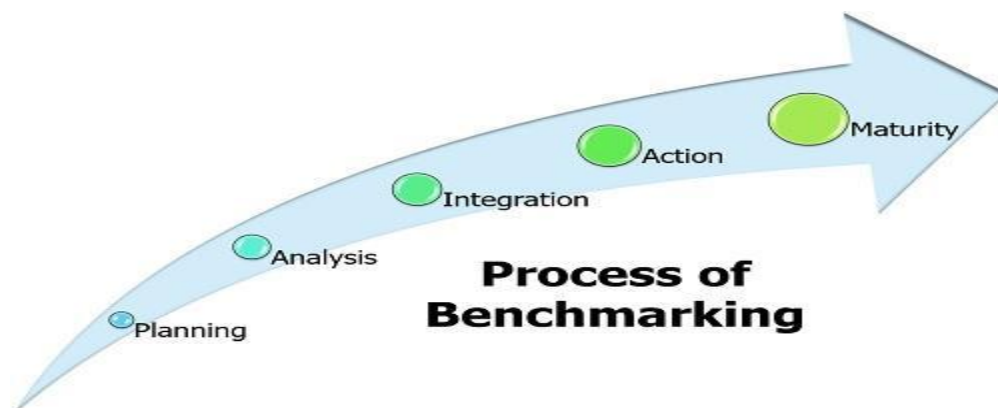
1. **Planning**: The planning phase determines the need for benchmarking and the area which requires it. The competitors and means to collect the relevant data are also decided at this particular stage.
2. **Analysis**: The Company then analyzes the data so gathered to find out the strengths of the competitors, list out its weaknesses and ways of improvement.
3. **Integration**: At this phase, the analysis is reported to the top management, and after their approval, the desired action plan with a well-defined strategy, is developed.
4. **Action**: Now, the management has a workable plan; at this stage, the employees execute the benchmarking plan.
5. **Maturity**: The final stage is maturity; it is at this phase, where the result of using benchmarking to improve the business operations can be observed. A successful application of benchmarking will lead to the attainment of market leadership.

ADVANTAGES OF BENCHMARKING

- **Improves Learning Methodology**: Benchmarking paves the way for idea generation and sharing of proven business practices which can be seen as a learning experience for the companies.
- **Initiates Technological Upgradation**: Through this strategy, the companies get to know about the new technology and techniques which have been adopted by the market leaders. The companies can accordingly plan for up-gradation of its technology to sustain the competition.
- **Improve Company's Standards**: The company analyzes and studies the standards of the competitors. This facilitates the company to raise its standard of production and products accordingly.
- **Enhances Work Quality**: It leads to organizational growth since it improves the overall quality of the output and reduces the chances of errors due to the standardization of business operations.
- **Cope Up with Competition**: Knowing about the competitors' business and their strategy, helps the company to design its strategies efficiently. It also facilitates the company to be updated with the recent developments and technology, hence beating the market competition.
- **Improves Efficiency**: The overall efficiency of the employees increases with this practice since standardization of work motivates them to perform better without making many mistakes.
- **Increases Customer Satisfaction**: Through benchmarking, the company collects sufficient data on customer's needs and wants through customer feedback. This information helps the company to enhance the customer experience and satisfaction level.
- **Help Overcome Weaknesses**: These strategies help the company in finding out its shortcomings and working over them to get the desired results.

DISADVANTAGES OF BENCHMARKING

- **Lack of Information**: Sometimes, the company is unable to gather adequate information for benchmarking. This leads to an improper or inadequate comparison of the company's performance with that of its competitors.

- **Increases Dependency**: The companies tend to depend on other companies' strategies to become successful. In this process of following the market leaders, they sacrifice their individuality and uniqueness and starts following the path shown by others.
- **Lack of Understanding**: At times, companies adopt benchmarking for the sake of doing so, rather than finding out the necessity of it. It fails to understand its weaknesses while keeping an eye on the functioning of its competitors.
- **Copying Others**: Some organizations don't understand the actual purpose of this strategy and start copying their competitors in every aspect. This may even lead to a downfall of the business.
- **Incorrect Comparison**: It demands a comparison between two or more companies belonging to the same industry and competes with each other. But sometimes, the companies make irrelevant comparison resulting in poor benchmarks.
- **Costly Affair**: It requires a team of experienced personnel who have excellent analytical skills and expertise in the area. Thus, increasing the administrative expenses of the company. Even the implementation of the changes involves capital expenditure at times.

COMMON PITFALLS IN BENCHMARKING

- ✔ Lack of management commitment and involvement
- ✔ Not applied to critical areas first
- ✔ Inadequate resources
- ✔ No involvement of the line organization.
- ✔ Scope not well defined.
- ✔ To many performance measures.
- ✔ Critical success factors & performance drivers not understood or identified.
- ✔ Potential partners ignored
- ✔ Poorly designed questionnaires.
- ✔ Inappropriate data collection method.
- ✔ Too much & inconsistent data.
- ✔ Analysis paralysis; excess precision.
- ✔ Management resistance to change.
- ✔ No repeat benchmarking.

ORGANIZING FOR TOTAL QUALITY MANAGEMENT

INTRODUCTION

There are two prerequisites for a TQM organization.

1. Quality attitude that pervades the entire organization. Quality is not just a special activity supervised by a high-ranking quality director.

2. Organizational infrastructure to support the pervasive attitude. Companies must have the means and the structure to set goals, assign them to appropriate people, and convert them to action plans.

People must be aware of the importance of quality and trained to accomplish the necessary tasks.

ORGANIZING FOR TQM: THE SYSTEMS APPROACH

A system can be defined as an entity composed of interdependent components that are integrated for achievement of an objective. The organization is a social system comprising a number of components such as marketing, production, finance, research, and so on. These organizational components are activities that may or may not be integrated, and they do not necessarily have objectives or operate toward achievement of an objective. Thus, synergism, a necessary attribute of a well-organized sys- tem, may be lacking as each activity takes a parochial view or operates independently of the others. This lack of synergism cannot continue under the TQM approach to strategic management because interdependency across functions and departments is a necessary precondition.

