14BEECE14_____ TOTAL QUALITY MANAGEMENT 3 0 0 3

COURSE OBJECTIVES:

- To understand the philosophy and core values of Total Quality Management (TQM).
- To determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
- To apply and evaluate best practices for the attainment of total quality.

COURSE OUTCOMES:

- To study the Total Quality Management concepts
- To understand the Total Quality Management principles and the various tools available to achieve Total Quality Management.
- To understand the statistical approach for quality control.
- To create an awareness about the ISO and QS certification process and its need for the industries.

UNIT- I INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT- II TQM PRINCIPLES

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT -III STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT- IV TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT- V QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

TEXT BOOKS:

1. Dale H.Besterfiled (2015), Total Quality Management, Pearson Education, India.

REFERENCE BOOKS:

1. James R.Evans and William M.Lidsay (2011), The Management and Control of Quality, South-Western (Thomson Learning)
2. Feigenbaum.A.V (2012), Total Quality Management, Tata McGraw-Hill Publishing Co. Ltd.
3. Zeiri S (2012), Total Quality Management for Engineers, New Age International publishers,Wood Head Publisher.

WEBSITES:

1. http://www.wiley.com/college/sc/reid/chap5.pdf
2. http://www.businessballs.com/.../total_quality_management_TQM.pdf

UNIT I INTRODUCTION

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management (TQM), Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

QUALITY

In manufacturing, a measure of excellence or a state of being free from defects, deficiencies and significant variations. It is brought about by strict and consistent commitment to certain standards that achieve uniformity of a product in order to satisfy specific customer or user requirements.

ISO 8402-1986 standard defines quality as "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs."

DEFINING QUALITY

Quality can be quantified as follows

Q = P / E

where, Q = Quality

P = Performance

E = Expectation

DIMENSIONS OF QUALITY

- **Performance:** Primary product characteristics, such as the brightness of the picture.
- **Features:** Secondary characteristics, added features, such as remote control.
- **Conformance:** Meeting specifications or industry standards, workmanship.
- **Reliability:** Consistency of performance over time, average time for the unit to fail.
- **Durability:** Useful life, includes repair.
- **Service**: Resolution of problems and complaint, ease of repair
- **Reputation:** Human-to-human interface, such as the courtesy of the dealer.
- **Aesthetics:** Sensory characteristics, such as exterior finish.
- **Response:** Past performance and other intangibles, such as being ranked first.

Therefore, quality products can be determined by using a few of the dimensions of quality.

QUALITY PLANNING

The following are the important steps for quality planning.

1. Establishing quality goals.
2. Identifying customers.
3. Discovering customer needs.
4. Developing product features.
5. Developing process features.
6. Establishing process controls and transferring to operations.

QUALITY COSTS

Quality costs are the costs associated with preventing, finding, and correcting defective work. These costs are huge, running at 20% - 40% of sales. Many of these costs can be significantly reduced or completely avoided. One of the key functions of a Quality Engineer is the reduction of the total cost of quality associated with a product.

Quality costs are defined as those costs associated with the non-achievement of product/service quality as defined by the requirements established by the organization and its contracts with customers and society.

Cost of Quality is the amount of money a business loses because its product or service was not done right in the right place (or) the cost associated in providing poor quality product and services is known as Cost of Quality (or) Cost of Quality are defined as those costs associated with the non-achievement of product or service quality as defined by requirements established by the organization and its contracts with customers and society.

Elements of Quality cost:-

1. **Prevention Costs:** Generally the most effective way to manage quality costs is to avoid having defects in the first place. It is much less costly to prevent a problem from ever happening than it is to find and correct the problem after it has occurred. **Prevention costs** support activities whose purpose is to reduce the number of defects. Companies employ many techniques to prevent defects for example statistical process control, quality engineering, training, and a variety of tools from total quality management (TQM).
    - Marketing / Customer / User.
    - Product / Service / Design Development.
    - Purchasing
    - Operations (Manufacturing or Service)
    - Quality Administration.

    Prevention costs include activities relating to quality circles and statistical process

2. **Appraisal Costs:** Any defective parts and products should be caught as early as possible in the production process. **Appraisal costs**, which are sometimes called *inspection costs*, are incurred to identify defective products before the products are shipped to customers. Unfortunately performing appraisal activates doesn't keep defects from happening again and most managers realize now that maintaining an army of inspectors is a costly and ineffective approach to quality control.
    - Purchasing Appraisal Costs.
    - Operations Appraisal Costs
    - External Appraisal Costs
    - Review of Test and Inspection Data
    - Miscellaneous Quality Evaluations
3. **Internal failure Costs:** Failure costs are incurred when a product fails to conform to its design specifications. Failure costs can be either internal or external. **Internal failure costs** result from identification of defects before they are shipped to customers. These costs include scrap, rejected products, reworking of defective units, and downtime caused by quality problem. The more effective a company's appraisal activities the greater the chance of catching defects internally and the greater the level of internal failure costs. This is the price that is paid to avoid incurring external failure costs, which can be devastating.
    - Product or Service Design Failure Costs (Internal)
    - Purchasing Failure Costs
    - Operations (Product or Service) Failure Costs
4. **External Failure Costs:** When a defective product is delivered to customer, external failure cost is the result. **External failure costs** include warranty, repairs and replacements, product recalls, liability arising from legal actions against a company, and lost sales arising from a reputation for poor quality. Such costs can decimate profits.
    - Complaint Investigations of Customer or User Service
    - Returned Goods
    - Retrofit and Recall Costs
    - Warranty Claims
    - Liability Costs
    - Penalties
    - Customer or User Goodwill
    - Lost Sales

ANALYSIS TECHNIQUES OF QUALITY COST

The purpose of quality cost analysis is to determine the cost of maintaining a certain level of quality. Such activity is necessary to provide feedback to management on the performance of quality assurance and to assist management in identifying opportunities.

Index Numbers

Index Numbers are often used in a variety of applications to measure prices, costs (or) other numerical quantities and to aid managers in understanding how conditions in one period compare with those in other periods.

QUARTER	COST IN RS.
1	200
2	220
3	210
4	190

A simple type of index is called a RELATIVE INDEX.

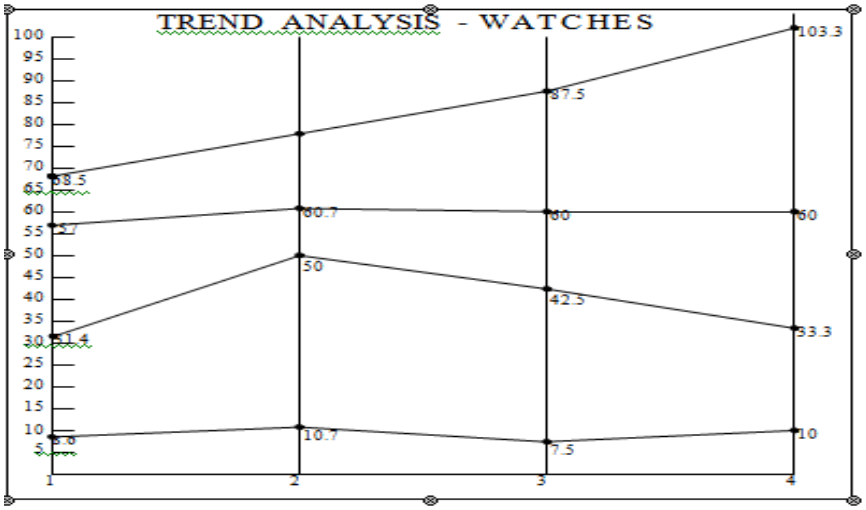
Cost Index in quarter t = (Cost in quarter t / Base period cost) x 100

QUARTER	COST RELATIVE INDEX
1	(2000/2000) x 100 = 100
2	(2200/2000) x 100 = 110
3	(2100/2000) x 100 = 105
4	(1900/2000) x 100 = 95

Trend Analysis

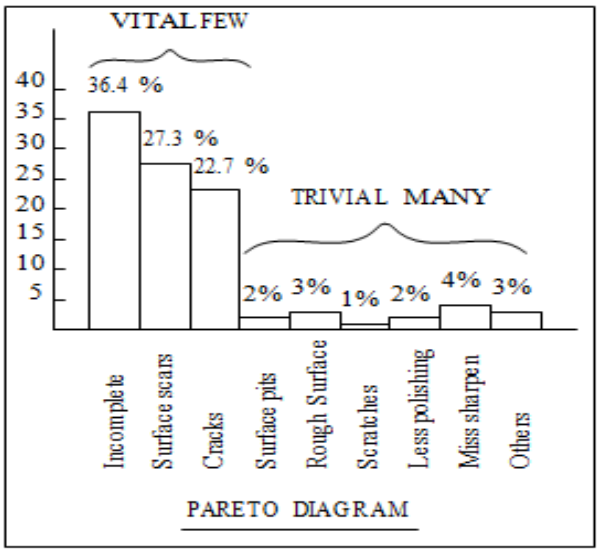
- Good visual aids are important communication tools.
- Graphs are particularly useful in presenting comparative results to management.

Trend Analysis is one where Time-to-Time comparisons can be made which illustrates



Pareto analysis

Joseph Juran observed that most of the quality problems are generally created by only a few causes. For example, 80% of all internal failures are due to one (or) two manufacturing problems. Identifying these "vital few" and ignoring the "trivial many" will make the corrective action give a high return for a low money input.



TOTAL QUALITY MANAGEMENT

The continuous process of reducing or eliminating errors in manufacturing, streamlining supply chain management, improving the customer experience and ensuring that employees are up-to-speed with their training. Total quality management aims to hold all parties involved in the production process as accountable for the overall quality of the final product or service.

Total quality management (TQM) was developed by William Deming, a management consultant whose work had great impact on Japanese manufacturing.

Total - M*ade up of the whole*

Quality- D*egree of excellence a product or service provides*

Management- Act, A*rt or manner of handling, controlling, directing, etc...*

Why TQM:

1. A question of survival in the intense competitive environment
2. Increasing customer consciousness

BASIC CONCEPTS OF TOTAL QUALITY MANGEMENT

While there are significant differences among the theorists and their approaches to implementation, they share basic concepts that are the foundation of TQM.

a. ***Continuous Improvement of Quality:*** Fundamental to all TQM systems is improving the quality of the products and services provided by an organization. Such quality improvement results in greater productivity and enhances the ability of an organization to remain vital, employ people, and serve customers. A focus on continuous quality improvement helps an organization do things right.

b. Customer Focus

The first, and overriding, feature of TQM is the company's focus on its customers. Quality is defined as meeting or exceeding customer expectations. The goal is to first identify and then meet customer needs. TQM recognizes that a perfectly produced product has little value if it is not what the customer wants. ***Open Work Environments:*** Continuous quality improvement requires an atmosphere for innovation where suggestions for improvement are solicited and respected and where supervisors and managers are open to disagreement, conflict, and challenge. Activities for the improvement of work processes, especially when teams are involved, help to break down barriers that occur between departments or between supervisors and those supervised.

c. ***Long- Term Thinking:*** TQM is also characterized by long- term thinking which helps mold the future by understanding the consequences of current actions. Such thinking requires decision making that is based on data, both hard and soft, and related to real problems, not symptoms. It requires time. It shies away from quick fixes arrived at by discussion and intuition. Long- term thinking works best in organizations where managers plan to stay, and thus have a stake in the consequences of their decisions.

d. ***Development of Human Resources:*** Organizations that follow TQM principles are organized to help people do their jobs; they are seriously committed to employee learning and development. Such development begins with a thorough orientation to the organization, including its mission, values, and information about where the job fits into the organization. It involves educating people to perform to the quality standards of a specific job before requiring them to work independently.

TQM expects managers to respect the ability of well trained employees to know the work they do better than anyone, and therefore, to be the best at improving it. Human resource development includes providing the training to learn the communication, quantitative, and team- participation skills required in an open, quality improvement work environment. Development programs provide extensive education to help individuals keep up- to- date on their jobs and to prepare themselves for new responsibilities.

e. ***Management Responsibility for TQM Leadership:*** Managers need to lead the transformation of the organization to the new culture of continuous quality improvement. They must accept personal responsibility for continuous quality improvement and be dedicated to empowering others in the organization to accept personal responsibility for it, too. This approach taps the collective genius of the organization to identify and solve problems. The leader's focus is on policy, structure, and systems to sustain continuous quality improvement. Within this context, quality is the first among equals of the organization's functions. Quality is at the top of the agenda for every meeting, every communication. The leader's goal is to help people, things, and machines do a better job; the leader's role is that of facilitator, catalyst, and coach.

- Performance measure is a must at organization, department and individual levels. It helps to asses and meets objectives of quality.
- There should be focus on team work.

HISTORICAL REVIEW

The origin of the TQM goes back to the time of the First World War. During the World War I, there have been a number of quality assurance initiatives taken place due to the large-scale manufacturing required for war efforts.

The military fronts could not afford poor quality products and suffered heavy losses due to the poor quality. Therefore, different stakeholders of the war initiated efforts to enhance the manufacturing quality.

First of all, quality inspectors were introduced to the assembly lines in order to inspect the quality. Products below certain quality standard were sent back for fixing.

