

TOTAL QUALITY MANAGEMENT

18ME734

ATME COLLEGE OF ENGINEERING

VISION

Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

MISSION

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torch bearers of tomorrow's society.
- To strive to attain ever-higher benchmarks of educational excellence.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To impart excellent technical education in Mechanical Engineering to develop technically competent, morally upright and socially responsible Mechanical engineering professionals.

MISSION:

- To provide an ambience which impart excellent technical education in Mechanical Engineering.
- To enable the students to acquire skill development, knowledge of Research and recent trends in Mechanical Engineering which will help them in lifelong learning.
- To engage students in co-curricular and extra-curricular activities to impart social & ethical values and imbibe leadership quality.

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

After successful completion of program, the graduates will be

PEO 1: Graduates will be able to have successful professional career in the allied areas and be proficient to perceive higher education.

PEO2: The Graduates will attain the ability to understand the need, technical ability to analyze, design and manufacture the product.

PEO 3: Work effectively, ethically and socially responsible in allied fields of Mechanical Engineering.

PEO 4: Work in a team to meet personal and organizational objectives and to contribute to the development of the society in large.

PROGRAM OUTCOMES (PO'S)

The Mechanical engineering program students will attain:

- PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- PO2. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
- PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO'S)

After successful completion of program, the graduates will be

PSO 1: To apply and interpret the acquired mechanical engineering knowledge for advancement in Industrial, Societal, and Environmental arenas.

PSO 2: To meet the needs of Industries in the field of design, manufacturing and testing using mechanical engineering software.

Module I - TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is an enhancement to the traditional way of doing business.

Total - Made up of the whole

Quality - Degree of Excellence a Product or Service provides.

Management - Art of handling, controlling, directing etc.

TQM is the application of quantitative methods and human resources to improve all the processes within an organization and exceed **CUSTOMER NEEDS** now and in the future.

DEFINING QUALITY :

Quality can be quantified as follows

$$Q = P / E$$

where,

Q = Quality

P = Performance

E = Expectation



DIMENSIONS OF QUALITY :

Dimension

Meaning and Example

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 of the unit to fail
Durability	Useful life, includes repair
Service	Resolution of problems and complaints, ease of repair
Response	Human – to – human interface, such as the courtesy of the dealer
Aesthetics	Sensory characteristics, such as exterior finish
Reputation	Past performance and other intangibles, such as being ranked first

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.

IMPORTANT POINTS TO BE NOTED WHILE QUALITY PLANNING :

1. Business, having larger market share and better quality, earn returns much higher than their competitors.
2. Quality and Market share each has a strong separate relationship to profitably.
3. Planning for product quality must be based on meeting customer needs, not just meeting product specifications.
4. For some products. We need to plan for perfection. For other products, we need to plan for value.

QUALITY COSTS

QUALITY COSTS:-

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.

- Quality cost is a cost for poor product or service.

ELEMENTS OF QUALITY COST:-

- ✓ Cost of prevention
- ✓ Cost of appraisal
- ✓ Cost of internal failures
- ✓ Cost of external failures.

ANALYSIS OF QUALITY COSTS:-

- ✓ Trend analysis
- ✓ Pareto analysis

1. PREVENTION COST

- Marketing / Customer / User.
- Product / Service / Design Development.
- Purchasing
- Operations (Manufacturing or Service)
- Quality Administration.

2. APPRAISAL COST

- Purchasing Appraisal Costs.
- Operations Appraisal Costs
- External Appraisal Costs
- Review of Test and Inspection Data
- Miscellaneous Quality Evaluations

3. INTERNAL FAILURE COST

- Product or Service Design Failure Costs (Internal)
- Purchasing Failure Costs
- Operations (Product or Service) Failure Costs

4. EXTERNAL FAILURE COST

- 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.

- A simple type of index is called a **RELATIVE INDEX**.