For any organization considering the implantation of quality management strategies, certain quality management principles need to be considered. One such principle is system approach, which determines the identification, understanding and management of a system of interrelated processes for any goals that will improve the organization's efficiency. This approach plays an important role in any continuous improvement process, offering great benefit to the organization.
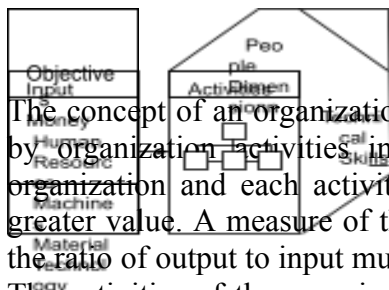
The Organizational System

The concept of an organizational system is shown in Figure. Inputs to the system are converted by organization activities into an output. Indeed, the sole reason for the existence of the organization and each activity within it is to add value to inputs and produce an output with greater value. A measure of this conversion of inputs into outputs is known as productivity, and the ratio of output to input must be a positive number if the system is to survive in the long run.

The activities of the organization are subsystems of the whole, but are also individual systems with inputs and outputs that provide input to other systems such as customers and other internal activities.

Key Benefits to System Approach

The primary benefits of system approach in regards to quality management can be seen on a short and long term scale. These benefits include the following:

- Incorporation and configuration of processes that will best ensure return on investment.
- Capacity to concentrate efforts on the primary processes.
- Giving confidence to relevant parties in regards to the reliability, success and efficiency of the organization.

Steps to Achieving System Approach

There are five steps that comprise of the system approach, with each step assisting organizations to

achieve more effective systems within their operations and goals. These steps include the following:

- **Outline** the system through the identification or development of specific processes that are able to ensure that certain goals can be achieved.
- **Organize** the system in order to achieve the goal in the most efficient way possible, with a clear plan that can be implemented by relevant parties.
- **Understand** the relationship among each one of the separate processes of the system, and how they interrelate to form a complete system.
- **Continuously expand** the system through reporting, goal measurement and regular system evaluation.
- **Evaluate** the resources that will be required to implement processes, to determine resource constraints before implementation of each process within the system.

When these steps are taken into consideration during the development of systems within the organization, processes will be far more effective. This in turn will assist with achieving quality management and continuous improvement within the workplace through efficient systems.

ORGANIZING FOR QUALITY IMPLEMENTATION

- The traditional approach to organization sees the process as a mechanical assemblage of functions and activities without a great deal of attention to strategy and desired results.
- This approach to building an organization structure has been criticized by Peter Drucker: "What we need to know are not all the activities that might conceivably have to be housed in the organization structure. What we need to know are the load-bearing parts of the structure, the key activities."
- Key activities will differ depending on the nature of the organization, its products, and its strategy.
- What is a key activity in one may not be in another.
  Example:
  - Advertising may be a key activity in the value chain of Coca-Cola, but not in Boeing Aircraft, where design is the key activity.
  - Back office activity may be a key activity in Merrill Lynch, but not in McDonald's.
- Firms frequently fail to prioritize or identify key activities in the value chain because of a tendency to organize around the chart of accounts.
- Some firms focus on those activities where cost, rather than quality or other source of differentiation, is the major consideration.

ACTIVITY	VALUE TO CUSTOMER
Purchasing	Improved cost and quality of product
Engineering and design characteristics	Unique product
Manufacturing	Product reliability
Order processing	Response time
Service	Customer installation
Scheduling	Response time
Inspection	Defect-free product
Spare parts	Maintenance
Human resources	Customer training

MAKING THE TRANSITION FROM A TRADITIONAL TO A TQM ORGANIZATION

The systems approach to organizing suggests three significant changes:
1. The concept of the inverted organizational chart
2. A system of intra company internal quality
3. Horizontal and vertical integration of functions and activities

Roles in organizational transition to TQM

The role of top management is critical.
- Many of the most successful companies launched their programs by creating a quality council or steering committee whose members comprise the top management team.
- Some multi-division companies encourage a council in each division or strategic business unit. The council provides a good vehicle for management to demonstrate its leadership in the quality initiative.
- Opinions differ as to who should lead or coordinate the TQM effort.
- One source suggests a new role similar to that of a financial controller, a role that is justified on the basis that quality is now a strategic business planning and management function.
- Others disagree and suggest that the company should avoid setting up a quality bureaucracy headed by a high-profile quality director.
- There is general agreement that it should not be headed by a staff department such as personnel or quality assurance.
- The process should be line led and given back to the business managers who implement it on a daily basis.
- The role of middle managers has traditionally been an integrative one.
- They are the drivers of quality and the information funnel for change both vertically and horizontally— the go-between for top management and front-line employees.
- They implement the strategy devised by top management by linking unit goals to strategic objectives.
- They develop personnel, make continuous improvement possible, and accept responsibility for performance deficiencies.

QUALITY CIRCLES

DEFINITION

The most widespread form of an employee involvement team is the quality circle, defined as "a small group of employees doing similar or related work who meet regularly to identify, analyze, and solve product quality and production problems and to improve general operations."

Quality Circle is a small group of 6 to 12 employees doing similar work who voluntarily meet together on a regular basis to identify improvements in their respective work areas using proven techniques for analyzing and solving work related problems coming in the way of achieving and sustaining excellence leading to mutual upliftment of employees as well as the organization.
It is "a way of capturing the creative and innovative power that lies within the work force".

CONCEPT

- The concept of Quality Circle is primarily based upon recognition of the value of the worker as a human being, as someone who willingly activities on his job, his wisdom, intelligence, experience, attitude and feelings.
- It is based upon the human resource management considered as one of the key factors in the

improvement of product quality & productivity. Quality Circle concept has three major attributes:
    – Quality Circle is a form of participation management.
    – Quality Circle is a human resource development technique.
    – Quality Circle is a problem solving technique.

OBJECTIVES

The objectives of Quality Circles are multi-faced.
a) Change in Attitude
- From "I don't care" to "I do care"
- Continuous improvement in quality of work life through humanization of work.

b) Self Development
- Bring out 'Hidden Potential' of people
- People get to learn additional skills.

c) Development of Team Spirit
- Individual Vs Team – "I could not do but we did it"
- Eliminate inter departmental conflicts.

d) Improved Organizational Culture
- Positive working environment.
- Total involvement of people at all levels.
- Higher motivational level.
- Participate in the Management process.

BENEFITS AND LIMITATIONS OF QUALITY CIRCLES
Advantages of quality circles
- Increase Productivity
- Improve Quality
- Boost Employee Morale

Disadvantages/problems with quality circles
- Inadequate Training
- Unsure of Purpose
- Not truly Voluntary
- Lack of Management Interest
- Quality Circles are not really empowered to make decisions.