Even after World War I ended, the practice of using quality inspectors continued in manufacturing plants. By this time, quality inspectors had more time in their hands to perform their job.

Therefore, they came up with different ideas of assuring the quality. These efforts led to the origin of Statistical Quality Control (SQC). Sampling was used in this method for quality control.

As a result, quality assurance and quality control cost reduced, as inspection of every production item was need in this approach. During the post World War II era, Japanese manufacturers produced poor quality products. As a result of this, Japanese government invited Dr. Deming to train Japanese engineers in quality assurance processes.

By 1950, quality control and quality assurance were core components of Japanese manufacturing processes and employees of all levels within the company adopted these quality processes.

By 1970s, the idea of total quality started surfacing. In this approach, all the employees (from CEO to the lowest level) were supposed to take responsibility of implementing quality processes for their respective work areas.

PRINCIPLES OF TQM

- Customer's requirements must be met the first time, every time.
- There must be agreed requirements, for both internal and external customers.
- Everybody must be involved, from all levels and across all functions.
- Regular communication with staff at levels is must. Two way communication at all levels must be promoted.
- Identifying training needs and relating them with individual capabilities and requirements is must.
- Top managements participation and commitment is must.
- A culture of continuous improvement must be established.
- Emphasis should be placed on purchasing and supplier management
- Every job must add value.
- Quality improvement must eliminate wastes and reduce total cost.
- There must be a focus on the prevention of problems.
- A culture of promoting creativity must be established.

LEADERSHIP

The process of influencing others towards the accomplishment of goals. He triggers tile will to do, shows the direction and guide the group members towards the accomplishment of goals.

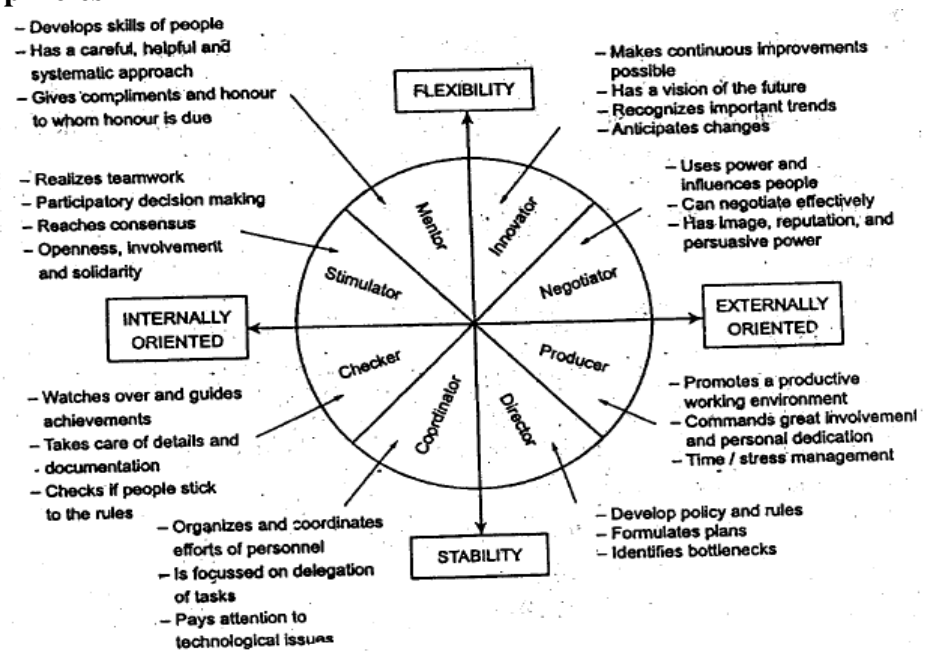
CHARACTERISTICS OF QUALITY LEADERS

1. Customers first
2. Value people
3. Build suppler partnership
4. Empower people
5. Strive for excellence
6. Demonstrate involvement / commitment
7. Explain & deploy policy
8. Improve communication
9. Promote teamwork
10. Benchmark continuously
11. Establish system
12. Encourage collaboration

BENEFITS OF TQM

Tangible Benefits	Intangible Benefits
Improved product quality	Improved employee participation
Improved productivity	Improved team work
Reduced quality costs	Improved working relationships
Increased market and customers	Improved customer satisfaction
Increased profitability	Improved communication
Reduced employee grievances	Enhancement of job interest
	Enhanced problem solving capacity
	Better company image

Leadership Roles



1. Producer role.
2. Director role.
3. Coordinator role roles.
4. Checker role.
5. Stimulator role.
6. Mentor role.
7. Innovator role.
8. Negotiator role

Leadership styles for effectiveness

- Directing style of leadership
- Consultative style of leadership
- Participative style of leadership
- Delegating style of leadership

Requirements of effective leadership

- Vision empowerment
- Intuition
- Self-understanding
- Value congruence

ROLE OF SENIOR MANAGEMENT

1. Study and investigate TQM concepts and issues
2. Set clear quality policies and provide challenging tasks
3. Establish customer satisfaction as a long term goal
4. To become coaches and cheer leaders for encouraging and supporting the managers during transition phase of the transformation
5. To stimulate employees to be involved
6. To attend TQM training programs
7. To up hold norms and issues
8. To create a basic of trust, respect and open communication which ensures individual participation and continuous improvement.
9. To monitor whether quality improvement programs are conducted as planned.

QUALITY COUNCIL

A quality council is established to provide overall direction. The council is composed of

- Chief Executive Officer
- Senior Managers
- Coordinator or Consultant
- A representative from the Union

Duties of the council

- Develop the core values, vision statement, mission statement and quality policy statement
- Develop the strategic long term plan with goals and Annual Quality
- Improvement Program with objectives
- Create the total education and training plan
- Determine and monitor the cost of poor quality
- Determine the performance measures
- Determine projects those improve the process
- Establish multifunctional project and work group teams
- Revise the recognition and rewards system

QUALITY STATEMENTS

VISION STATEMENT: It is a short declaration of what an organization aspires to be tomorrow. It is an ideal state which may never be achieved.

Example: "To continuously enrich knowledge base of practioners in mobility industry and institutions in the service of humanity" - **SAE**

MISSION STATEMENT: Describes the function of the organization. It provides the clear statement of purpose for the employees, customers and suppliers.

Example: " Facilitating world class technical education through high quality institutions, academic excellence and innovative research and development programmes, technology forecasting and global manpower planning, promoting industry institute interaction, inculcating entrepreneurship" - **AICTE**

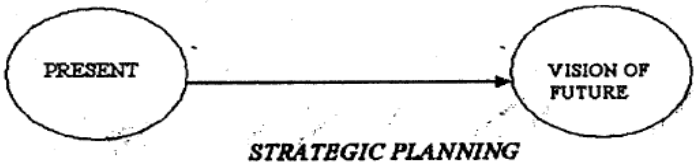
QUALITY POLICY STATEMENT: It is a guide for everyone in the organization as to how they provide products and services to the customer. Written by the CEO feedback from workforce and approved by quality council.

Example: "Xerox is a quality company. Quality is the basic business principle for Xerox. Quality means providing our external and internal customers with innovative products and service that fully satisfy their requirements. Quality is the job of every employee"

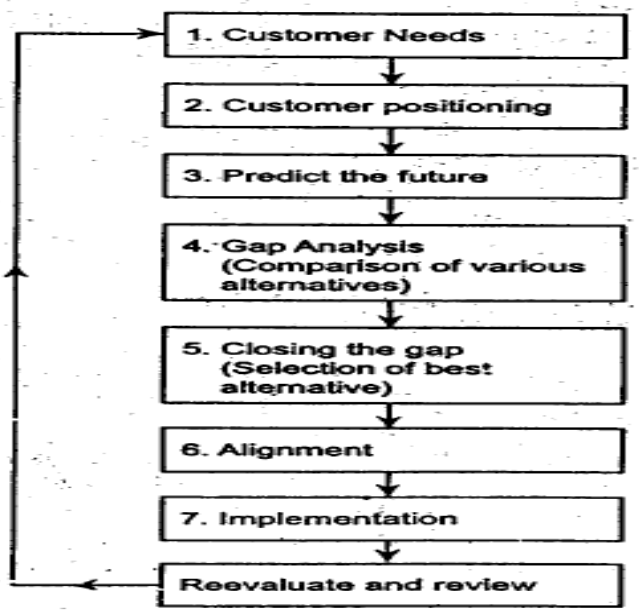
– Xerox Corporation

STRATEGIC PLANNING

It sets the long term direction of the organization in which it wants to proceed in future. Can be defined "As the process of deciding on objectives of the organization, on changes on this objective, on the resource used to obtain these objectives and on the policies that are to govern the acquisition use and disposition of these resources"



STRATEGIC PLANNING



Strategic planning cycle

DEMING PHILOSOPHY

1. Create and publish the Aims and Purposes of the organization.
2. Learn the New Philosophy.
3. Understand the purpose of Inspection.
4. Stop awarding business based on price alone.
5. Improve constantly and forever the System.
6. Institute Training.
7. Teach and Institute Leadership.
8. Drive out Fear, Create Trust and Create a climate for innovation.

9. Optimize the efforts of Teams, Groups and Staff areas.
10. Eliminate exhortations for the Work force.
11. Eliminate numerical quotas for the work force.
12. Eliminate Management by objectives.
13 Remove Barriers THAT ROB PEOPLE OF PRIDE OF WORKMANSHIP.
14. Encourage Education and Self-improvement for everyone. Take action to accomplish the transformation.

BARRIERS TO TQM IMPLEMENTATION

1. Lack of management commitment
2. Lack of faith in and support to TQM activities among management personnel
3. Failure to appreciate TQM as a cultural revolution. In other words, inability to change organizational culture
4. Misunderstanding about the concept of TQM
5. Improper planning
6. Lack of employees commitment
7. Lack of effective communication
8. Lack of continuous training and education
9. Lack of interest or incompetence of leaders
10. Ineffective measurement techniques and lack of access to data and results
11. Non-application of proper tools and techniques
12. Inadequate use of empowerment and team work

Part – B Questions

1. What is TQM? Explain why TQM philosophy is so important in today's scenario.
2. Explain the pillars of TQM.
3. Brief the history of evolution of TQM.
4. Describe the various contributions of Deming.
5. Briefly elaborate the various elements of TQM.
6. Discuss how the dimensions of quality influence product and service.
7. What are the duties of quality council? Explain.
8. Elucidate the seven steps to strategic planning.
9. Discuss the various responsibilities of senior manager.
10. Explain the leadership concept in detail.
11. Elaborate the elements of quality cost and its techniques.
12. What are the basic concepts and principles of TQM?

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UNIT II TQM PRINCIPLES

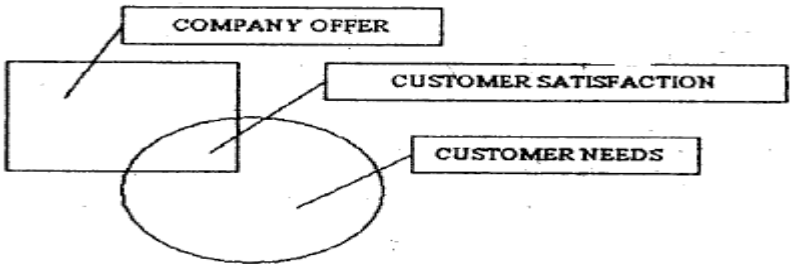
Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Triology, PDSA Cycle, 5S Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy and Performance Measures.

CUSTOMER SATISFACTION

The Customer is the King - Emphasized by Today's Buyers Market. TQM's Purpose is meeting or exceeding customer expectations, so that the customers are delighted. The customer satisfactions must be the primary goal of any organization.

Customer Satisfaction Model

Teboul's Model of customer satisfaction as shown in figure



From the above diagram it is understood that the company should strive for increasing the intersection portion i.e. Customer Satisfaction.

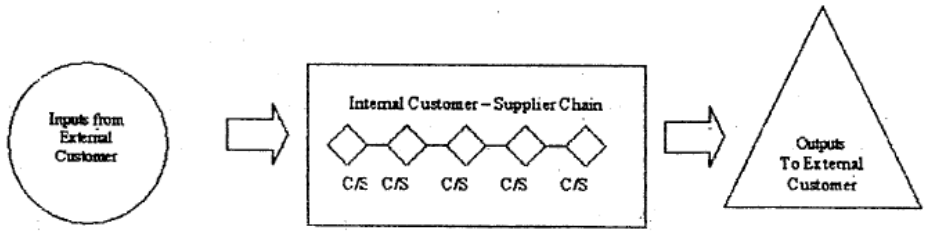
The Customers Are

- The most important people in the business
- Not dependent on the organization, but the organization depends on them. Not an interruption to work but are the purpose of it.
- Doing a favor when they seek business and not vice-versa.
- A part of business, not outsiders and they are life blood of the business
- People who come with their needs and jobs

Types of Customers

- **Internal Customer:** The customer inside the company are called internal customers
- **External Customers:** An external customer is the one who used the product or service or who purchase the products or service or who influences the sale of the product or service.