QUARTER	COST IN RS.
1	2000
2	2200
3	2100
4	1900

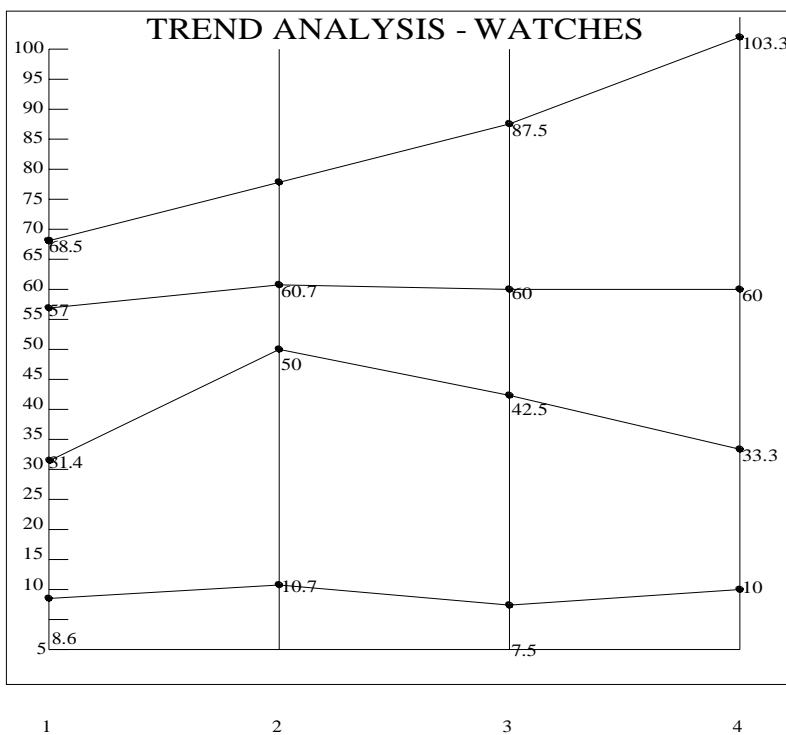
Cost Index in quarter t = (Cost in quarter t / Base period cost) x 100

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

TREND ANALYSIS :

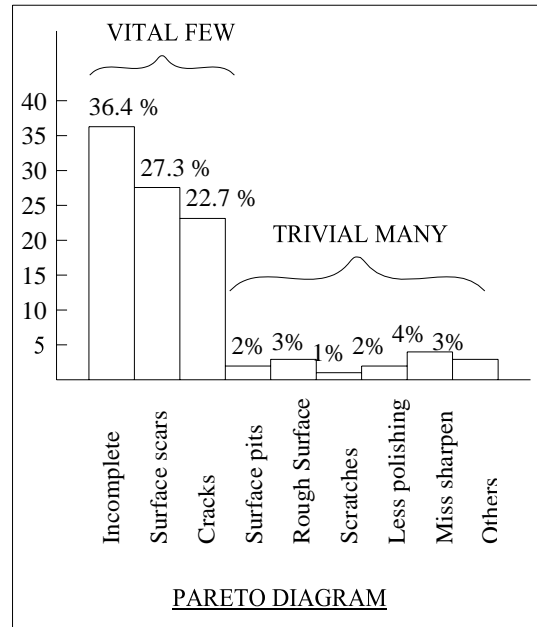
- Good visual aids are important communication tools.
- Graphs are particularly useful in presenting comparative results to management.

Trend Analysis is one where Time-to-Time comparisons can be made which illustrates the changes in cost over time.



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.



BASIC CONCEPTS OF TOTAL QUALITY MANGEMENT:-

- Top management committed to quality in all aspects
- Customers focus of the organization
- Process focus and improvement
- Measurement of performance
- Employee invalment and empowerment
- Continuous improvement
- Bench marking
- Teams
- Supplier teaming
- Training of employees
- Inventory management
- Communication
- Quality cost.

PILLARS OF TQM:-

- ✓ Problem solving discipline
- ✓ Interpersonal skills
- ✓ Teamwork
- ✓ Quality improvement process.