**<u>SEVEN STATISTICAL TOOLS OF QUALITY</u>**
The Seven Basic Tools of Quality (7 QC Tools) originated in Japan when the country was undergoing a major revolution in quality standards. It had become a mandatory topic as part of Japanese's industrial training program. These tools have simple graphical and statistical techniques which are helpful in solving critical quality related issues.
They are also known as Seven Basics Tools of Quality because these tools could be implemented by any person with very basic training in statistics. They are simple to apply and solve quality-related complex issues.
The seven QC tools are:

<u>STRATIFICATION (DIVIDE AND CONQUER)</u>

☐ It is a method of dividing data into sub–categories. After that, one has to classify it based on various parameters into groups and sub-groups. It helps in deriving meaningful information and analyse the existing problem.

☐ It helps in dividing the data and deriving meaning out of it to solve a problem.
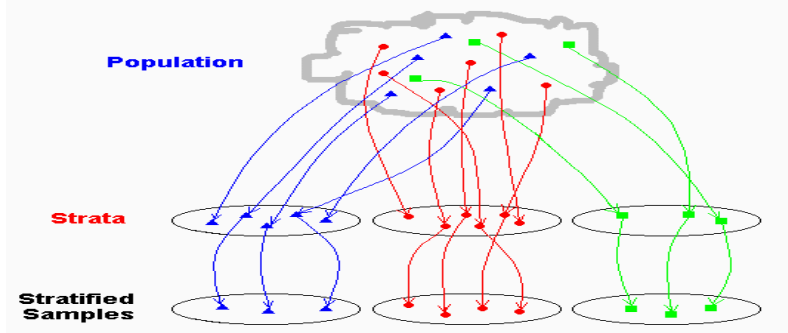
CHECK SHEET
DEFINITION:
☐ Check sheets are tools for collecting data. They are designed specific to the type of data to be collected. Check sheets aid in systematic collection of data.

EXAMPLES:
☐ Daily maintenance check sheets, attendance records, production log books, etc.

FUNCTIONS:
☐ To check the shape of the probability distribution of a process.
☐ To quantify defects by type.
☐ To quantify defects by location.
☐ To quantify defects by cause (machine, worker).
☐ To keep track of the completion of steps in a multistep procedure (in other words, as a checklist).

Sample Checksheets

Defect Type		Totals
1.Assembly	II	2
2.Print Quality	IIIIIIIIIIIII	13
3.Print Detail	IIII	4
4.Edge Flaw	IIIIIIIIIIIIIIIIIIIIII	22
5.Cosmetic	IIIII	5

| Customer Complaints		Totals
1.Missing Ring	II	2
2.Print Quality	IIIIIIIIIIIIIIIIIIIIIII	23
3.Misplace Print	IIII	4
4.Rough Edge	III	3
5.Type Error	IIIIII	6
6.Excess Flash	IIIIIIIIIIIII	13
7.Late Shipment	IIIIII	6
8.Bad Count	IIII	4

PARETO DIAGRAM/(80/20 RULE)
☐ 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.

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□ This is named after Vilfredo Pareto. It revolves around the concept of 80-20 rule which underlines that in any process, 80% of problem or failure is just caused by 20% of few major factors which are often referred as Vital Few, whereas remaining 20% of problem or failure is caused by 80% of many minor factors which are also referred as Trivial Many.

□ The purpose of Pareto Chart is to highlight the most important factors that is the reason for major cause of problem or failure.

□ Pareto chart is having bars graphs and line graphs where individual factors are represented by a bar graph in descending order of their impact and the cumulative total is shown by a line graph.

BENEFITS:

□ Prioritize projects for improvement,

□ Set up corrective action teams to solve problems,

□ Identify products on which most complaints are received,

□ Identify the nature of complaints occurring most often,

□ Identify most frequent causes for rejections or for other similar purposes.
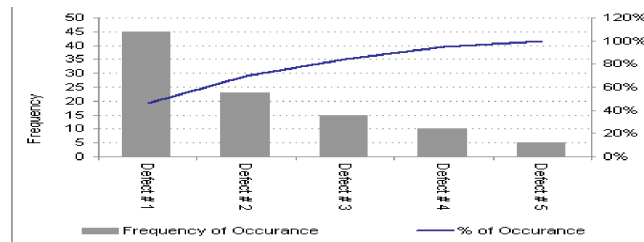

A Pareto Chart

SCATTER DIAGRAM/SHEWHART CHART

DEFINITION:

□ A scatter diagram, also called a scatter plot or a scatter plot, is a visualization of the relationship between two variables measured on the same set of individuals.

□ A tool to study the relationship between two variables is known as Scatter Diagram. It consists of plotting a series of points representing several observations on a graph in which one variable is on X-axis and the other variable in on Y-axis.

BENEFITS:

□ It shows the relationship between two variables.

□ It is the best method to show a non-linear pattern.

□ The range of data flow, i.e. maximum and minimum value, can be easily determined.

□ Shows a trend in the data relationship

□ Retains exact data values and sample size

□ Shows minimum/maximum
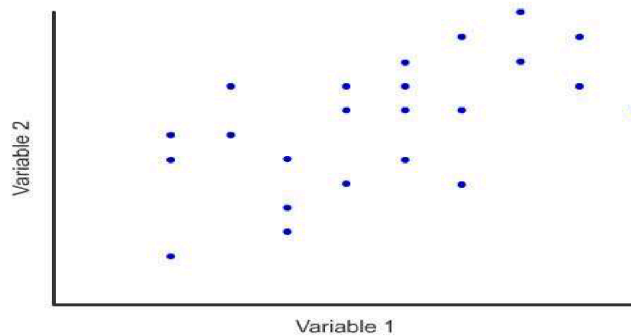
CAUSE & EFFECT DIAGRAM/ FISH-BONE DIAGRAM/ ISHIKAWA DIAGRAM