Customer Supply Chain



CUSTOMER COMPLAINTS (FEEDBACK)

Customer feedback must be continuously solicited and monitored to reduce the dissatisfied customers as much as possible.

Customer Feedback or Customer Complaint is Required

- To discover customer dissatisfaction
- To identify customer's needs
- To discover relative priorities of quality
- To compare performance with the competition
- To determine opportunities, for improvement

Tools used for Collecting Customer Complaints

a. **Comment card** - Low cost method, usually attached to warranty card

b. **Questionnaire** - Popular tool, costly and time consuming - by mail or telephone preferably multiple choice questions or a point rating system (1 to 5) or (1 to 10)

c. **Customer Focus groups** - Meeting by a representative of the company with the group of customers. Imprint analysis is an emerging technique to obtain intrinsic feelings using customer meetings, word associations, discussion, relaxation techniques etc.

d. **Phone -** Toll free Telephone numbers

e. **Customer visits** - Visit customer's place of business.

f. **Report cards** - Usually, send to customer on a quarterly basis.

g. **The internet and computer** - It includes newsgroups, electronic bulletin board mailing lists, Employee feedback.

h. **Mass Customization** - Capturing the voice of customers using data of what customer want instead of what customer is thinking about buying and manufacturing exact what they want.

Steps to solve customer complaints

- Complaints can be collected from all sources (letters, phone -calls, meetings and verb inputs)
- Develop procedures for complaint resolution, that include empowering front-line personnel.
- Analyze complaints, but understand that complaints do not always fit into new categories
- Work to identify process and material variations and then eliminate the root cause.
- When a survey response is received, a senior manager should contact the customer and strive to resolve the concern.
- Establish customer satisfaction measures and constantly monitor them. Communicate complaint information, as well as the result of all investigation solution, to all people in the organization. .
- Provide a monthly complaint report to the quality council for their evaluation and needed, the assignment of process improvement teams.
- Identify customer's expectations beforehand rather than afterward through complaint analysis.

CUSTOMER RETENTION

More powerful and effective than customer satisfaction. It is the process of retaining the existing customer. Customer care can be defined as every activity which occurs within the organization that ensures that the customer is not only satisfied but also retained.

Significance of Customer Retention

- 60% of organizations future revenue will come from existing customers
- 2% increase in customer retention has 10% decrease in operating cost.

- 96% of unhappy customers do not complain but 3 times likely to convey to other customers about their bad experience.
- 91% of unhappy customers never purchase goods and services from you.
- It costs 5 times more to attract the customer than retaining the existing customer. Customer retention creates customer loyalty and moves customer satisfaction to a next level called customer delight.

EMPLOYEE INVOLVEMENT

It is the total involvement from every person at all levels in the organization

Aspects of Employee Involvement

1. Employee motivation
2. Employee Empowerment
3. Teams and Team work
4. Recognition and Reward Schemes
5. Performance Appraisal

1. Employee Motivation

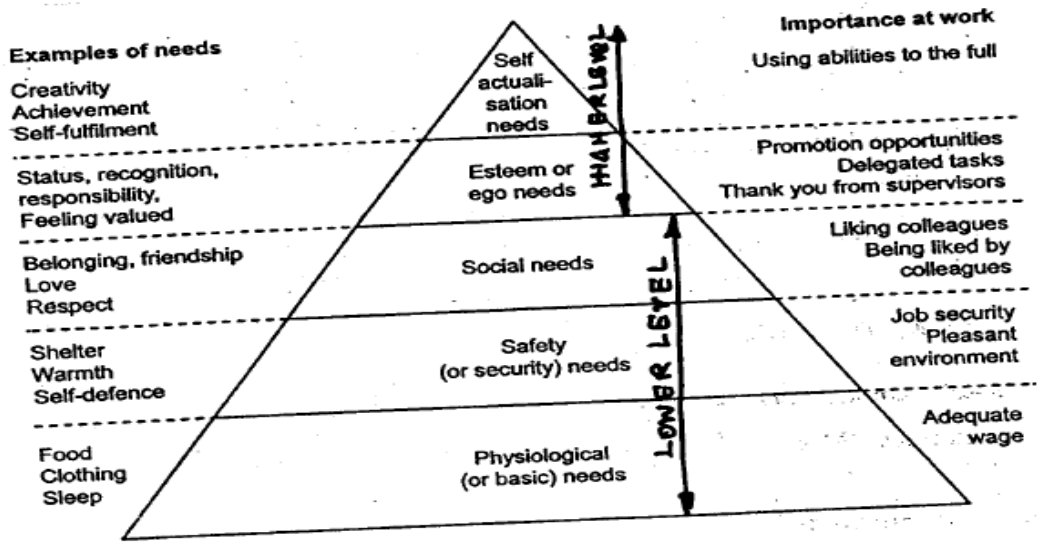
It is the process of stimulating people or attempting to influence other to do your will or accomplish desire goals through the possibility of reward

- Improves employee involvement
- Reduces absenteeism and increases turn over
- Promotes job satisfaction

Theories of Motivation

1.MASLOW'S HIERARCHY NEED THEORY

One of the most widely mentioned theories of motivation is the hierarchy of needs theory put forth by psychologist Abraham Maslow. Maslow saw human needs in the form of a hierarchy, ascending from the lowest to the highest, and he concluded that when one set of needs is satisfied, this kind of need ceases to be a motivator. As per his theory these needs are:



Maslow's hierarchy of needs

(i) Physiological needs:

These are important needs for sustaining the human life. Food, water, warmth, shelter, sleep, medicine and education are the basic physiological needs which fall in the primary list of need satisfaction. Maslow was of an opinion that until these needs were satisfied to a degree to maintain life, no other motivating factors can work.

(ii) Security or Safety needs:

These are the needs to be free of physical danger and of the fear of losing a job, property, food or shelter. It also includes protection against any emotional harm.

(iii) Social needs:

Since people are social beings, they need to belong and be accepted by others. People try to satisfy their need for affection, acceptance and friendship.

(iv) Esteem needs:

According to Maslow, once people begin to satisfy their need to belong, they tend to want to be held in esteem both by themselves and by others. This kind of need produces such satisfaction as power, prestige status and self-confidence. It includes both internal esteem factors like self respect, autonomy and achievements and external esteem factors such as states, recognition and attention.

(v) Need for self-actualization:

Maslow regards this as the highest need in his hierarchy. It is the drive to become what one is capable of becoming; it includes growth, achieving one's potential and self-fulfillment. It is to maximize one's potential and to accomplish something.

All of the needs are structured into a hierarchy and only once a lower level of need has been fully met, would a worker be motivated by the opportunity of having the next need up in the hierarchy satisfied.

c) FREDERICK HERZBERG'S MOTIVATION-HYGIENE THEORY:

Frederick has tried to modify Maslow's need Hierarchy theory. His theory is also known as two-factor theory or Hygiene theory. He stated that there are certain satisfiers and dissatisfiers for employees at work. Intrinsic factors are related to job satisfaction, while extrinsic factors are associated with dissatisfaction.

1. **Motivation Factor:** People are motivated by recognition, responsibility, achievement, advancement and the work itself. These are called as motivators
2. **Dissatisfies or Hygiene Factor**: Low salary, minimal fringe benefits, poor working conditions, ill defined organizational policy, mediocre technical supervision are dissatisfies which implies they are preventable.

Employee Wants

1. Good pay factor is normally in the middle of ranking.
2. Normal Wants are interesting work, appreciation, involvement job security, Good pay, Promotion/growth, Good working conditions, Loyalty to employees, Help with personal problems arid Tactful Discipline.

EMPLOYEE EMPOWERMENT

It is an environment in which people have the ability, the confidence and the commitment to take his responsibility and ownership to improve the process and initiate the necessary steps to satisfy customer requirements within well-defined boundaries in order to achieve organizational values and goals.

- Job Enrichment: Is expanding content of the Job.
- Job Empowerment: Is expanding the context of the job.

General Principles Or Characteristics for' Empowering Employees

1. Tell people what their responsibilities are.
2. Given the authority equal to the responsibility assigned to them.
3. Set standards of excellence.
4. Give them knowledge information and feed back.
5. Trust them and treat them with dignity and respect.

Conditions to Create the Empowered Environment

1. Every one should under stand the need to change
2. The system need to change to new paradigm.
3. The organization must provide information, education, and skill to its employees.

TEAMS AND TEAM WORKS

A team can be defined as a group of people working together to achieve common objectives or goals. Team work is the cumulative actions of the team during which each member of the team subordinates his individual interest and opinions for the fulfilling of objectives of the group.

Benefits of Team Work

Improved solutions to quality problems, ownership of solutions, communication and integration

Objectives – Short Term Planning

Goal – Long Term Planning

Types of Teams

a. **Process improvement team:** Involved in improvement of sub processes or processes. Usually has 6-10 members. Disbanded when the objective is reached. May include the local supplied and customer depending on the location
b. **Cross functional teams:** 6-10 members temporary team. Members are Top management level from various functional areas of management. Discuss complex problems and break down into smaller parts to refer it to various departmental teams for further solution.

c. **Natural work teams:** Not voluntary and the total work unit is part of the team. Manager also a part of the team and the management selects the projects to be improved. Managers must also ensure that the entire team is comfortable with each other.

d. **Self directed / self managed work team:** Extension of natural work teams but here the group of individuals is empowered not only to do work but manage it. No manger will present but a coordinator (Which will be normally rotated among members) will be appointed. Additional responsibilities of the team hiring/ dismissal, performance evaluation, customer relations, supplier relations, recognition/rewards and training.

Characteristics of Successful Teams

1. **Sponsor:** In order to have effective liaison with quality council, there should be sponsor.The sponsor is a person from the quality council, he is to provide support to the organization
2. **Team Charter:** A team charter is a document that defines the team's mission boundaries, the background of the problem, the team's authority and duties and resources. It also identifies the members and their assigned roles – leader, recorder, time keeper and facilitator.
3. **Team Composition:** Not exceeding 10 members except natural work team and self managed teams.
4. **Training:** The team members should be trained in the problem solving techniques team dynamics and communication skills
5. **Ground Rules:** The team should have separate rules of operation and conduct. Ground rules should be discussed with the members, whenever needed it should be reviewed and Revised.
6. **Clear objectives, Accountability :** Periodic status report should be submitted to quality council for review
7. **Well defined decision procedure, Resources:** Adequate information should be provided.

8. **Trust by the management, Effective problems solving**: Not by hunches or quick fires

9. **Open communication, Appropriate Leadership, Balanced participation and Cohesivenes**

Stages of Team Development

- **Forming stage-** Initial stage with only group of individuals and no team work. Team purpose, roles are created.
- **Storming Stage -**Initial agreement roles are challenged. Hostilities, emerge which may be resolved
- **Norming Stage-**Formal informal relations get established.
- **Performing Stage** -Team operates in a successful manner with trust, openness, healthy conflict and decisiveness among the members.
- **Maintenance stage –** Functioning should not deteriorate with time Q
- **Evaluating Stage** – Evaluating team performance

Barriers to Team Progress

- Insufficient training,
- Incompatible rewards and compensation,
- First-line supervisor resistance,
- Lack of planning;
- Lack of management support,
- Access to information systems,
- Lack of union support,
- Project scope too large,
- Project objectives are not significant,
- No clear measures of success and

RECOGNITION AND REWARD

Recognition is a process whereby management shows acknowledgement (Verbal or written) of an employee outstanding performance. Recognition is a form of employee +ve motivation.

Reward is a tangible one such as increased salaries, commission, cash bonus, gain sharing etc., to promote desirable behavior. It can be even theatre tickets, dinner for two, a small cash awards, etc.,

The employees are recognized to improve their morale, show the company's appreciation for Better Performance, create satisfied and motivated workplace and stimulate creative efforts.