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

SIX BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT

1. Management Commitment
2. Customer Focus
3. Involvement and utilization of entire work force
4. Continuous Improvement
5. Treating Suppliers as Partners
6. Establish Performance Measures for the processes

NEW AND OLD CULTURES :

QUALITY ELEMENT	PREVIOUS STATE	TQM
<hr/>		
DEFINITION	PRODUCT ORIENTED	CUSTOMER ORIENTED
Priorities	Second to service and cost	First among equals of service and cost
DECISIONS	SHORT TERM	LONG TERM
Emphasis	Detection	Prevention
Errors	Operations	System
Responsibility	Quality control	Everyone
Problem Solving	Managers	Teams
Procurement	Price	Life cycle costs, Partnership
Manager" s Role	Plan, assign, control and enforce	Delegate, coach, facilitate and mentor

GURUS OF TQM :

- | | | |
|-------------------|---|------------------------------|
| SHEWHART | - | Control chart theory |
| | - | PDCA Cycle |
| DEMING | - | Statistical Process Control |
| JURAN | - | Concepts of SHEWHART |
| | - | Return on Investment (ROI) |
| FEIGANBAUM | - | Total Quality Control |
| | - | Management involvement |
| | - | Employee involvement |
| | - | Company wide quality control |
| ISHIKAWA | - | Cause and Effect Diagram |
| | - | Quality Circle concept |
| CROSBY | - | “Quality is Free” |
| | - | Conformance to requirements |
| TAGUCHI | - | Loss Function concept |
| | - | Design of Experiments |

OBSTACLES IN IMPLEMENTING TQM :

- Lack of Management Commitment
- Inability to change Organizational culture
- Improper planning
- Lack of continuous training and education
- Incompatible organizational structure and isolated individuals and departments
- Ineffective measurement techniques and lack of access to data and results
- Paying inadequate attention to internal and external customers
- Inadequate use of empowerment and teamwork
- Failure to continually improve

BENEFITS OF TQM :

- Improved quality
- Employee participation
- Team work
- Working relationships
- Customer satisfaction
- Employee satisfaction
- Productivity
- Communication
- Profitability
- Market share

Module 2

LEADERSHIP

LEADERSHIP:-

“Leadership is lifting of man” s visions to higher sights, the raising of man” s performance to a higher standard, the building of man” s personality beyond its normal limitations”.

CHARACTERISTICS FOR LEADERSHIP:-

- The customers first.
- Value people.
- Built supplier partnership.
- Empower people.
- Demonstrate involvement/commitment.
- Strive for excellence.
- Explain and deploy policy.
- Improve communication.
- Promote teamwork.
- Benchmark continuously.
- Establish system.
- Encourage collaboration.

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.

Leaders

- Shape the Organization” s value
- Promote the Organization” s value
- Protect the Organization” s value and
- Exemplifies the Organization values

CHARACTERISTICS OF QUALITY LEADERS :

1. They give priority attention to external and internal customers and their needs.
2. They empower, rather than control, subordinates.
3. They emphasis improvement rather than maintenance.
4. They emphasis prevention.
5. They emphasis collaboration rather than competition.
6. They train and coach, rather than direct and supervise.
7. They learn from the problems.
8. They continually try to improve communications.
9. They continually demonstrate their commitment to quality.
- 10.They choose suppliers on the basis of quality, not price.
- 11.They establish organizational systems to support the quality effort.
- 12.They encourage and recognize team effort.

LEADERSHIP CONCEPTS :

A leader should have the following concepts

1. People, Paradoxically, need security and independence at the same time.
2. People are sensitive to external and punishments and yet are also strongly self - motivated.
3. People like to hear a kind word of praise. Catch people doing something right, so you can pat them on the back.
4. People can process only a few facts at a time; thus, a leader needs to keep things simple.
5. People trust their gut reaction more than statistical data.
6. People distrust a leader" s rhetoric if the words are inconsistent with the leader" s actions.

THE 7 HABITS OF HIGHLY EFFECTIVE PEOPLE :

1. Be Proactive
2. Begin with the End in mind
3. Put First Things First
4. Think Win – Win
5. Seek First to Understand, then to Be Understood
6. Synergy
7. Sharpen the Saw (Renewal)

ROLE OF SENIOR MANAGEMENT

1. Management by Wandering Around (MBWA).
2. Strategy of problem solving and decision making.
3. Strong information base.
4. Recognition and Reward system.
5. Spending most of the time on Quality.
6. Communication.
7. Identify and encourage potential employee.
8. Accept the responsibility.
9. To play a role model.
10. Remove road blocks.
11. Study TQM and investigate how TQM is implemented elsewhere.
12. Establish policies related to TQM.
13. Establish „priority of quality' and „customer satisfaction' as the basic policy.
14. Assume leadership in bringing about a cultural change.