- ☐ A cause and effect diagram, also known as a fish-bone diagram shows the many possible causes of a problem.
- ☐ The defect is shown as the fish's head, facing to the right, with the causes extending to the left as fishbones; the ribs branch off the backbone for major causes, with sub-branches for root-causes, to as many levels as required.
- ☐ A diagram that shows the causes of an event and is often used to outline the different steps in a process, demonstrate where quality control issues might arise and determine which resources are required at specific times.
- ☐ To use this tool, you need to first identify the problem you are trying to solve and simply write it in the box (head of the fish) to the right.
- ☐ Next, you will list the major causes of the problem on the spine of the fish.
- ☐ Causes are typically separated into categories of people, process, materials and equipment.
- ☐ Causes are then identified through brainstorming with a group familiar with the problem.
- ☐ Once all of the possible causes are identified, they can be used to develop an improvement plan to help resolve the identified problem.
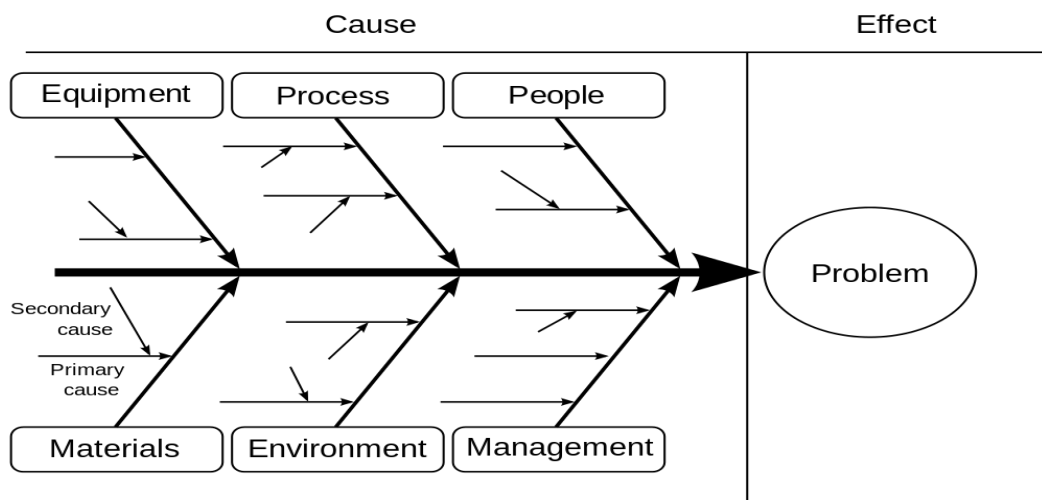
K-T METHODOLOGY

- ☐ Kepner Tregoe methodology is a structured methodology for gathering information and prioritizing and evaluating it. It was developed by Charles H. Kepner and Benjamin B. Tregoe in the 1960s.

- This is a rational model that is well respected in business management circles. An important aspect of Kepner Tregoe decision making is the assessment and prioritizing of risk.
- So the idea is not to find a perfect solution but rather the best possible choice, based on actually achieving the outcome with minimal negative consequences.
- It is marketed as a way to make unbiased decisions in that it is said to limit conscious and unconscious biases that draw attention away from the outcome.
- It is used for decision making .
- It is very detailed and complex method applicable in many areas, which is much broader than just idea selection.
- It is called also a root cause analysis and decision-making method.
- It is a step-by-step approach for systematically solving problems, making decisions, and analyzing potential risks.

There are four basic steps when using the Kepner Tregoe decision matrix:

- **Situation appraisal** - is used to clarify the situation, outline concerns and choose a direction
- **Problem analysis** - here the problem is defined and it's root cause determined
- **Decision analysis** - alternatives are identified and a risk analysis done for each
- **Potential problem analysis** - the best of the alternatives is further scrutinized against potential problems and negative consequences and actions are proposed to minimize the risk.

Following the step-by-step approach of Kepner Tregoe decision making allows for the use of critical thinking skills in considering many possible factors that may be vital in making the decision.
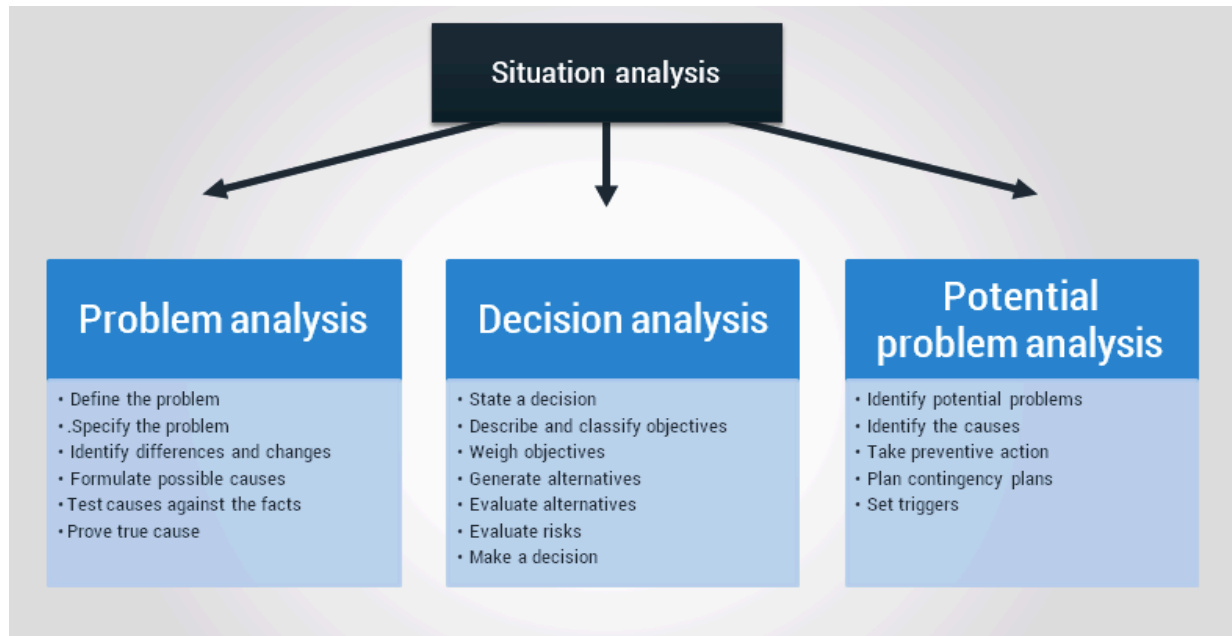
COST OF QUALITY:

Cost of Quality is a methodology used to define and measure where and what amount of an organization's resources are being used for prevention activities and maintaining product quality as opposed to the costs resulting from internal and external failures. The Cost of Quality can be represented by the sum of two factors. The Cost of Good Quality and the Cost of Poor Quality equals the Cost of Quality, as represented in the basic equation below:

$$CoQ = CoGQ + CoPQ$$

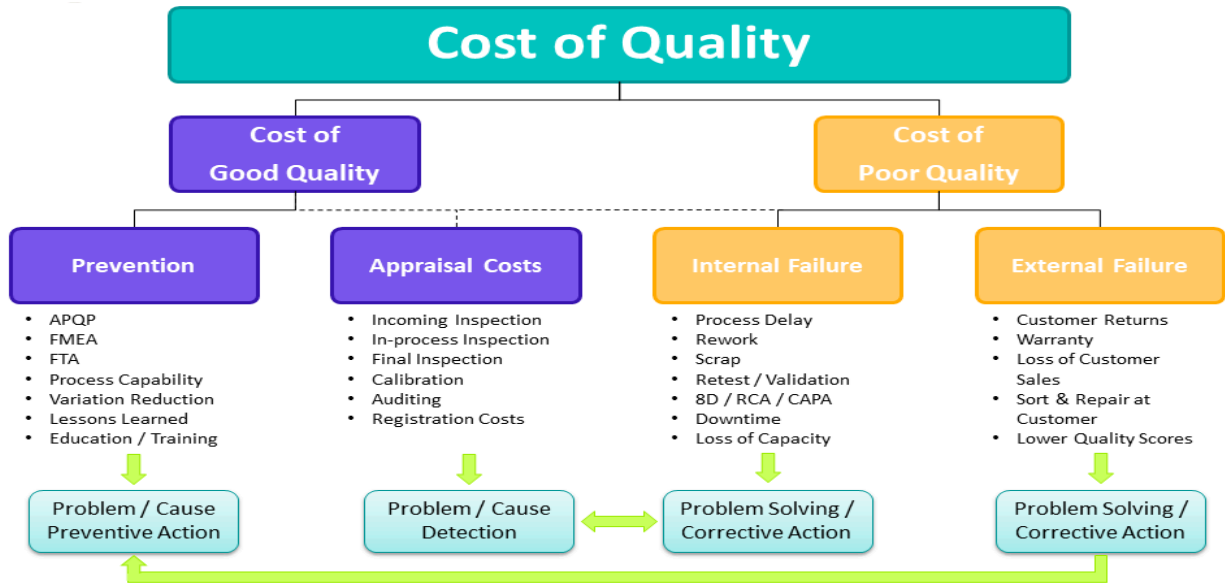Cost of quality = Cost of conformance + Cost of nonconformance

- Cost of conformance is the cost of providing products or services as per the required standards. This can be termed as a good amount spent. (Prevention & Appraisal costs)
- Cost of non-conformance is the failure cost associated with a process not being operated to the requirements. This can be termed as unnecessary amount spent.(Internal & External failure costs)

The Cost of Quality equation looks simple but in reality it is more complex. The Cost of Quality includes all costs associated with the quality of a product from preventive costs intended to reduce or eliminate failures, cost of process controls to maintain quality levels and the costs related to failures both internal and external.

QUALITY COSTS

Quality costs are the costs associated with preventing, detecting, and remediating product issues related to quality. Quality costs do not involve simply upgrading the perceived value of a product to a higher standard. Instead, quality involves creating and delivering a product that meets the expectations of a customer. Thus, if a customer spends very little for an automobile, he will not expect leather seats and air conditioning - but he will expect the vehicle to run properly. In this case, quality is considered to be a vehicle that functions, rather than a luxury experience.

The Cost of Quality can be divided into four categories. They include Prevention, Appraisal, Internal Failure and External Failure. Within each of the four categories there are numerous possible sources of cost related to good or poor quality. Some examples of typical sources of Cost of Quality are listed below.

Cost of Quality

Cost of Good Quality

Cost of Poor Quality

Prevention	Appraisal Costs	Internal Failure	External Failure
• APQP • FMEA • FTA • Process Capability • Variation Reduction • Lessons Learned • Education / Training	• Incoming Inspection • In-process Inspection • Final Inspection • Calibration • Auditing • Registration Costs	• Process Delay • Rework • Scrap • Retest / Validation • 8D / RCA / CAPA • Downtime • Loss of Capacity	• Customer Returns • Warranty • Loss of Customer Sales • Sort & Repair at Customer • Lower Quality Scores
Problem / Cause Preventive Action	Problem / Cause Detection	Problem Solving / Corrective Action	Problem Solving / Corrective Action

The Cost of Good Quality (CoGQ)

1. **Prevention Costs** – costs incurred from activities intended to keep failures to a minimum. It is much better to prevent defects rather than finding and removing them from products. The costs incurred to avoid or minimize the number of defects at first place are known as **prevention costs**. Some examples of prevention costs are improvement of manufacturing processes, workers training, quality engineering, statistical process control etc. These can include, but are not limited to, the following:
   - Establishing Product Specifications
   - Quality Planning
   - New Product Development and Testing
   - Development of a Quality Management System (QMS)
   - Proper Employee Training

2. **Appraisal Costs** – **Appraisal costs** (also known as **inspection costs**) are those cost that are incurred to identify defective products before they are shipped to customers. All costs associated with the activities that are performed during manufacturing processes to ensure required quality standards are also included in this category. Identification of defective products involve the maintaining a team of inspectors. It may be very costly for some organizations. Costs incurred to maintain acceptable product quality levels.
   Appraisal costs can include, but are not limited to, the following:
   - Incoming Material Inspections
   - Process Controls
   - Check Fixtures
   - Quality Audits
   - Supplier Assessments

The Cost of Poor Quality (CoPQ)

- **Internal Failures** – costs associated with defects found before the product or service reaches the customer.
  Internal Failures may include, but are not limited to, the following examples:
  - Excessive Scrap

- Product Re-work
- Waste due to poorly designed processes
- Machine breakdown due to improper maintenance
- Costs associated with failure analysis

- **External Failures** – costs associated with defects found after the customer receives the product or service. If defective products have been shipped to customers, external failure costs arise. External failure costs include warranties, replacements, lost sales because of bad reputation, payment for damages arising from the use of defective products etc. The shipment of defective products can dissatisfy customers, damage goodwill and reduce sales and profits. External Failures may include, but are not limited to, the following examples:
  - Service and Repair Costs
  - Warranty Claims
  - Customer Complaints
  - Product or Material Returns
  - Incorrect Sales Orders
  - Incomplete BOMs
  - Shipping Damage due to Inadequate Packaging

These four categories can now be applied to the original Cost of Quality equation. Our original equation stated that the Cost of Quality is the sum of Cost of Good Quality and Cost of Poor Quality. This is still true however the basic equation can be expanded by applying the categories within both the Cost of Good Quality and the Cost of Poor Quality.