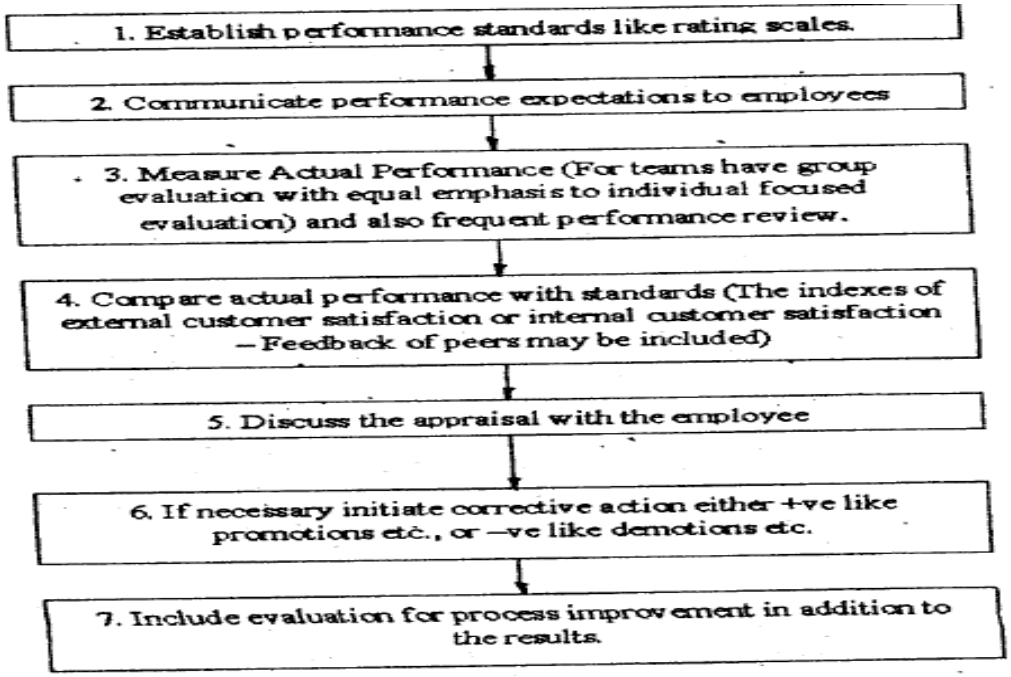
PERFORMANCE APPRAISAL

It is a systematic and objective assessment or evaluation of performance and contribution of individual

Needs

- Identifying employees for salary revision, promotion, transfer, demotion, lay off
- To determine training needs of employee
- To take organizational inventory of people
- To know personal strength and weakness of individuals
- To validate the selection procedure

Appraisal Process



Benefits of Performance Appraisal

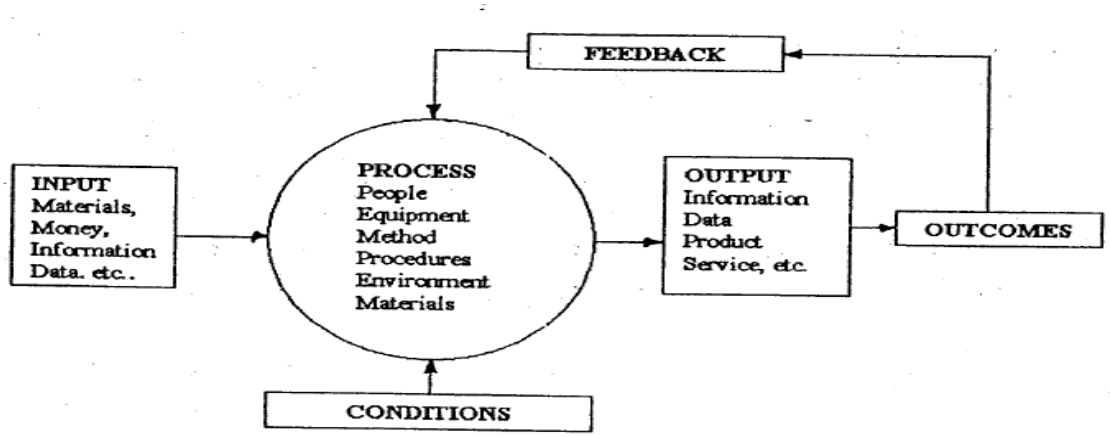
1. Provides a feedback to identify employees for salary revision, transfer, lay-off
2. Helps in determining training needs of employee
3. Provides organization inventory of people
4. Helps to evaluate personal strength and weakness of individuals
5. To validate the selection procedure.
6. Provide the basis for promotion, demotion etc
7. May provide some information on external factors like family circumstances, health, financial or personal matters that may be affecting the performance

CONTINUOUS PROCESS IMPROVEMENT (CPI)

TQM has been defined as a philosophy based on quest for progress and continual improvement in the areas of cost, reliability, quality, innovation, efficiency and business effectiveness. It is a continuous learning process which never stops and is cyclic and iterative

Input / Output Process Model

The process refers to business and production activities of an organization. Example Purchasing, Engineering, Marketing and Accounting



Basic Ways to Improve Process

- To reduce resources
- To reduce errors
- To meet exceed customer needs
- To make process safer
- To make process more satisfying to the person doing it.

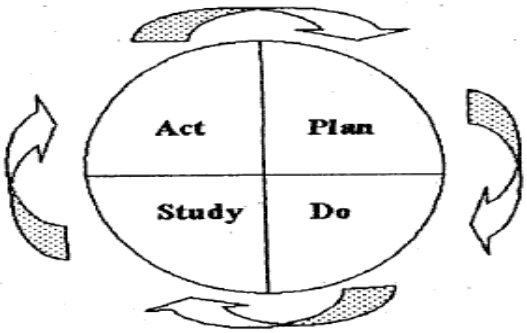
JURAN TRILOGY

Dr. Joseph M. Juran, who .wrote a 1900 page text. book on QUALITY CONTROL HANDBOOK and other contributions to the total quality. Juran divides· Quality Management into

- Quality Planning
- Quality control
- Quality improvement. .

PDSA CYCLE

It is also called as Deming Cycle or Deming Wheel. Developed by Walter A. Shewart and popularized by Edward Deming



Benefits of PDSA Cycle

1.Daily routine management for the individual and or the team

2. Problem solving process

3. Project management

4. Continuous development

5. Vendor development

6. Human resource management

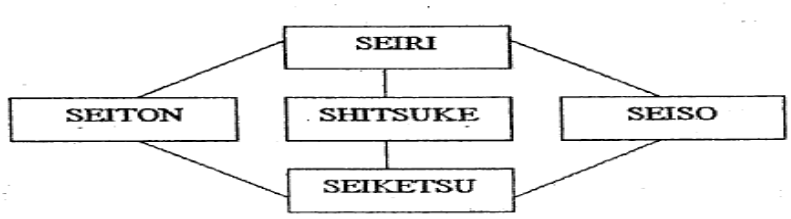
7. New product development Process trials

5s HOUSE KEEPING

This is a house keeping technique used to establish and maintain a productive and quality environment in an organization. This method is invented in Japan which will give safer, more efficient and more productive operation results in boosting of morale of workers, job involvement and satisfaction and ownership of their responsibilities.

Japanese term	English equivalent	Meaning
SEIRI	Tidiness	**Cleaning** – Throw away all rubbish unrelated materials in the work place
SEITON	Orderliness	**Arranging** – Set everything in proper place for quick retrieval and storage
SEISO	Cleanliness	**Sweeping** – Clean the work place, everything without fail
SEIKETSU	Standardization	**Maintaining Cleanliness** – Standardizing the way of maintaining cleanliness
SHISUKE	Discipline	**Self Discipline** – Practice ‘5S’ daily. Make it a way or life. This also means commitment

Relationship Between Various 5s



Objectives of 5s

- To create a neat and clean work place
- To create systemize day to day working
- To improve work efficiency
- To standardize work practice
- To improve work discipline
- To improve the quality of work and products

Factors in Implementing 5S

- **Participation by all** - Should be understood and practiced by all employees
- **Top management commitment** – CEO and Senior management team need personally commitment practice and supervise the program
- **Should be self sustaining** – Banners, slogan posters and new tutors should be fully utilized to draw attention of every one
- **Review the program** – Every month group of people from different areas of responsibilities plan and evaluate each zone

Benefits in Implementing 5S

- Work place becomes proud place to work
- Results in good image and- generates business
- Operations become easier and safer in work place
- Improve productivity' and morality
- Better quality awareness
- More usable space
- Less Material handling time
- Less production cost Preventive maintenance
- High employee involvement

KAIZEN

Japanese - word -means continuous improvement or improvement over improvement - continuous improvement in small increments that make the process more efficient, effective, controllable and adequate.

Features of Kaizen

1. Value added and non value added work activities
2. Muda, which refers to the seven classes of wastes. Wastes are over production, delay, transportation, processing, inventory, wasted motion, and defective parts
3. Principles of motion study and the use of cell technology
4. Principles of materials handling and use of one piece flow
5. Documentation of standard operating procedures
6. The 5S for workplace organization, which are five Japanese words that mean proper arrangement (SEIRI), Orderliness (SEITON), Personal cleanliness (SEISO), Standardization (SEIKETSU) and Discipline (SHITSUKE)
7. Visual management by means of visual display that everyone in the plant can use for better communication
8. Just in time principle to produce only the units in the right quantities at the right time and with the right resources
9. Poka-Yoke to prevent or detect errors
10. Team dynamics, which include problem solving, communication skills and conflit resolution

Role of People in Implementing Kaizen

1. Top management must be committed to introducing Kaizen as a company strategy
2. The executives just below top management must formulate and carry out Kaizen goals according to guidelines from top management
3. Supervisors like everyone else must use Kaizen in their activities
4. Workers must be involved in Kaizen through the suggestions systems and small group activities

SUPPLIER PARTNERSHIP

A commitment to continuous quality improvement cannot be translated into reality without treating supplier as partner

Principles of Customer / Supplier Relation

- Both the customer and the supplier are fully responsible for the control quality Both the customer and the supplier should be independent of each other and respect each other's independence
- The customer is responsible for providing the supplier with clear and sufficient requirements so that the supplier can know precisely what to produce
- Both the customer and the supplier should enter into an non adversarial contract with respect to quality, quality, price, delivery method and terms of payments
- The supplier is responsible for providing the quality that will satisfy the customer and submitting necessary data upon the customer's request
- Both the customer and the supplier should decide the methods to evaluate the quality of the product or service to the satisfaction of both parties
- Both the customer and the supplier should establish in the contract the method by which they can reach an amicable settlement of any disputes that may arise
- Both the customer and the supplier should continually exchange information, sometimes using multifunctional teams, in order to improve the product or service quality
- Both the customer and the supplier should perform business activities such as procurement, production and inventory planning, clerical work and system so that an amicable and satisfactory relationship is maintained
- When dealing with business transactions both the customer and the supplier should always have the best interest of the end user in mind

SUPPLIER PARTNERING

It is defined as a continuing relationship, between a buying firm and supplying firm, involving a commitment over an extended time period, an exchange of information, and acknowledgement of the risks end rewards of the relationship.

Benefits of Supplier Partnering

- Improved Quality
- Reduced cost
- Increased Productivity
- Increased efficiency
- Increased market share
- Increased opportunity for innovation
- Continuous improvement of products/services. .

Japanese Review of Partnering

The Japanese partnering concept is KELRESTU – developing long term relationships with a few key suppliers rather than having short term relationship with many suppliers.

Key elements to Partnering

- Long term Commitment
- Trust
- Shared vision - To satisfy the end users is the common goal of both supplier and customer.

SUPPLIER SOURCING

- **Sole sourcing -** only one supplier for the entire organization. This may be forced. to happen because of patent, technical specification, raw material location, monopolistic supplier.
- **Multiple sourcing -** For a single item having two or more supplier, resulting in better quality, better service at lower cost.

- **Single sourcing-** use of one supplier to one item when several sources are available leading to long-term partnering relationship.

Basis of Supplier Selection

Cost, Quality, Delivery, Reliability, Management compatibility, Goal congruence and Strategic direction of supplier firm.

Stage in Supplier Selection & Evaluation

- Survey stage, enquiry stage, negotiation and selection stage, experience stage.
- The supplier should understand and appreciate the management philosophy of the organization
- The supplier should have a stable management system
- The supplier should maintain high technical standards and have the capability of dealing with future technological innovation
- The supplier should provide those raw materials and parts required by the purchaser and those supplied meet the quality specifications
- The supplier should have the capability to produce the amount of production needed
- The supplier should not breach the corporate secrets
- The supplier should be easily accessible in terms of transportation and communication
- The supplier should be sincere in implementing the contract provisions
- The supplier should have an effective quality system and improvement program such as ISO / QS 9000
- The supplier should have a track record of customer satisfaction and organization credibility

SUPPLIER RATING

Also referred as score card system, is used to obtain and overall rating of supplier performance based on quality, price, performance and production capability

Objectives of Supplier Rating

Obtain an overall rating of supplier performance – ensure completer communication with suppliers - provide each supplier about the details of problems for corrective action and - maintain and improve the partnering relationship between the customer and the supplier.

Three Basic Factors for Successful Supplier Rating System

- An internal structure to implement and sustain the rating program
- A regular and formal review process
- A standard measurement for all the suppliers

RELATIONSHIP DEVELOPMENT

Refers to maintaining the relationship development through the various techniques discussed previously. For maintainability and growth of relationship the following key factors are considered

- Inspection – 100% inspection, Sampling, Audit and identify check
- Training
- Team approach – Formation of customer supplier team in all the functional areas Recognition – Customers can recognize suppliers by non monetary / monetary rewards

PERFORMANCE MEASURES

An important principle along with customer satisfaction, employee involvement, continuous process improvement and supplier partnership, refers to measuring the performance of entire organization

Basic Ways to Improve Process

- To reduce resources
- To reduce errors
- To meet exceed customer needs
- To make process safer
- To make process more satisfying to the person doing it.

PART-B

1. Explain the 5s house keeping in detail.
2. Explain the various stages in supplier selection in evaluation
3. What are the types of supplier sourcing? Explain
4. Explain the tools used for collecting customer complaints.
5. Describe the steps of performance appraisal system.
6. Explain the phases of PDCA cycle with suitable illustration.
7. What is motivation? Explain Maslow's hierarchy of need and Herzberg two factor theory
8. How do recognition and reward affect employee involvement? Explain different ways to recognize people.
9. Explain Juran's steps to quality improvement.
10. Briefly discuss on customer satisfaction.
11. Explain various aspects of kaizen.
12. Explain with neat sketch the continuous improvement cycle.
13. Explain the basic steps used for the measuring performance.