15. Check whether the quality improvement programmes are conducted as planned.
16. Become coaches and cheer leaders to implement TQM.
17. Generate enthusiasm for TQM activities.
18. Visit other companies to observe TQM functioning.
19. Attend TQM training programme.
20. Teach others for the betterment of society and the surroundings.

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 are

- 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

A typical meeting agenda will have the following items

- Progress report on teams
- Customer satisfaction report
- Progress on meeting goals
- New project teams
- Benchmarking report

Within three to five years, the quality council activities will become ingrained in the culture of the organization.

QUALITY STATEMENTS



VISION STATEMENT :

- It is a short declaration of what an organization aspires to be tomorrow.

Example :

Disney Theme Park	-	Happiest place on earth
Polaroid	-	Instant photography

- Successful visions provide a guideline for decision making

MISSION STATEMENT :

It answers the following questions

- Who we are?
- Who are the customers?
- What we do?
- How we do it?

It describes the function of the organization. It provides a clear statement of purpose for employees, customers & suppliers

A simpler mission statement is

—To meet customers transportation and distribution needs by being the best at moving their goods on time, safely and damage free||

- NATIONAL RAILWAYS

QUALITY POLICY STATEMENT :

It is guide for everyone in the organization as to how they should provide products and services to the customers.

Common characteristics are

- Quality is first among equals
- Meet the needs of the internal & external customers
- Equal or exceed competition
- Continuously improve the quality
- Utilize the entire workforce

STRATEGIC QUALITY PLANNING

Goals – Long term planning (Eg : Win the war)
Objectives – Short term planning (Eg : Capture the bridge)

Goals should

- Improve customer satisfaction, employee satisfaction and process
- Be based on statistical evidence
- Be measurable
- Have a plan or method for its achievement
- Have a time frame for achieving the goal
- Finally, it should be challenging yet achievable

SEVEN STEPS TO STRATEGIC QUALITY PLANNING :

- | | |
|-------------------------|--------------------|
| 1. Customer needs | 5. Closing the gap |
| 2. Customer positioning | 6. Alignment |
| 3. Predict the future | 7. Implementation |
| 4. Gap analysis | |

TQM IMPLEMENTATION :

- Begins with Management Commitment
- Leadership is essential during every phase of the implementation process and particularly at the start
- Senior Management should develop an implementation plan
- Timing of the implementation process is very important
- Formation of Quality Council
- Active involvement of Middle Managers and First Line Supervisors is essential
- Early discussions with the Union is a must
- Communicate TQM to the entire organization
- Training on quality awareness and problem solving
- Customer, Employee and Supplier surveys must be conducted to benchmark
- The council establishes the project teams and work groups and monitors their progress

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.
- 11a. Eliminate numerical quotas for the work force.
- 11b. Eliminate Management by objectives.
- 12 Remove Barriers THAT ROB PEOPLE OF PRIDE OF
WORKMANSHIP.
13. Encourage Education and Self-improvement for everyone.

Take action to accomplish the transformation.

QUESTION BANK

Module- I **INTRODUCTION-TQM**

PART – A

1. Define Total Quality?
2. Define Quality?
3. What are the Dimensions of Quality?
4. Give the Basic Concepts of TQM?
5. Give the Principles of TQM?
6. Give the Obstacles associated with TQM Implementation?
7. Give the Analysis Techniques for Quality Costs?
8. Define Quality Costs?
9. Give the primary categories of Quality cost?
10. Give the typical cost bases?
11. How will you determine the optimum cost?
12. State the Quality Improvement Strategy?
13. Define Quality Planning?
14. Give the Objectives of TQM?
15. What is needed for a leader to be effective?
16. What is the important role of senior management?
17. What are the general duties of a quality council?
18. What does a typical meeting agenda contain after establishing the TQM?
19. What are the various quality statements?
20. Give the basic steps to strategic quality planning?
21. What is a quality policy?