- The Cost of Good Quality is the sum of Prevention Cost and Appraisal Cost (CoGQ = PC + AC)
- The Cost of Poor Quality is the sum of Internal and External Failure Costs (CoPQ = IFC + EFC)

By combining the equations, Cost of Quality can be more accurately defined, as shown in the equation below:

$$COQ = (PC + AC) + (IFC + EFC)$$

One important factor to note is that the Cost of Quality equation is nonlinear. Investing in the Cost of Good Quality does not necessarily mean that the overall Cost of Quality will increase. In fact, when the resources are invested in the right areas, the Cost of Quality should decrease. When failures are prevented / detected prior to leaving the facility and reaching the customer, Cost of Poor Quality will be reduced.

MEASURING QUALITY COSTS
Quality costs may be classified as:
- **Observable**
  - Quality costs available from an organization accounting records
- **Hidden**
  - Opportunity costs resulting from poor quality
  - Usually in the external failure category

METHODS OF MEASURING QUALITY COSTS
1. MULTIPLIER METHOD
  □ Assumes that total failure cost is some multiple of measured failure costs
Formula:
Total failure costs= k (Measured external failure costs)

K = multiplier effect whose value depends on experience
2. MARKET RESEARCH METHOD
- ☐ Uses formal market research methods to assess the effect of poor quality on sales and market share
- ☐ Customer surveys and interviews with members of a firm's sales force would provide insights into the magnitude of the firm's hidden quality costs
- ☐ May use to project future profit losses attributable to poor quality

3. THE TAGUCHI QUALITY LOSS FUNCTION
- ☐ Assumes that any variation from the target value of a quality characteristic causes hidden quality costs
- ☐ The hidden quality costs increase quadratically as the actual value deviates from the target value as follows:

$$L(y) = k (y - T)^2$$

Where   y = actual value of quality characteristic

        T = Target value of quality characteristic

        L = Quality loss

     K = proportionality constant dependent on the organization's external failure cost structure that can be estimated as follows:

$$K = c/d^2$$

Where   c = Loss at the lower or upper specification limit

        d = distance of the limit from t (the target value)

        Total hidden quality costs= L (y) x Number of units produced

THE USE OF QUALITY COST INFORMATION
A **quality cost report** has several uses.
- ☐ Quality cost information can be used in a number of ways:21
- ☐ To identify profit opportunities (every dollar saved goes to the bottom line)
- ☐ To make capital budgeting and other investment decisions (quality, as opposed to payback, is the driver of decisions to purchase new equipment or dispose of unneeded equipment; equipment for rework is not needed if the rework is eliminated or reduced)
- ☐ To improve purchasing and supplier-related costs
- ☐ To identify waste in overhead caused by activities not required by the customer
- ☐ To identify redundant systems
- ☐ To determine whether quality costs are properly distributed
- ☐ To establish goals for budgets and profit planning
- ☐ To identify quality problems
- ☐ As a management tool for comparative measures of input–output relationships (e.g., the cost of a reliability effort vs. warranty costs)
- ☐ As a tool of Pareto analysis to distinguish between the "vital few" and the "trivial many"
- ☐ As a strategic management tool to allocate resources for strategy formulation and implementation
- ☐ As an objective performance appraisal measure

ACCOUNTING SYSTEMS AND QUALITY MANAGEMENT
Accounting information by itself provides little help for reducing costs and improving quality and productivity. The tendency is to allocate rather than manage costs. Moreover, the allocation is normally a function of direct labor, an item that has shrunk to 15% or less of manufacturing

costs. Overhead, at about 55%, is spread across all products using the same formula. Accounting also cannot identify or account for the many non-dollar hidden costs of quality and productivity. Critics claim that management accounting systems should be designed to support the operations and strategy of the company, two dimensions in which quality plays a dominant role. This is increasingly evident in the "new" manufacturing environment, sometimes known as advanced manufacturing technology, which is characterized by a number of emerging trends. Some of the decision-making needs and how traditional accounting practices may fall short in meeting them are listed here:

Decision needs	**Traditional accounting**
Activity management	Financial accounting
Investment management	Payback or ROI
Non-dollar measures	Dollar accounting
Process control	Cost allocation
Just-in-time	Inventory turns
Feed forward control	Historical control

ISO 9000: A UNIVERSAL STANDARD OF QUALITY

INTRODUCTION TO ISO 9000

Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as to ensure that rules, guidelines, materials, products, processes and services are fit for their purpose

Ex: In smart card, optical thickness - 0.76 mm. Paper size, symbols for automobile controls, ISO international codes for country names, currencies and languages ,OSI ....etc;

ISO stands for international organization for standardization.

ISO (International Organization for Standardization) is an independent, non-governmental membership organization established in 1947 in Geneva, Switzerland. It has a membership of 163 national standard organizations all across the world. It has 783 technical committees and subcommittees that gather and distribute information all across the world in order to maintain international standards that are:

- ✔ voluntary
- ✔ consensus-based
- ✔ market-relevant
- ✔ innovative
- ✔ Designed to solve global challenges.

The International Organization for Standardization (ISO) is an international standard-setting body composed of representatives from various national standards organizations.

KEY PRINCIPLES IN STANDARD DEVELOPMENT

1. Response to needs

ISO does not decide when to develop a new standard, but responds to a request from industry or other stakeholders such as consumer groups. Typically, an industry sector or group communicates the need for a standard to its national member who then contacts ISO.

2. Global expert opinion

ISO standards are developed by groups of experts from all over the world, that are part of larger groups called technical committees. These experts negotiate all aspects of the standard, including its scope, key definitions and content.

3. Multi-stakeholder process

The technical committees are made up of experts from the relevant industry, but also from consumer associations, academia, NGOs and government.

4. Consensus

Developing ISO standards is a consensus based approach and comments from all stakeholders are taken into account.

ISO 9000: A UNIVERSAL STANDARD OF QUALITY

ISO 9000 is defined as a set of international standards on quality management and quality assurance developed to help companies effectively document the quality system elements needed to maintain an efficient quality system. They are not specific to any one industry and can be applied to organizations of any size.

ISO 9000 can help a company satisfy its customers, meet regulatory requirements, and achieve continual improvement. It should be considered to be a first step or the base level of a quality system.

ISO-9000 set of standards are "generic management system standards". This means that the same standards can be applied:

✔ To any organization, large or small, whatever its product;
✔ Including whether its "product" is actually a service;
✔ In any sector of activity; and
✔ Whether it is a business enterprise a public administration, or a government department.