*** CIA – 3 X 16 (EITHER OR TYPE)**

**** ESE – 5 X 16 (EITHER OR TYPE)**

UNIT III

STATISTICAL PROCESS CONTROL

The seven QC tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

SEVEN TOOLS OF QUALITY (Q - 7 TOOLS)

Prof. Ishikawa proposed seven elemental tools based on statistical techniques. The seven basic tools are used to facilitate successful accomplishment of quality improvement objectives.

Seven tools of quality are:

1. check sheets,
2. Histograms,
3. cause and effect diagrams,
4. pare to diagrams,
5. stratification analysis,
6. scatter diagrams, and
7. Control charts.

Check sheet:

A check sheet also known as tally sheet is a form for systematic data gathering to get a clear view of the facts.

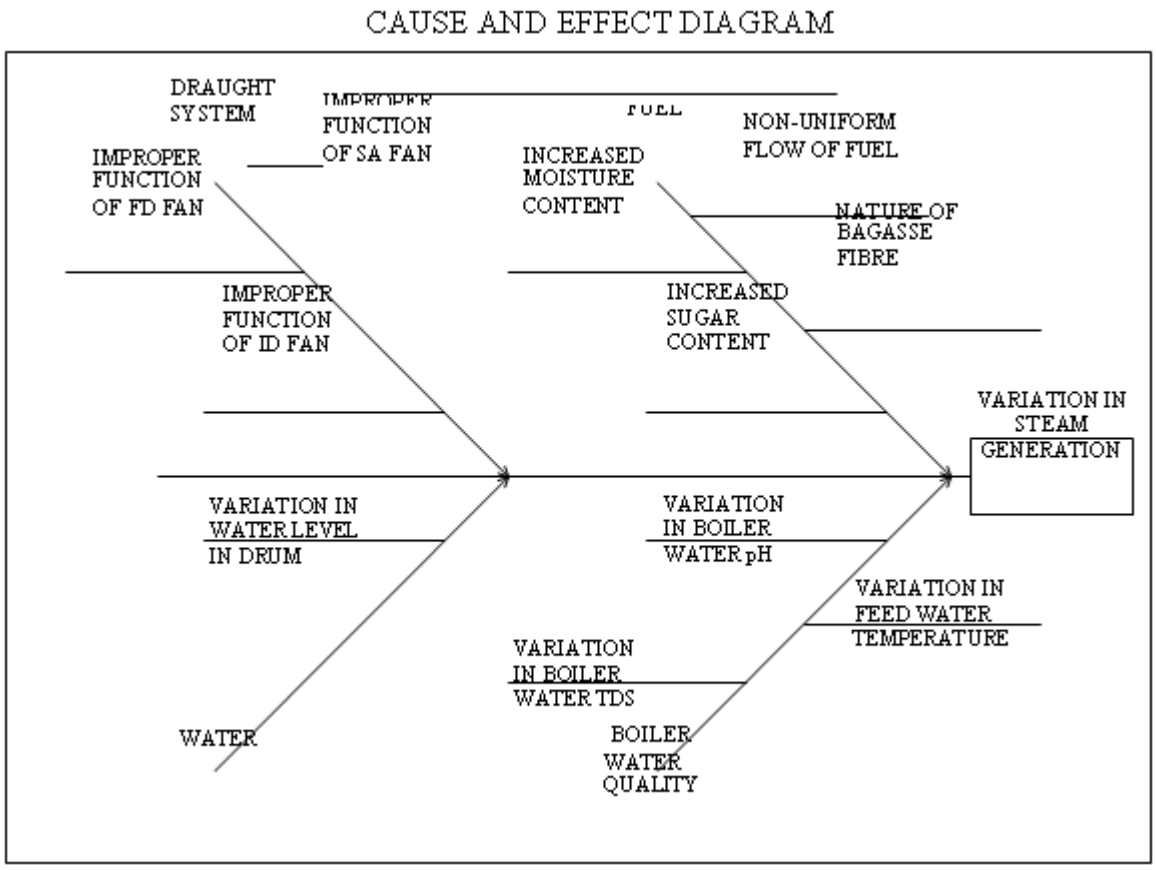
Patient Transport Problem Sheet		
Type	**Tally**	**Subtotal**
Equipment broken	IIIII	5
Patient not ready	IIIII II	7
Not enough staff	III	3
Patient having another exam etc.	IIIII IIIII II	12

Histograms:

A histogram is a bar chart showing a distribution of variable quantities or characteristics.

Cause and effect diagram:

The cause and effect diagram is a graphical tabular chart to list and analyze the potential causes of a given problem. The cause and effect diagram is also called the fishbone diagram because of its appearance and the Ishikawa diagram after the man who developed it in 1943



Pareto diagram:

A pareto diagram is a diagnostic tool commonly used for separating the vital few causes that account for a dominant share of quality loss.

Stratification analysis: Stratification is a method of analysis of data by grouping it in different ways. Literally stratification means segregating a group of measurements, observations or any other data in to several subgroups on the basis of certain characteristics.

Scatter diagram:

The scatter diagram is a simple graphical device to depict the relationship between two variables. A scatter diagram is composed of a horizontal axis containing the measure values of one variable and a vertical axis, representing the measurements of the variable.

MEASURE OF CENTRAL TENDENCY

Measure of Central Tendency

The most commonly used measures are as follows.

1. **Mean, or Average** : The mean, or average**,** of *n* numbers is the sum of the numbers divided by *n*.'' commonly referred to as the average or arithmetic mean. most widely used measure of central location.

$$X = \frac{\text{Sum of all values in the data set}}{\text{Total number of observations}}$$

Advantages of the MEAN:

- Takes into account all observations.
- Can be used for further statistical calculations and mathematical manipulations.

Disadvantages of the MEAN:

- Easily affected by extreme values.
- Cannot be computed if there are missing values due to omission or non-response.
- In grouped data with open-ended class intervals, the mean cannot be computed

2. **Median** : The median of *n* numbers is the middle number when the numbers are writ- ten in order. If *n* is even, the median is the average of the two middle numbers. The value of the middle item in a set of observations which has been arranged in an ascending or descending order of magnitude. It is the centermost value in a distribution.

Advantages of the MEDIAN:

- Not affected by extreme values.
- Can be computed even for grouped data with open-ended class intervals.

Disadvantages of the MEDIAN:
Observations from different data sets have to be merged to obtain a new median, whether group or ungrouped data are involved.

3. Mode : The mode of *n* numbers is the number that occurs most frequently. If two numbers tie for most frequent occurrence, the collection has two modes and is called **bimodal.**

Advantage of the MODE:

- Can be easily identified through ocular inspection.

Disadvantages of the MODE:

- Does not possess the desired algebraic property of the mean that allows further manipulations.
- Like the median, observations from different data sets have to be merged to obtain a new mode, whether group or ungrouped data are involved.

POPULATION AND SAMPLE

POPULATION

The "population" in statistics includes all members of a defined group that we are studying or collecting information on for data driven decisions. A part of the population is called a sample.

SAMPLE

A sample is "a smaller (but hopefully representative) collection of units from a population used to determine truths about that population

Sampling Methods

- Probability (Random) Samples
- Simple random sample
    - Systematic random sample
    - Stratified random sample
    - Multistage sample

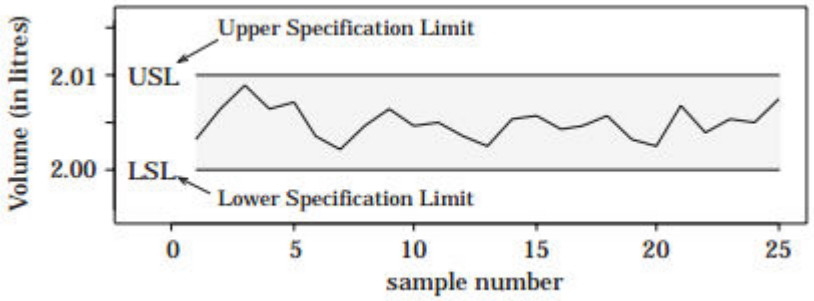
- Multiphase sample
- Cluster sample

➢ Non-Probability Samples

- Convenience sample
- Purposive sample
- Quota

CONTROL CHART

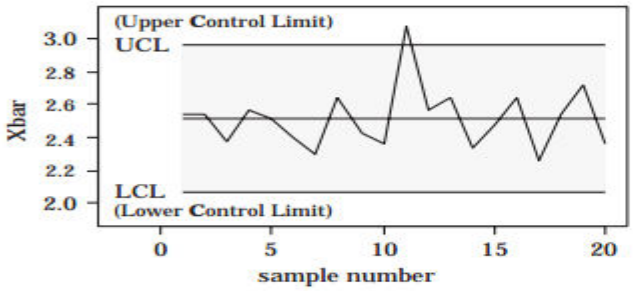
A control chart is a graph that displays data taken over time and the variations of this data. The control chart is based on a series of random samples taken at regular intervals.



Control charts on variables

X chart or average chart

The x-chart is used to look for changes in the average value of X-measurements as time goes on. As the measured characteristic of the process may not be Normally distributed, we make use of the Central Limit effect by working with sample means instead of individual X-values so that we are working with quantities that have a distribution that is closer to Normal.



$\bar{\bar{x}}$–chart

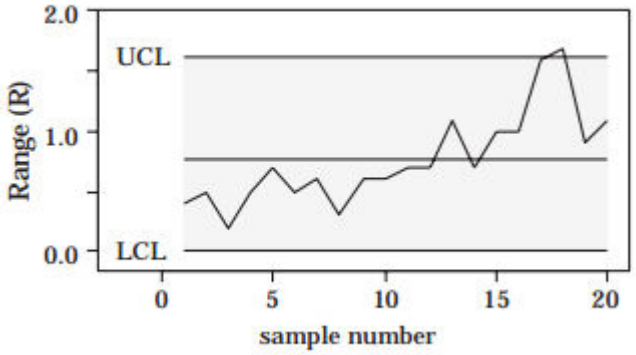
UCL: $\bar{\bar{x}} + 3\hat{\sigma}_{\bar{x}}$

Center Line: $\bar{\bar{x}}$

LCL: $\bar{\bar{x}} - 3\hat{\sigma}_{\bar{x}}$

R chart or range chart

An R-chart (or range chart) is specifically designed for detecting changes in variability. This time we plot the subgroup ranges, ri, rather than the subgroup means.



R–chart

$$UCL = \bar{r} + 3\hat{\sigma}_R = D_4\bar{r}$$

Center Line: $\bar{r}$

$$LCL = \bar{r} - 3\hat{\sigma}_R = D_3\bar{r}$$

[See Table 13.2.3 for values of D_3 and D_3.]

S chart or standard deviation chart

- The sample standard deviations are plotted in order to control the variability of a variable.
- For sample size (n>10), the S-chart is more efficient than R-chart.
- For situations where sample size exceeds 10, the X-bar chart and the S-chart should be used.

$$\bar{s} = \frac{\sum s_i}{k}$$

$$UCL = \bar{s}B_4$$

$$LCL = \bar{s}B_3$$

Control charts for Attributes

p chart (proportion chart)

To evaluate process stability when counting the fraction defective. It is used when the sample size varies: the total number of circuit boards, meals, or bills delivered varies from one sampling period to the next.

$$UCL = \bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n_j}}$$

$$LCL = \max[0, \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n_j}}]$$

n_p chart

Evaluating process stability when counting the fraction defective. The n_p chart is useful when it's easy to count the number of defective items and the sample size is always the same. Examples might include: the number of defective circuit boards, meals in a restaurant, teller interactions in a bank, invoices, or bills.

A fully capable process delivers zero defects. Although this may be difficult to achieve, it should still be our goal

$$\bar{p} = \frac{\sum_{j=1}^{m} (count)_j}{m \bullet n} \qquad n\bar{p} = \frac{\sum_{j=1}^{m} (count)_j}{m}$$

$$UCL_{np} = n\bar{p} + 3\sqrt{n\bar{p}(1-\bar{p})}$$

$$LCL_{np} = MAX\left[0 , n\bar{p} - 3\sqrt{n\bar{p}(1-\bar{p})}\right]$$

c chart (count chart)

Determining stability of "counted" data (e.g., errors per widget, inquiries per month, etc.) The c chart will help evaluate process stability when there can be more than one defect per unit. Examples might include: the number of defective elements on a circuit board, the number of defects in a dining experience--order wrong, food too cold, check wrong, or the number of defects in bank statement, invoice, or bill.