PART – B

1. What is quality cost? Explain the techniques used for Quality cost? (16)
2. Explain the principles of TQM? (16)
3. Explain Deming Philosophy? (16)
4. Explain the barriers to TQM implementation? (16)
5. Explain the concepts of Leadership? (16)

Module 3

CUSTOMER SATISFACTION

Customer satisfaction, a [business term](#), is a measure of how products and services supplied by a company meet or surpass customer expectation. It is seen as a key performance indicator within business and is part of the four of a [Balanced Scorecard](#).



- In a competitive marketplace where businesses compete for customers, customer satisfaction is seen as a key differentiator and increasingly has become a key element of business strategy.

Customer Preception of Quality:-

- Performance
- Features
- Service
- Warranty
- Price
- Reputation.

Customer complaints:-

- ✓ Satisfied
- ✓ Dissatisfied customer
- ✓ Totally satisfied customer contributes to monitored.

FEEDBACK (INFORMATION COLLECTING TOOLS):

Feedback enables organization to

- Discover customer satisfaction
- Discover relative priorities of quality
- Compare performance with the competition
- Identify customer needs
- Determine opportunities for improvement

Listening to the voice of the customer can be accomplished by numerous information collecting tools.

1. Comment Card

2. Customer Questionnaire

	<u>Highly</u> <u>Satisfied</u>		<u>Neutral</u>	<u>Highly</u> <u>Dissatisfied</u>	
1. Trash removal	5	4	3	2	1
2. Personal hygiene	5	4	3	2	1
3. Romance	5	4	3	2	1
4. Thoughtfulness	5	4	3	2	1
5. Listening skills	5	4	3	2	1
6. Faithfulness	5	4	3	2	1
7. Respect for Mother – in - law	5	4	3	2	1
8. Overall,how satisfied are you with your marriage?	5	4	3	2	1

To make surveys more useful, it is best to remember eight points

- Clients and Customers are not the same
- Surveys raise customers expectations
- How you ask a question will determine how the question is answered
- The more specific the question, the better the answer
- You have only one chance and only 15 minutes
- The more time you spend in survey development, the less time you will spend in data analysis and interpretation
- Who you ask is as important as what you ask
- Before the data are collected, you should know how you want to analyse and use the data

3. Focus Groups

These groups are very effective for gathering information on customer expectations and requirements.

4. Toll – Free Telephone Numbers

5. Customer Visits

6. Report Card

7. The Internet and Computers

8. Employee Feedback

9. Mass Customization

USING CUSTOMER COMPLAINTS :

Actions an organization can take to handle complaints are as follows

- Investigate customers experiences by actively getting feed back, both positive and negative, and then acting on it promptly
- Develop procedures for complaint resolution that include empowering front – line personnel.
- Analyze complaints, but understand that complaints do not always fit into neat categories.
- Work to identify process and material variations and then eliminate the root cause. “More inspection” is not corrective action.
- 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 results of all investigations and solutions, to all people in the organization.
- Provide a monthly complaint report to the quality council for their evaluation and, if needed, the assignment of process improvement teams.
- Identify customers” expectations beforehand rather than afterward through complaint analysis.

SERVICE QUALITY

Customer service is the set of activities an organization uses to win and retain customer" s satisfaction. It can be provided before, during, or after the sale of the product or exist on its own.

Elements of customer service are

ORGANIZATION

1. Identify each market segment.
2. Write down the requirements.
3. Communicate the requirements.
4. Organize processes.
5. Organize physical spaces.

CUSTOMER CARE

6. Meet the customer" s expectations.
7. Get the customer" s point ofview.
8. Deliver what is promised.
9. Make the customer feel valued.
10. Respond to all complaints.
11. Over – respond to the customer.
12. Provide a clean and comfortable customer reception area.

COMMUNICATION

13. Optimize the trade – off between time and personal attention.
14. Minimize the number of contact points.
15. Provide pleasant, knowledgeable and enthusiastic employees.
16. Write document in customer friendly language.

FRONT-LINE PEOPLE

17. Hire people who like people.
18. Challenge them to develop better methods.
19. Give them the authority to solve problems.
20. Serve them as internal customers.
21. Be sure they are adequately trained.
22. Recognize and reward performance.
23. Lead by example.
24. Listen to the front-line people.
25. Strive for continuous process improvement.