The "ISO-9000 quality management system" adopting organizations fulfill:

✔ The customer's quality requirements;
✔ Applicable regulatory requirements;
✔ Enhance customer satisfaction; and
✔ Achieve continual improvement of its performance.

FUNCTIONAL STANDARDS

ISO 9000 standards also require documentation and follow-up performance for all functions affecting quality. Functional requirements are illustrated by the following examples:

✔ **Design** — Sets a planned approach for meeting product or service specifications
✔ **Process control** — Provides concise instructions for manufacturing or service functions
✔ **Purchasing** — Details methods for approving suppliers and placing orders
✔ **Service** — Details instructions for carrying out after-sales service
✔ **Inspection and testing** — Compels workers and managers to verify all production steps
✔ **Training** — Specifies methods to identify training needs and keeping records

ISO 9000 OBJECTIVES

It defines quality system standards. To meet five objectives

1. Achieve, maintain and seek to continuously improve product quality [including services] in relationship to requirements
2. Improve the quality of operations
3. Provide confidence to internal management
4. Provide confidence to customers
5. Provide confidence that quality system requirements are fulfilled

NEED FOR ISO

☐ Main factors are "Quality and Standardization" around the world
☐ Worldwide progress in trade liberalization

- ✔ Interpenetration of sectors
- ✔ Worldwide communications systems
- ✔ Global standards needs for emerging technologies
- ✔ Developing countries

☐ The ISO 9000 family of standards is related to quality management systems and designed to help organizations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements.

☐ ISO 9000 deals with the fundamentals of quality management systems, including the eight management principles on which the family of standards is based.

☐ International standards promote international trade by providing one consistent set of requirements recognized around the world.

☐ ISO 9000 can help a company satisfy its customers, meet regulatory requirements and achieve continual improvement. It provides the base level of a quality system, not a complete guarantee of quality.

☐ Originally published in 1987 by the International Organization for Standardization (ISO), a specialized international agency for standardization composed of the national standards bodies of 90 countries.

ISO 9000 SERIES

ISO 9000	Explains fundamental quality concepts and provides guidelines for the selection and application of each standard
ISO 9001	Model for quality assurance in design, development, production, installation and servicing.
ISO 9002	Model for quality assurance in the production and installation of manufacturing systems.
ISO9003	Quality assurance in final inspection and testing.
ISO9004	Guidelines for the applications of standards in quality management and quality systems.

ISO 9000 and ISO 9004 are guidance standards. They describe what is necessary to accomplish the requirements outlined in standards 9001, 9002 or 9003.

STRUCTURE OF ISO 9000 STANDARDS

☐ The ISO 9000:2000 standards focus on developing, documenting and implementing procedures
- ✔ to ensure consistently of operations
- ✔ and performance in production and service delivery processes, with the aim of continual improvement and also supported by fundamental principles of total quality

☐ It is a series of standards that are "generic rather than specific".

- □ It can be applied to all type of organizations, large or small scale industry, public, private,
- □ ISO standards are developed through consensus, applied industry wide and it is voluntary.

The standard consists of 3 documents

1. ISO 9000 (Fundamentals & Vocabulary)
2. ISO 9001 (Quality Management Systems – set of 4 minimum Requirements)
   - Management Responsibility
   - Resource Management
   - Product Realization
   - Measurement analysis & improvement
3. ISO 9004: 2000 Quality Management Systems – Guidelines for performance improvements Relates to organizations who wish to improve beyond the scope of ISO 9001 Has an element of self evaluation and this standard does not stand for certification

ISO AROUND THE WORLD

The International Organization for Standardization (ISO) is the specialized international agency for standardization and at present comprises the national standards bodies of 91 countries. The American National Standards Institute (ANSI) is the member body representing the U.S. ISO is made up of approximately 180 technical committees. Each technical committee is responsible for one of many areas of specialization, ranging from asbestos to zinc. The purpose of ISO is to promote the development of standardization and related world activities in order to facilitate the international exchange of goods and services and to develop cooperation in intellectual, scientific, technological, and economic activities. The results of ISO technical work are published as international standards, and the ISO 9000 Series is a result of this process.

In 1987 (the same year the ISO 9000 Series was published), the U.S. adopted the ISO 9000 Series verbatim as the ANSI/ASQC Q-90 Series. Thus, the use of either of these series is equivalent to the use of the other.2 The ISO standards are being adopted by a varying number of companies in over 50 countries around the world that have endorsed them.

ISO 9000 QUALITY MANAGEMENT PRINCIPLES

The ISO 9000:2015 and ISO 9001:2015 standards are based on seven quality management principles that senior management can apply to promote organizational improvement.

ISO 9000 Quality Management Principles

❖ **Customer focus**
- ✔ Understand the needs of existing and future customers
- ✔ Align organizational objectives with customer needs and expectations
- ✔ Meet customer requirements
- ✔ Measure customer satisfaction
- ✔ Manage customer relationships
- ✔ Aim to exceed customer expectations

❖ **Leadership**
- ✔ Establish a vision and direction for the organization
- ✔ Set challenging goals
- ✔ Model organizational values
- ✔ Establish trust
- ✔ Equip and empower employees
- ✔ Recognize employee contributions

❖ **Engagement of people**
- ✔ Ensure that people's abilities are used and valued
- ✔ Make people accountable
- ✔ Enable participation in continual improvement
- ✔ Evaluate individual performance
- ✔ Enable learning and knowledge sharing
- ✔ Enable open discussion of problems and constraints

❖ **Process approach**
- ✔ Manage activities as processes
- ✔ Measure the capability of activities
- ✔ Identify linkages between activities
- ✔ Prioritize improvement opportunities
- ✔ Deploy resources effectively

❖ **Improvement**
- ✔ Improve organizational performance and capabilities
- ✔ Align improvement activities
- ✔ Empower people to make improvements

        ✔   Measure improvement consistently

        ✔   Celebrate improvements

❖ **Evidence-based decision making**

        ✔   Ensure the accessibility of accurate and reliable data

        ✔   Use appropriate methods to analyze data

        ✔   Make decisions based on analysis

        ✔   Balance data analysis with practical experience

❖ **Relationship management**

        ✔   Identify and select suppliers to manage costs, optimize resources, and create value

        ✔   Establish relationships considering both the short and long term

        ✔   Share expertise, resources, information, and plans with partners

        ✔   Collaborate on improvement and development activities

        ✔   Recognize supplier successes

ADVANTAGES OF ISO 9000 CERTIFICATION

The advantages associated with ISO 9000 certification are numerous, as both business analysts and business owners will attest. These benefits, which can impact nearly all corners of a company, range from increased stature to bottom-line operational savings. They include:

❖ **Increased marketability**—Nearly all observers agree that ISO 9000 registration provides businesses with markedly heightened credibility with current and prospective clients alike. Basically, it proves that the company is dedicated to providing quality to its customers, which is no small advantage whether the company is negotiating with a long-time customer or endeavoring to pry a potentially lucrative customer away from a competitor. This benefit manifests itself not only in increased customer retention, but also in increased customer acquisition and heightened ability to enter into new markets; indeed, ISO 9000 registration has been cited as being of particular value for small and mid-sized businesses hoping to establish a presence in international markets.