This chart is especially useful when you want to know how many defects there are not just how many defective items there are. The c chart is useful when it's easy to count the number of defects and the sample size is always the same.

$$LCL = MAX\left[0, \bar{c} - 3\sqrt{\bar{c}}\right]$$

$$UCL = \bar{c} + 3\sqrt{\bar{c}}$$

$$\bar{c} = \frac{\sum_{j=1}^{m} (count)_j}{m}$$

u chart

- Determining stability of "counted" data (e.g., errors per widget, inquiries per month, etc.) when the sample size varies.
- The u chart will help evaluate process stability when there can be more than one defect per unit.
- This chart is especially useful when you want to know how many defects there are not just how many defective items there are. It's one thing to know how many defective circuit boards, meals, statements, invoices, or bills there are; it is another thing to know how many defects were found in these defective items.
- It is used when the sample size varies: the number of circuit boards, meals, or bills delivered each day varies.

$$u_j = \frac{(count)_j}{n_j} \qquad \bar{u} = \frac{\sum_{j=1}^{m}(count)_j}{m}$$

$$UCL = \bar{u} + 3\sqrt{\frac{\bar{u}}{n_j}}$$

$$LCL = MAX\left[0, \bar{u} - 3\sqrt{\frac{\bar{u}}{n_j}}\right]$$

SIX SIGMA

Six sigma stands for six standard deviation from mean (sigma is the Greek letter used to represent standard deviation in statistics).

Six sigma, similar to Zero Defect (ZD), is a philosophical benchmark or standard of excellence proposed by Philip Crosby.

- Six sigma methodology provides the techniques and tools to improve the capability and reduce the defects in any process.
- It was started by Motorola in 1987, in its manufacturing division.

- Six sigma strives for perfection. **It allows for only 3.4 defects per million opportunities (or 99.999666 percent accuracy).** Here a defect can be anything from a faulty party to an incorrect customer bill.
- Six sigma improves the process performance, decrease variation and maintains **consistent quality** of the process output. This leads to defect reduction and improvements in profits, product quality and customer satisfaction.
- Six sigma incorporates the basic principles and techniques used in business, statistics and engineering.

Why Do We Need Six Sigma?

We know that, the three sigma quality, i.e., the natural variability ($\bar{x} \pm 3\sigma$) is equal to tolerance (= upper specification limit – lower specification limit). It means, in normal distribution curve, only 0.27% of the output would be expected to fall outside the specifications limits.

The real meaning of 3σ concept: A medium aircraft consists of 10,000 different parts. At 3σ quality, 27 of those parts in an assembled aircraft would be defective. So three sigma quality level cannot be accepted as good enough quality level. So we have to increase the sigma level (i.e., reducing the number of defectives). In fact, even four sigma quality also not sufficient for the aircraft case. That's why six sigma quality level is preferred than 3σ and 4σ quality levels.

The Concept of Six Sigma

Before studying the concept of six sigma, first let us re-introduce the concept of process capability ratio (C_p)

Process capability ratio,

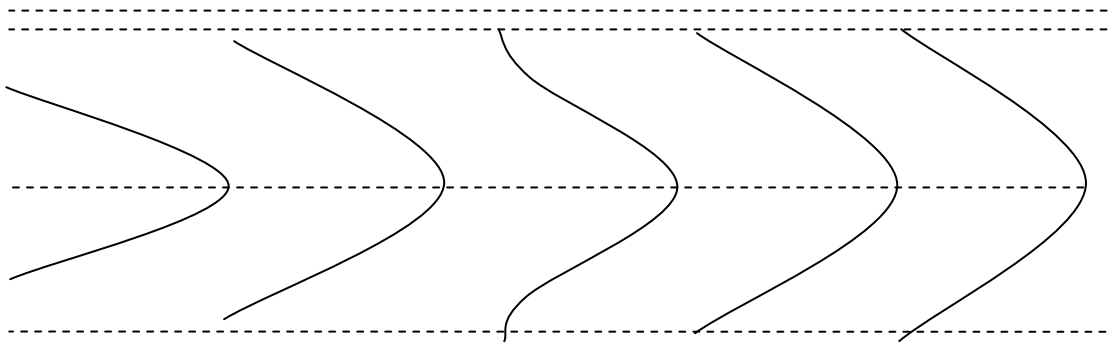
$$C_p = \frac{\text{Design width}}{\text{Process width}} = \frac{\text{USL} - \text{LSL}}{\text{UCL} - \text{LCL}}$$

USL = Upper Specification Limit;

LSL = Lower Specification Limit,

(Assumption is that process is centered midway the specification limits, i.e., there is no shift in process mean)

Process capability ratio measures how well the product requirements match with the process capabilities. The higher the value of Cp' the better the match between product and process.



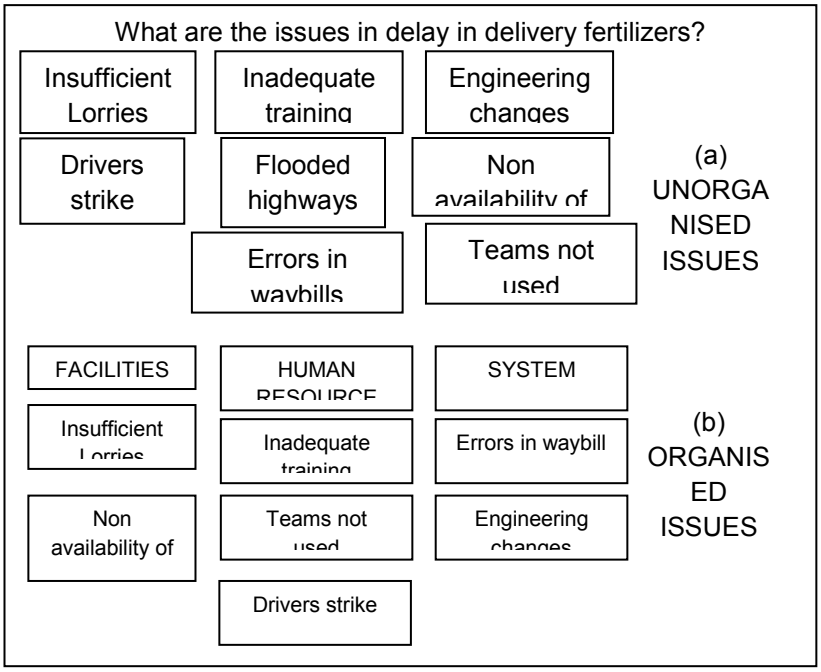
MANAGEMENT AND PLANNING TOOLS

Affinity Diagram

This diagram permits the team to creatively generate large number of ideas and then group them logically for understanding and possible solutions.

In this procedure, the issue is stated in full, then brainstormed using short sentences, posted them for the team to see. The ideas are sorted into logical groups and finally brief headings for each group are identified. The affinity diagram encourages team creativity, break down barriers, promote breakthroughs and motivate ownership of the process.

Affinity diagram



Inter-Relationship Diagram

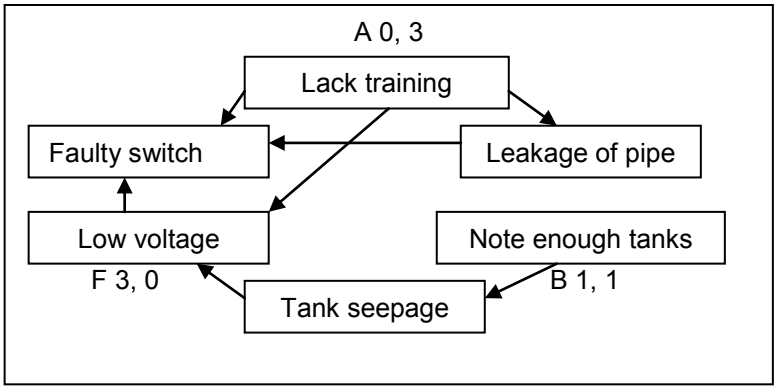
This method is useful in clarifying the relationship in complex situations. The team will be able to classify the cause and effect relationship, so that the key elements can be used to solve the problems.

Steps:

The team agrees on the statement of the problem.

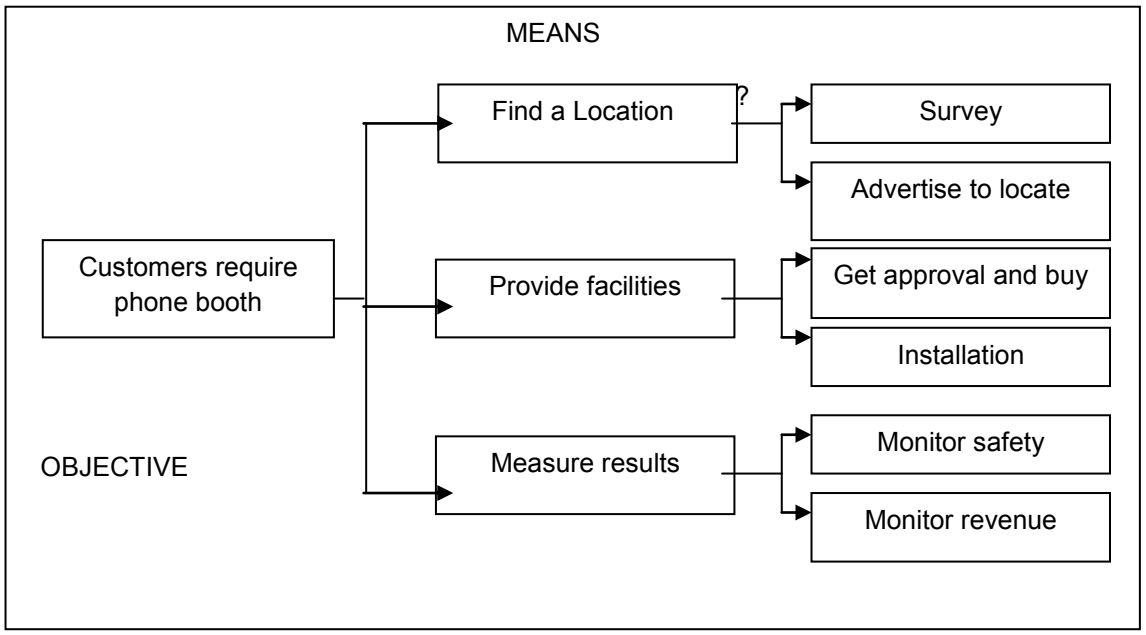
- Different ideas or issues from other methods are initially listed and named with alphabets, A B etc.
- Begin with the issue A, and evaluate the cause and effect relationship with B. If A is stronger, draw the arrow A to B, by a thick line. Each issue is compared with A, one by one. Draw thick arrows wherever strong influence is identified. In this example, only issues B, E and F have relationship with A. The first trial is now over.
- Second iteration is to compare B with issues C, D, E and F. The third step is to compare C with other issues. The fourth is compare issue D with E and F. The fifth step is to compare issue E with F.

- The diagram may be reviewed and revised, if necessary.
- The incoming and outgoing arrows are recorded as indicated, above the rectangle block. The completed diagram is shown in figure.
- The issue with highest outgoing arrows (A), is the root cause and the issue with highest incoming arrows (F), is the critical issue. This method encourages the team work and effectiveness in identifying major problem and the root cause, to tackles further the problem.



Tree Diagram

In the first step, the objective is traced from the interrelationship diagram, brainstorming and team participation. Using further brainstorming, major means are identified.



Matrix Diagram

The Matrix diagram helps to identify, analyse and rate the relationship among the variables. Data can be presented in tabular form, with numerical values or otherwise. Quality function Deployment, is a typical example of the matrix diagram. The standard formats that are used are: for 2 variables, L shaped; for 3 variables, T shaped, Y shaped and C shaped and for 4 variables, X shaped. L shaped matrix diagram for 2 variables are most frequently used.

Matrix diagram for uses of seven management tools

Tool	Use creativity	Analysis	Consen-sus	Action
Affinity diagram	⊙		O	Δ
Interrelationship diagram		O	⊙	
Tree diagram		⊙		⊙
Prioritisation matrix			O	
Matrix diagram		O	⊙	O
Process decision				
Program chart	⊙	⊙	⊙	O
Activity network				
Diagram			⊙	O

The seven management tools are presented in Table as matrix diagram. The steps involved in its construction are:

1. select the appropriate format
2. Determine the relationship symbols. Numerical values may be added when necessary

3. Complete the matrix, by analyzing each cell and insert appropriate symbol.
4. The matrix diagram approach encourages lateral thinking by the team, in terms of the relationships, their strengths and patterns.

Prioritization Matrix

In this method the issues, tasks, and characteristics are prioritized, based on weighted criteria, using a combination of tree and matrix diagram techniques. This is the most difficult, of the tools discussed.

Steps:

- Construct an L shaped matrix combining the options, which are then lowest level of detail of the tree diagram with the criteria.
- Determine the implementation criteria, using the nominal group technique or any other technique, with proper weight age criteria. Each team member submits the most important criteria on a piece of paper. They are listed on as flip chart and the team members submit the rank in another paper, ordering those listed criteria on the chart. Those criteria with greatest value are the most important. Three or four criteria are chosen.
- Prioritize the criteria using the NGT. Each team member weighs the criteria so the total weight equals 100%. The results are shown in Table.

Table: Weight age for different criteria

Criteria	Member A	Member J	Member M	Total
Low cost	30	25	35	155
Easy to implement	40	30	30	210
Technology permits	15	20	25	100
Customer preference	20	25	20	110

Compute the option importance score under each criterion, by multiplying the rank by the weight age of criteria. The details are shown in Table. The options with the highest total are those that should be implemented first.