CHARACTERISTICS AND EXPECTATIONS :

Characteristic

Expectation

Delivery	Delivered on schedule in undamaged condition
Installation	Proper instructions on setup, or technicians supplied for complicated products
Use	Clearly-written training manuals or instructions provided on proper use
Field repair	Properly-trained technicians to promptly make quality repairs
Customer Service	Friendly service representatives to answer questions
Warranty	Clearly stated with prompt service on claims

CUSTOMER RETENTION

It means “retaining the customer” to support the business. It is more powerful and effective than customer satisfaction.

For Customer Retention, we need to have both “Customer satisfaction & Customer loyalty”.

The following steps are important for customer retention.

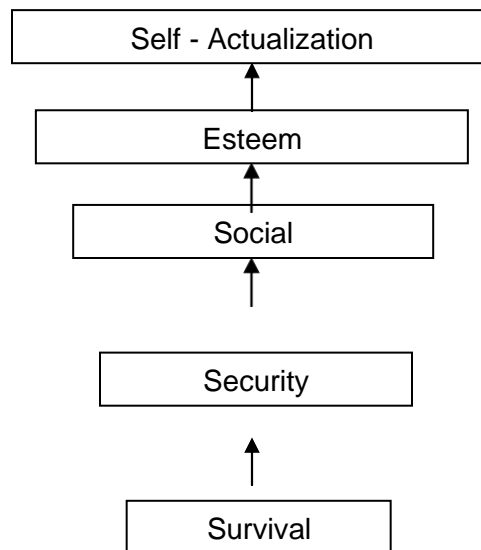
1. Top management commitment to the customer satisfaction.
2. Identify and understand the customers what they like and dislike about the organization.
3. Develop standards of quality service and performance.
4. Recruit, train and reward good staff.
5. Always stay in touch with customer.
6. Work towards continuous improvement of customer service and customer retention.
7. Reward service accomplishments by the front-line staff.
8. Customer Retention moves customer satisfaction to the next level by determining what is truly important to the customers.
9. Customer satisfaction is the connection between customer satisfaction and bottom line.

EMPLOYEE INVOLVEMENT

- Employee involvement is one approach to improve quality and productivity.
- It is a means to better meet the organization's goals for quality and productivity.

MOTIVATION

MASLOW'S HIERARCHY OF NEEDS :



EMPLOYEE WANTS :

FACTOR	EMPLOYEE RATING RATING	MANAGER
<hr/>		
Interesting work	1	5
Appreciation	2	8
Involvement	3	10
Job security	4	2
Good Pay	5	1
Promotion/ growth	6	3
Good working conditions	7	4
Loyalty to employees	8	7
Help with personal problems	9	9
Tactful discipline	10	6

ACHIEVING A MOTIVATED WORK FORCE :

The building of a motivated work force if for the most part an indirect process. Concepts to achieve a motivated work force are as follows:

1. Know thyself.
2. Know your employees.
3. Establish a positive attitude.
4. Share the goals.

5. Monitor progress.

6. Develop interesting work.

- Job rotation
- Job enlargement
- Job enrichment

7. Communicate effectively

8. Celebrate success.

EMPLOYEE SURVEYS :

Employee surveys help managers assess the current state of employee relations, identify trends, measure the effectiveness of program implementation, identify needed improvements, and increase communication effectiveness.

STEP 1 : The Quality Council to create a multifunctional team

STEP 2 : The Team will develop survey instrument

STEP 3 : Administer the survey

STEP 4 : Results are compiled and analyzed

STEP 5 : Determine areas for improvement

- Employee involvement is creating an environment in which people have an impact on decisions and actions that affect their jobs. **Tell:** the supervisor makes the decision and announces it to staff. The supervisor provides complete direction.
- **Sell:** the supervisor makes the decision and then attempts to gain commitment from staff by "selling" the positive aspects of the decision.
- **Consult:** the supervisor invites input into a decision while retaining authority to make the final decision herself.
- **Join:** the supervisor invites employees to make the decision with the supervisor. The supervisor considers her voice equal in the decision process.

To round out the model, I add the following.

- **Delegate:** the supervisor turns the decision over to another party.

SEVEN RULES OF MOTIVATION

#1 Set a major goal, but follow a path. The path has mini goals that go in many directions. When you learn to succeed at mini goals, you will be motivated to challenge grand goals.