❖ **Reduced operational expenses**—Sometimes lost in the many discussions of ISO 9000's public relations cache is the fact that the rigorous registration process often exposes significant shortcomings in various operational areas. When these problems are brought to light, the company can take the appropriate steps to improve its processes. These improved efficiencies can help companies garner savings in both time and money. "The cost of scrap, rework, returns, and the employee time spent analyzing and troubleshooting various products are all considerably reduced by initiating the discipline of ISO 9000, "

❖ **Better management control**—The ISO 9000 registration process requires so much documentation and self-assessment that many businesses that undergo its rigors cite increased understanding of the company's overall direction and processes as a significant benefit.

❖ **Increased customer satisfaction**—Since the ISO 9000 certification process almost inevitably uncovers areas in which final product quality can be improved, such efforts often bring about higher levels of customer satisfaction. In addition, by seeking and securing ISO 9000 certification, companies can provide their clients with the opportunity to tout their suppliers' dedication to quality in their own business dealings.

❖ **Improved internal communication**—The ISO 9000 certification process's emphasis on self-analysis and operations management issues encourages various internal areas or

departments of companies to interact with one another in hopes of gaining a more complete understanding of the needs and desires of their internal customers.

❖ **Improved customer service**—The process of securing ISO 9000 registration often serves to refocus company priorities on pleasing their customers in all respects, including customer service areas. It also helps heighten awareness of quality issues among employees.

❖ **Reduction of product-liability risks**—Many business experts contend that companies that achieve ISO 9000 certification are less likely to be hit with product liability lawsuits, etc., because of the quality of their processes.

❖ **Attractiveness to investors**—Business consultants and small business owners alike agree that ISO-9000 certification can be a potent tool in securing funding from venture capital firms.

THE THIRD-PARTY AUDIT

Audit - Planned, independent, and documented examination and verification of activities, records, processes, and other elements of a quality system to determine their conformity with the requirements of a quality standard.

Different types of standards
- International standards – ISO 9000, ISO 22000
- Global Food Safety Initiative (GFSI) audit schemes
- Other GMP/GHP, HACCP standards

The third-party audit is a quality system audit performed by an auditor on the supplier in order to achieve certification for one of the ISO 9000 Standards. The third-party auditor must be independent of both the customer and the supplier.

Third-party audits cannot be performed by the customer or the supplier.

Third Party Auditing carried out by independent accredited organizations

Mainly for the purpose of granting or to confirm continuation of (for ongoing surveillance audit) ISO9001 certification.

DOCUMENTATION

There are three basic steps to the registration process:

1. Appraisal of the organization's quality manual
2. Evaluation of conformance to documented procedures
3. Presentation of findings, with recommendations for corrective action

The amount of documentation depends on the nature and complexity of the business. A hierarchical approach involving three levels is generally acceptable:

❖ **Level 1** — An overview type of quality manual consisting of policies that meet the requirements of the ISO standard for which certification is sought
❖ **Level 2** — Functional or departmental operating procedures in terms of "who does what"
❖ **Level 3** — Work instructions that explain how each task is to be accomplished

THE COSTS OF CERTIFICATION IMPLEMENTING ISO 9000

- Implementing ISO 9000 can be beneficial, but costly. The cost can be affected by:

  - ✔ Multiple Locations
  - ✔ Design
  - ✔ Non-existence of a Quality Program
  - ✔ Significant Corporate Changes

- Registering for ISO 9000 creates additional costs which vary based upon:

  - ✔ Design Responsibility
  - ✔ Number of Locations
  - ✔ Size of Facility in Terms of Employment

Cost and certification

- ☐ **Contracting a Registrar** - The registration audit is performed by a Registrar and the cost will depend on how big and how complex the organization is. They will charge depending on how many audit days they spend at the organization.
  - ✔ Auditor's fees
  - ✔ Auditor's Travel and living expenses
  - ✔ Application fee
  - ✔ Registration fee
  - ✔ Initial assessment (optional)
  - ✔ Certification audit (Year 1)
  - ✔ Surveillance audits (Year 2 and 3)
  - ✔ Reassessments (optional)
- ☐ **Internal Cost** - The time the employees will need to spend building and implementing the system.
  - ✔ Learn about ISO 9001
  - ✔ Graph Analysis
  - ✔ Plan the project
  - ✔ Train Employees
  - ✔ Document your Quality Management System (QMS)
  - ✔ Quality Manual
  - ✔ Procedures/Work Instructions/Flowcharts
  - ✔ Forms/Records
  - ✔ Implementation of the Quality Management System
  - ✔ Audit the QMS
  - ✔ Registration
- ☐ **Outside help** - This is either consultant fees or the purchasing of tools to help with the project.
- ☐ **1-25 Employees, no quality system in place yet** - Estimated costs of doing the implementation using ISO authority, All-in-One Documentation & Training Package, and by hiring a consultant

Implementing the system

Although the series provides guidance on the required attributes of the quality system, the standards do not spell out the means of implementation. Once a decision is made to adopt the standards and seek certification, the following major steps will facilitate successful change:

1. Recognize the need for change and get the commitment of top management.
2. Incorporate quality in the strategic plan as the linchpin of differentiation.
3. Formulate and adopt a holistic quality policy statement adapted to ISO requirements. Get support and commitment from all managers.
4. Determine the scope of the business to be certified. Will it be a particular process, related facilities, a geographical site, or the whole company?
5. Determine the status of the current quality system through an internal audit. Define the gap between where you are and what it will take to close the gap.
6. Estimate the cost in time and money, and implement the plan by organizing the necessary action steps.