Process Decision Program chart

The Process decision program chart avoids unexpected developments and identifies possible counter measures. Figure shows an example of this technique.

Initially the team states the objective that is to plan a successful industrial seminar. Those activities are listed in the first level, which are, call for papers, screening and acceptance, registration, and conduct proceedings and arranging Boarding and lodging facilities. The activity of conducting the proceedings is explained hereinafter. The team is brainstormed to determine what could go wrong with the seminar proceedings, and these are shown in Level 2 i.e., 'what if level'. Countermeasures are discussed and listed in the last level. Now the countermeasures are evaluated and the optimal ones are selected and marked O, and rejected ones are marked, X, as shown in the figure.

This method is preferred if the task is new or unique, complex, or potential failure has great risks. It provides a means to effectively minimize uncertainty in implementation stage.

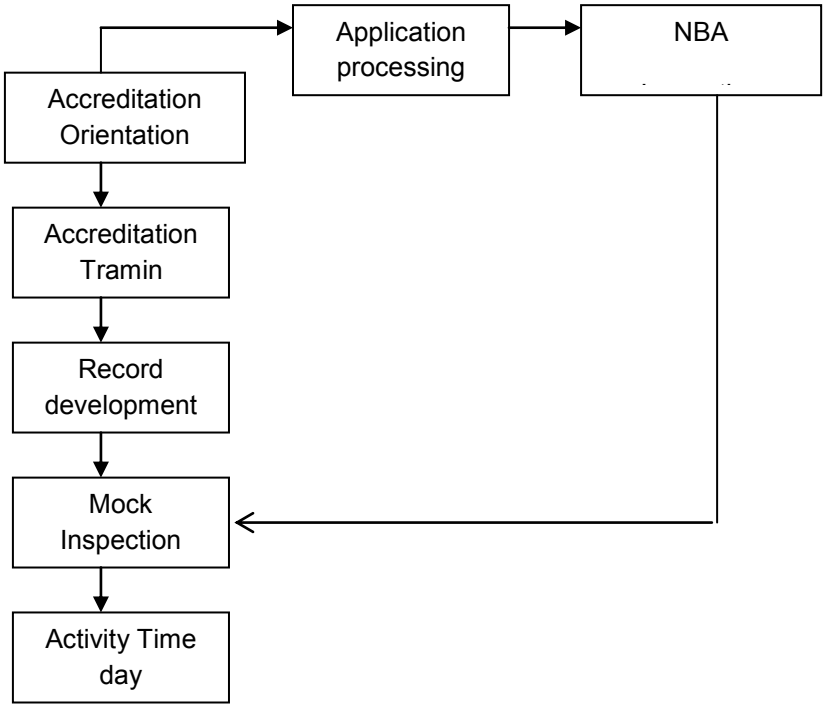
Activity Network Diagram

PERT, CPM, and Arrow diagram are the typical variations of this diagram. They allow the team to schedule the project efficiently. The details such as the critical path, project completion time, simultaneous tasks, and precedence relationships are obtained from this diagram.

Steps:

- The team brainstorms or documents all the activities to complete the project.
- The first task is identified and fixed on the extreme left of the board.
- The tasks done simultaneously are placed in parallel.
- Steps (b) and (c) are repeated until all the tasks are located on the board in correct sequence, as shown in figure.

- Number all activities and draw the corresponding arrows. Activity times are recorded in the lower left box. It may be hours, days, weeks or months.
- Find the critical path, after completing the details of box in each activity.



The critical path is the path along which all the activities are completed in the minimum time. The advantages of this method are:

a. A realistic project execution time is determined.

b. Bottlenecks are identified and when necessary, corrective actions can be planned.

c. Focus is made on the activities lying in the critical path. Time-cost trade off can be worked out, to complete the project earlier, with optimum additional cost.

PART-B

1. Explain and plot control chart for variables and attributes.
2. Discuss application of new seven management tools with examples.
3. Explain the stages of six sigma in process improvement.
4. Elaborate process capability.
5. Explain any five basic tools for quality.
6. Explain measure of central tendency and dispersion with suitable example.
7. Discuss the properties of Normal curve.
8. Outline the steps used to construct the tree diagram.
9. Explain the tree diagram and arrow diagram.

*** CIA – 3 X 16 (EITHER OR TYPE)**

**** ESE – 5 X 16 (EITHER OR TYPE)**

UNIT IV

TQM TOOLS

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process Benefits, Taguchi Quality Loss Function, Total Productive Maintenance – Concept, Improvement Needs, FMEA – Stages of FMEA.

BENCH MARKING.

MEANING:

Bench marking is the process of determining who is the very best, who sets the standard, and what that standard is. In cricket, one could argue that two consecutive world cup champions made the Australian cricket team the benchmark.

Definition:

American productivity and quality centre has defined the benchmarking as "the process of identifying, understanding, and adopting outstanding practices and process from organizations anywhere in the world to an organization to improve its performance.

DAVID KEARNS defines benchmarking as "the continuous process of measuring products, services and practices against the toughest competitors or those companies recognized as industry leaders."

THORE defines benchmarking as "the systematic comparison of elements of performance of an organization against those of other organizations, usually with the aim of mutual improvement."

Objectives of benchmarking:

- Benchmarking aims at a goal setting process to facilitate comparison with the best.
- It aims at motivating and stimulating company employees towards the goal of continuous quality improvement.
- It aims at external orientation of the company

- It aims at identifying a technological breakthrough
- It aims at searching for industry best practices.

Types of Benchmarking

Classification based on the object to be benchmarked:

- Product Benchmarking: this refers to comparison of different features and attributes of competing products and services.
- Performance Benchmarking: this refers to comparison of performance indicators related to a business as a whole or to the group of critical activities or processes.
- 3. Process Benchmarking: this refers to comparison of processes. It identifies a more effective and efficient process to be implemented.
- Strategic Benchmarking: this refers to examining competitive position in the market place. It helps the company to study the business strategy of another successful business and use the strategy for becoming more competitive.

Classification based on the organizations against Benchmarking:

1. Internal Benchmarking: it refers to comparison of performance between departments, plants, subsidiaries, within the organization.
2. Industry Benchmarking: It refers to comparison of performance by the organization
3. Competitive Benchmarking: It refers to comparison of performance against direct competitors.
4. Best in class Benchmarking: It refers to comparison of performance with best practices prevalent in an organization irrespective of products and services.
5. Relationship Benchmarking: it refers to comparison of performance with the Benchmarking Company which already has a relationship like customer-supplier relations, joint venture arrangement, etc.

Steps in benchmarking process:

Phase 1**: Planning:**

Step1: What can be benchmarked? (I.e., deciding what to benchmark)

Step2: To whom or what shall we compare (Identifying benchmark partners)

Step3: Determine data collection method and collect data

Phase 2: **Analysis:**

Step4: determine the current performance gap

Step 5: Project future performance levels

Phase 3**: Integration**:

Step6: communicate benchmark findings and gain acceptance.

Step7: **Establish functional goals**

Phase 4**: Action**

Step8: Develop action plans

Step9: Implements specific actions and monitor the progress

Step10: Recalibrate benchmarks

Phase 5: **Maturity:**

Step 11: Attain the leadership position.

Step 12: Integrate practices into the process.

Benefits of benchmarking:

- Creating a culture that values continuous improvement to achieve excellence.
- Sharing the best practices between benchmarking partners.
- Prioritizing the areas that need improvement.
- Enhancing creativity by devaluing the not invented here syndrome
- Increasing sensitivity to changes in the external environment.
- Shifting the corporate mindset from relative complacency to a strong sense of urgency for ongoing improvement.
- Focusing resources through performance target set with employee unit.

QUALITY FUNCTION DEVELOPMENT

Meaning:

Quality function development is a systematic and organized approach of taking customer needs and demands into consideration while designing new products and services or while improving the existing products and services.

Definition:

Quality function development may be defined as a system for translating consumer requirements into appropriate requirements at every stage, from research through product design and development, to manufacture, distribution, installation and marketing, sales and service.

Objectives of QFD:

- To identify the true voice of the customer and to use this knowledge to develop products which satisfy customers.
- To help in the organization and analysis of all the pertinent information associated with the project.
- Quality function development aims at translating the customers voice into product specifications.

Benefits of QFD:

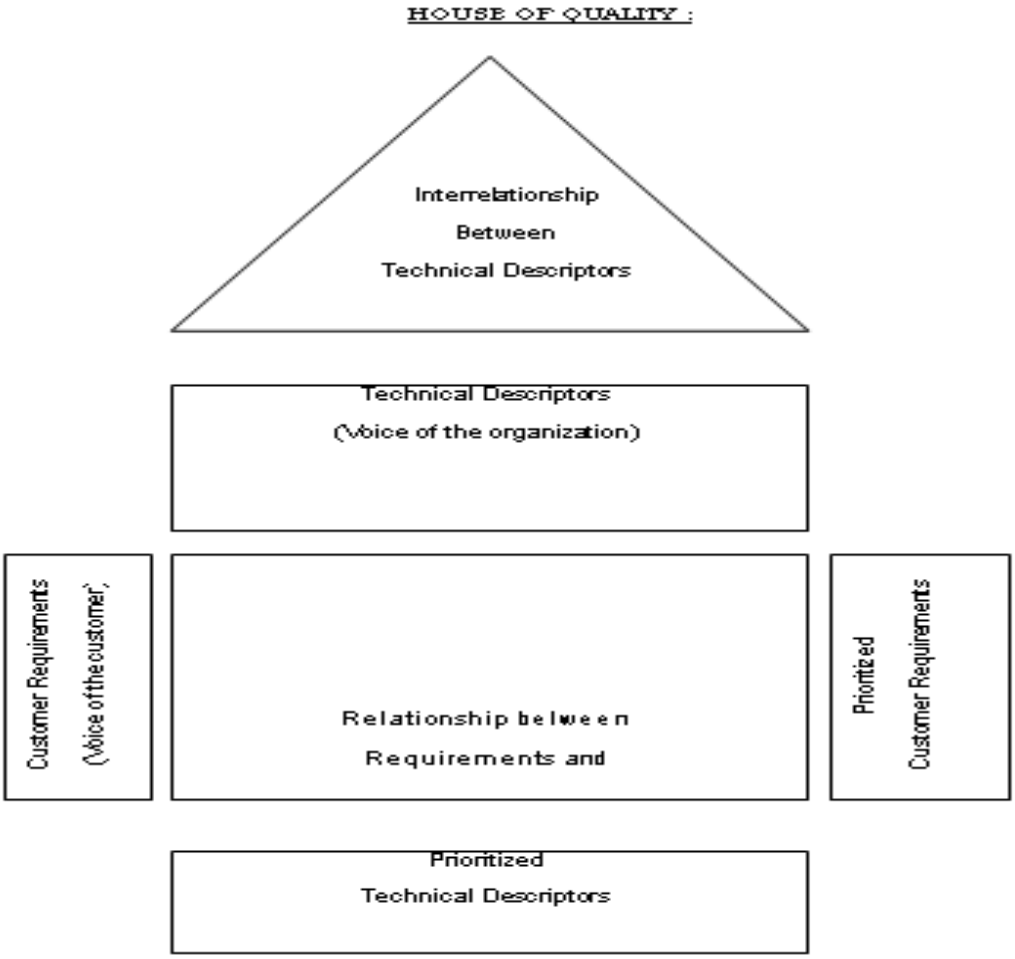
- Improves customer satisfaction
- Reduces implementation time.
- Promotes teamwork
- Provides documentation

House of quality:

The primary planning tool used in QFD is the house of quality. The house of quality converts the voice of the customer into product design characteristics. QFD uses a series of matrix diagrams, also called 'quality tables', resembles connected houses.

Basic structure of house of quality:

- Customer requirements
- Prioritized customer requirements
- Technical descriptors
- Relationship matrix
- prioritized technical descriptors
- Competitive assessments



Quality Function Development Process:

Phase 1: product planning

Step1: list customer requirements

Step2: List technical descriptors

Step3: Develop a relationship between WHATS AND HOWS

Step4: Develop a interrelationship matrix between HOWS

Step5: Do competitive assessments

Step6: Develop prioritized customer requirements

Step7: Develop prioritized technical descriptors.

Phase 2: part development

Step8: Deploy QFD process down to sub-components level both in terms of requirements and characteristics.

Step9: Deploy the component deployment chart. Relate the critical sub-component control characteristics.

Phase 3: process planning

Step10: Develop the relationship between the critical characteristics and process used to create the characteristics

Step11: Develop the control plan relating critical control to critical processes.

Phase 4: production planning

Step 12: Tabulate operating instructions from process requirements

Step13: develop prototype and do testing

Step14: Launch the final product to the market.

TAGUCHI'S QUALITY LOSS FUNCTION

Taguchi's methods are statistical methods developed largely by Genichi Taguchi to improve the quality of manufactured goods. Taguchi methods are controversial among many convention western statisticians. Taguchi's principle contributions to statistics are:

1. Taguchi loss function;
2. The philosophy of off-line quality control; and
3. Innovations in the design of experiments.