#2 Finish what you start. A half finished project is of no use to anyone. Quitting is a habit. Develop the habit of finishing self-motivated projects.



#3 Socialize with others of similar interest. Mutual support is motivating. We will develop the attitudes of our five best friends. If they are losers, we will be a loser. If they are winners, we will be a winner. To be a cowboy we must associate with cowboys.





#4 Learn how to learn. Dependency on others for knowledge supports the habit of procrastination. Man has the ability to learn without instructors. In fact, when we learn the art of self-education we will find, if not create, opportunity to find success beyond our wildest dreams.

#5 Harmonize natural talent with interest that motivates. Natural talent creates motivation, motivation creates persistence and persistence gets the job done.



#6 Increase knowledge of subjects that inspires. The more we know about a subject, the more we want to learn about it. A self-propelled upward spiral develops.

#7 Take risk. Failure and bouncing back are elements of motivation. Failure is a learning tool. No one has ever succeeded at anything worthwhile without a string of failures.

EMPOWERMENT

Empowerment is investing people with authority. It's purpose is to tap the enormous reservoir of potential contribution that lies within every worker.

The two steps to empowerment are

1. To arm people to be successful through coaching, guidance and training.
2. Letting people do by themselves.

The principles of empowering people are given below.

1. Tell people what their responsibilities are.
2. Give authority.
3. Set standards for excellence.
4. Render training.
5. Provide knowledge and information.
6. Trust them.
7. Allow them to commit mistakes.
8. Treat them with dignity and respect.

Three dimensions of empowerment are

- Capability
- Alignment and
- Trust

TEAMS



- Employee involvement is optimized by the use of teams.
- A **team** is defined as a group of people working together to achieve common objectives or goals.
- **Teamwork** is the cumulative actions of the team during which each member of the team subordinates his individual interests and opinions to fulfill the objectives or goals of the group.

WHY TEAMS WORK :

1. Many heads are more knowledgeable than one.
2. The whole is greater than the sum of its members.
3. Team members develop a rapport which each other.
4. Teams provide the vehicle for improved communication.

TYPES OF TEAMS :

1. Process improvement team.
2. Cross – functional team.
3. Natural work teams.
4. Self – Directed / Self – Managed work teams.

CHARACTERISTICS OF SUCCESSFUL TEAMS :

- | | |
|-------------------------------|------------------------------------|
| 1. Sponsor | 2. Team Charter |
| 3. Team Composition | 4. Training |
| 5. Ground Rules | 6. Clear Objectives |
| 7. Accountability | 8. Well-Defined decision procedure |
| 9. Resources | 10. Trust |
| 11. Effective Problem Solving | 12. Open Communication |
| 13. Appropriate Leadership | 14. Balanced Participation |
| 15. Cohesiveness | |

TEAM MEMBER ROLES :



TEAM LEADER

- Ensures the smooth and effective operation of the team.
- Facilitates the team process.
- Serves as a Contact Point.
- Organizes the implementation of changes.
- Prepares the meeting agenda.

FACILITATOR

- Supports the leader.
- Focuses on the team process.
- Acts as a resource to the team.
- Provides feedback to the team.

RECORDER

- Documents the main ideas of the team" s discussion, the issues raise, decisions made, action items etc.
- Presents the documents and distributes the MOM.
- Participates as a team member.

TIMEKEEPER

- Ensures that the team maintains the schedule.
- Participates as a team member.

TEAM MEMBER

- Contributes best, without reservation.
 - Respects other people" s contributions.
 - Listens carefully and asks questions.
 - Works for consensus on decisions.
 - Supports the decision of the team.
 - Understands and is committed to the team objectives.
-

- Respects and is tolerant of individual differences.
- Acknowledges and works through conflict openly.
- Carries out assignments.

DECISION MAKING METHODS :

1. Non-decision.
2. Unilateral decision.
3. Handclasp decision.
4. Minority-rule decision.
5. Majority-rule decision.
6. Consensus.

COMMON 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.

- No time to do improvement work.

RECOGNITION AND REWARD



Recognition is a process by which management shows acknowledgement of an employee's outstanding performance.