Taguchi loss function:

- Taguchi defines quality as "the loss imparted by the product to society from the time the product is shipped".
- This loss includes costs to operate, failure to function, maintenance and repair costs, customer dissatisfaction injuries caused by poor design and similar costs.

- Defective products/ parts that are detected repaired reworked or scrapped before shipment are not considered part of this loss.
- The essence of the loss function concept is that whenever a product deviates from its target performance it generates a loss to society.
- This loss is minimum when performance is right on target, but it grows gradually as one deviates from the target.
- Therefore the loss function philosophy says that for a manufacturer, the best strategy is to produce products as close to the target as possible, rather than aiming at "being"

LOSS FUNCTION:

Taguchi has defined quality as the loss imparted to society from the time a product is shipped. Societal losses include failure to meet customer requirements, failure to meet idea performance, and harmful side effects. Many practitioners have included the losses due to production such as raw material energy and labor consumed on unusable products or toxic by-products.

TOTAL PRODUCTIVE MAINTENANCE

Total Productive Maintenance (TPM) is defined as keeping the running plant and equipment at its highest productive level with the co-operation of all areas of the organization. Predictive and Preventive maintenance are essential to building a foundation for a successful TPM environment. Predictive Maintenance is the process of using data and statistical tools to determine when a piece of equipment will fail. Preventive Maintenance is the process of periodically performing activities such as

1. To maintain and improve equipment capacity.
2. Lubrication on the equipment to keep it running.
3. To maintain equipment for life.
4. To use support from all areas of the operation.
5. To encourage input from all employees.
6. To use teams for continuous improvement.

Total Productive Maintenance (TPM) is an extension of the Total Quality Management (TQM) philosophy to the maintenance function.

Steps of TPM process

TPM has the following steps:

1. Management should learn the new philosophy of TPM.

2. Management should promote the new philosophy of TPM.

3. Training should be funded and developed for everyone in the organization.

4. Areas of needed improvement should be identified.

5.Loss measurements to identify improvement needs are

- Down time losses
- Reduced speed losses
- Poor quality losses

6. Performance goals should be formulated.

7. An implementation plan should be developed.

8. Autonomous worth groups should be established**.**

FAILURE MODE AND EFFECT ANALYSIS (FMEA).

Meaning:

Failure mode and effect analysis also known as risk analysis is a preventive measure to systematically display the causes, effects, and possible actions regarding observed failures.

Objectives of FEMA:

- The objective of FEMA is to anticipate failures and prevent them from occurring. FEMA prioritizes failures and attempts to eliminate their causes.
- FEMA is an engineering technique is used to define, identify and eliminate known and or potential failures, problems, errors which occur in the system, design, process and service before they reach the customer.
- FEMA is a before the event action and is done when existing systems products processes are changed or redesigned.
- FEMA is a never ending process improvement tool.

Types of FEMA:

1. System FEMA
2. Design FEMA
3. Process FEMA
4. Service FEMA
5. Equipment FEMA
6. Maintenance FEMA
7. Concept FEMA
8. Environmental FEMA

Benefits of FEMA:

1. Improve product/process reliability and quality.
2. Increase customer satisfaction.
3. Early identification and elimination of potential product/process failure modes.
4. Prioritize product or process deficiencies
5. Capture engineering/organization knowledge
6. Document and track the actions taken to reduce risk
7. Provide focus for improved testing and development.
8. Minimize late changes and associated cost.
9. Act as catalyst for teamwork and idea exchange between functions.

STAGES OF FEMA.

The FEMA methodology has four stages: they are:

Stage1: specifying possibilities

- Functions
- Possible failure modes
- Root causes
- Effects
- Detection/prevention

Stage 2: quantifying Risk

- probability of cause
- severity of effect
- effectiveness of control to prevent cause
- Risk priority number

Stage3: correcting High risk causes

- prioritizing work
- detailing action
- assigning action responsibility
- check points on completion

stage4: re-evaluation of risk

- Recalculation of risk priority number

The process of FEMA and documentation

- process function requirements
- potential failure mode
- potential effects of failure
- severity
- classification
- potential causes mechanisms of failure
- occurrence
- current process controls
- detection

PART-B

1. What are the steps that contain the core techniques of Benchmarking?
2. What are the six major loss areas needed to be measure for implementing TQM.
3. What is FMEA? Explain the stages of FMEA.
4. How to build a house of quality? Explain.
5. Elaborate QFD process.
6. Explain the concept of Benchmarking and its process.
7. Elaborate total productive maintenance and its types.
8. Describe the different Benchmarking metrics' that can be used in educational institutions.
9. Briefly explain quality function deployment process.
10. Explain types and stages of failure mode and effect analysis.

*** CIA – 3 X 16 (EITHER OR TYPE)**

**** ESE – 5 X 16 (EITHER OR TYPE)**

UNIT – V

Quality System

Need for ISO 9000 and other quality System, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality auditing, TS 16949, ISO 140000- Concept, Requirements and Benefits.

What Is ISO 9000?

The ISO 9000 standards define minimum requirements for business quality assurance systems. These are "consensus standards" promulgated by the International Standards Organization in Europe and the American National Standards Institute (ANSI) in the United States. The ANSI standards are officially titled the "Q90" series. They are identical to the ISO 9000 series and people use the names interchangeably.

Conformance is voluntary. However, many European firms use them as a requirement for suppliers. Within the United States, some firms also use the standards for supplier certification.

- **ISO 9000 (Q90)** is a guideline for selection and use of quality system standards. It provides insight for various situations and conditions as well as definitions and explanations.
- **ISO 9001 (Q91)** defines minimum quality system requirements for design/development, production, installation and servicing. It is the most complete standard. It applies to manufacturing and service businesses engaged in all these activities.
- **ISO 9002 (Q92)** is essentially a subset of 9001. It applies only to production and installation activities.
- **ISO 9003 (Q93)** applies to final inspection and test.

- **ISO 9004 (Q94)** is a guideline for quality system elements. It is like a textbook which describes, explains and recommends.

Requirements

The standards use proven management principles:

- Policy Definition
- Clear Responsibility & Authority
- Appropriate Documentation
- Corrective Action
- Capable People & Equipment
- Adequate Resources

Conformance requires that firms apply these principles to areas which impact quality. It further requires consistent practice which is usually most difficult.

Under section 4.4, for example, ISO 9001 requires that product design projects should be planned, that design input parameters shall be defined and at design completion, the resulting design is confirmed as meeting the input requirements. It requires that the design, as well as any changes, be documented. The standard also requires that design changes be approved by the organization or persons who made the original design.

Certification

- The American Society for Quality Control has organized a Registrar Accreditation Board (RAB). This board oversees the training and activities of assessors and certify conformance. Certification is evidence to customers, potential customers and others that a business meets the standard's requirements.
- Assessors typically spend 1-3 days at a site. They examine documents, interview employees and observe processes. They look for evidence to confirm compliance or non-compliance. To obtain certification, a business may contract with an accredited assessor. An important customer may wish to assess as part of their supplier certification. Management may wish a self-assessment for internal evaluation.

Who Should Use ISO?

- Any firm whose customers make their buying decisions on quality issues should consider using these standards. Firms whose customers require conformance and certification as a qualifier will need a certificate of conformance from an approved Assessor.
- Firms who perceive quality as a marketing tool may obtain certification as part of their marketing strategy.
- In markets where quality is not a dominant issue firms may use the standards as a guide, but not attempt certification.
- Firms may use the standards for their own suppliers requiring certification as a condition of doing business.

Implementation

- An important implementation issue is speed. Most firms require 18 months or longer to achieve certification. Another issue is the current state of quality. Those with severe quality problems may need a maximum effort.
- Is certification necessary for your firm? Is the need urgent enough for a maximum effort? Or should the standards be used internally for their intrinsic value?
- The first step is awareness. Management must convince the organization that conformance is important. People within the organization must know the basics.
- Special purpose teams are an effective implementation tactic. They establish procedures and practices for various parts of the organization or for certain requirements of the standard.
- An especially important requirement of the standard is ongoing self-assessment. The authors consider self assessment and correction as essential for continuing compliance.

BENEFITS OF ISO 9000 STANDARDS :

- Achievement of international standard of quality.
- Value for money.
- Customer satisfaction.

- Higher productivity.
- Increased profitability
- Improved corporate image
- Access to global market
- Growth of the organization
- Higher morale of employees

The ISO 9000:2000 Series

The ISO 9000:2000 series consists of four separate, but closely related standards:

ISO 9000:2000 Quality Management – Fundamentals and Vocabulary

This describes the fundamentals of quality management systems, and specifies the terminology for quality management systems used throughout the series. An Annex to the standard illustrates concept relationships relating to quality, management, documentation, audit etc.

ISO 9001:2000 Quality Management Systems – Requirements

- This specifies requirements for a quality management system where an organization needs to demonstrate its ability to provide products that meet customer requirements. The ISO 9001:2000 specification provides the basis for quality systems certification or registration.
- All users of ISO 9001:1994, ISO 9002:1994 or ISO 9003:1994 will now need to migrate to the single requirements standard, ISO 9001:2000, during the NSAI transition period. For the future it is the only standard in the series to which organizations can be certified or registered.
- ISO 9004:2000 Quality Management Systems – Guidelines for Performance Improvements
- ISO 9004 provides guidelines that consider both the effectiveness and efficiency of the quality management system. The aim of this standard is improvement of the performance of the organization and satisfaction of customers and other interested parties.

Principal Benefits of ISO 9000:2000

- ISO 9000:20000 builds upon the 15 year track record of ISO 9000 and makes a good product even better.

Some of the principal benefits of the new standards series include :

- The ISO 9000:2000 series is restructured on a business process model, which more closely corresponds to the way organizations actually operate and should result in quality management systems that are more effective, easier to implement and audit.
- The language of the ISO 9000:2000 version has been crafted to make the standards easier to understand and implement by organizations.

IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM :

1. Top Management Commitment
2. Appoint the Management Representative
3. Awareness
4. Appoint an Implementation Team
5. Training
6. Time Schedule
7. Select Element Owners
8. Review the Present System
9. Write the Documents
10. Install the New System
11. Internal Audit
12. Management Review
13. Pre-assessment
14. Registration

QUALITY AUDITING

The term Audit refers to a regular examination and checking of accounts or financial records, settlement or adjustment of accounts.

It also refers to checking, inspection and examination of Production Processes.

Quality audit is the process of systematic examination of a quality system carried out by an internal or external quality auditor or an audit team. It is an important part of organization's quality management system and is a key element in the ISO quality system standard, ISO 9001.

Purpose of Quality Audit:

- To establish the adequacy of the system.
- To determine the effectiveness of the system.
- To afford opportunities for system analysis.
- To help in problem solving.
- To make decision making easier etc.

Types of Quality Audit:

1. First – Party Audit.
2. Second – Party Audit.
3. Third – Party Audit.

Quality audit can also be classified on the basis of the area taken into account for the audit such as

- System Audit.
- Process Audit.
- Product Audit.
- Adequacy Audit.
- Compliance Audit.

ISO 14000

ISO 14000 is a series of environmental management standards developed and published by the International Organization for Standardization (ISO) for organizations. The ISO 14000 standards provide a guideline or framework for organizations that need to systematize and improve their environmental management efforts.

The Benefits of ISO 14000 certification.

- The benefits of acquiring ISO certification go beyond the satisfaction of doing a good deed. Adhering to the standard may result in better conformance to environmental regulations, greater marketability, better use of resources, higher quality goods and services, increased levels of safety, improved image and increased profits.
- The environmental awareness and the documentation that are required by the ISO 14000 standards assist a company in conforming to environmental regulations. This means that a company, by diligently adhering to the standard, is less likely to violate envir onmental regulations and is always ready for inspection by a regulatory agency. In addition, the certification and documentation may aid a company in acquiring capital, in defending itself during environmental litigation and in receiving insurance or per mits.
- A wider market for a company's goods and services may result from certification. Many corporations and governments will be looking for suppliers that are ISO 14000 certified in order to maintain their own certification and environment-friendly image. Al though the European Union claims that ISO 9000 certification is not required to do business in Europe, that was the message received by many non-European firms and lead to the amazing success of that standard.
- The process analyses that go along with ISO 14000 certification may result in streamlining processes and more efficient use of resources and raw materials and subsequently reduce a company's costs. This leads to a safer internal environment for employees and the possibility of reduced insurance premiums. Improved employee morale may result when employees feel that the workplace is safer and they are contributing to the environmental effort.

PART-B

1. Discuss the need for standardization procedure for quality assurance.
2. Explain how quality system is implemented, documented and audited.
3. Explain quality auditing in detail.
4. Discuss in detail the elements of ISO 14000. What are the benefits of ISO 14000.
5. Discuss the steps to be followed in implementing quality system ISO 9000:2000.
6. Explain the implementation and documentation of quality system.
7. Discuss about ISO 9000:2000 quality systems.
8. What is ISO 14000? Explain its benefits in detail?
9. What is the registration process of ISO 9000? Explain.

*** CIA – 3 X 16 (EITHER OR TYPE)**

**** ESE – 5 X 16 (EITHER OR TYPE)**