Various ways for Recognition and Rewards are

1. Recognition can be expressed using verbal and written praise.
2. Rewards may be in the form of certificates and plaques.
3. Reward is normally in the form of cinema tickets, dinner for family etc.
4. The financial compensation (for recognition) can be paid in terms of increased salaries, commissions, gain sharing etc.
5. The efforts of employees can be recognized by promotions, special job assignments etc.
6. A letter of appreciation from the CEO or the Top Management will increase the employee's involvement.
7. Reward may be delayed but recognition should be in a timely basis.
8. Rewards should be appropriate to the improvement level.
9. People like to be recognized than any reward.
10. Special forms of recognition include pictures on the bulletin board, articles in news letters, letter to families etc.
11. Supervisors can give on-the-spot praise for a job which is done well.

EFFECTS OF RECOGNITION AND REWARD SYSTEM :

1. Recognition and reward go together for letting people know that they are valuable members for the organization.
2. Employee involvement can be achieved by recognition and reward system.
3. Recognition and reward system reveals that the organization considers quality and productivity as important.
4. It provides the organization an opportunity to thank high achievers.
5. It provides employees a specific goal to achieve.
6. It motivates employees to improve the process.
7. It increases the morale of the workers.

PERFORMANCE APPRAISAL

The performance appraisal is used to let employees know how they are performing. The performance appraisal becomes a basis for promotions, increase in salaries, counseling and other purposes related to an employee's future.

IMPORTANCE OF PERFORMANCE APPRAISALS :

1. It is necessary to prevail a good relationship between the employee and the appraiser.
2. Employee should be informed about how they are performing on a continuous basis, not just at appraisal time.
3. The appraisal should highlight strength and weakness and how to improve the performance.
4. Employee should be allowed to comment on the evaluation and protest if necessary.
5. Everyone should understand that the purpose of performance appraisal is to have employee involvement.
6. Errors in performance evaluations should be avoided.

7. Unfair and biased evaluation will render poor rating and hence should be eliminated.

BENEFITS OF EMPLOYEE INVOLVEMENT :

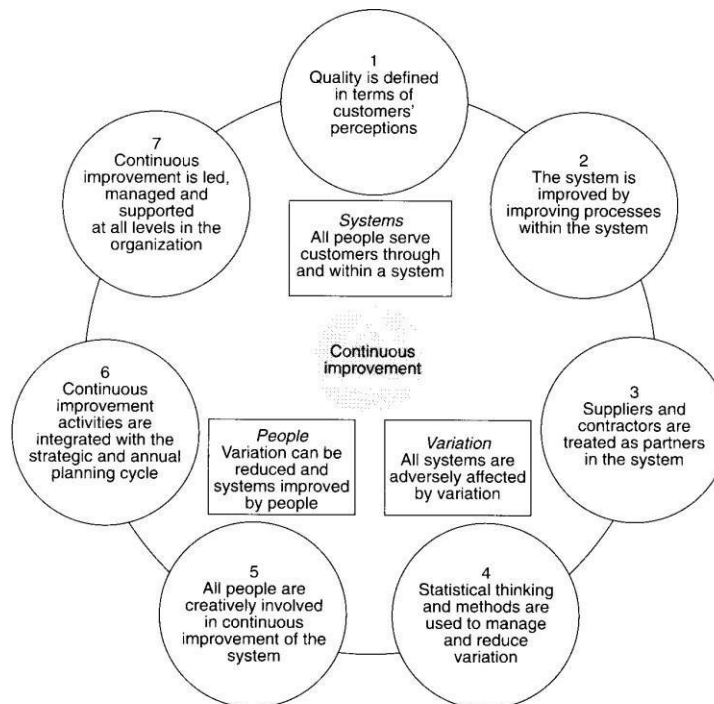
Employee involvement improves quality and increases productivity because

- Employees make better decisions using their expert knowledge of the process
- Employees are better able to spot and pin-point areas for improvement.
- Employees are better able to take immediate corrective action.
- Employee involvement reduces labour / management friction.
- Employee involvement increases morale.
- Employees have an increased commitment to goals because they are involved.



CONTINUOUS PROCESS IMPROVEMENT

Continuous process improvement is designed to utilize the resources of the organization to achieve a quality-driven culture.



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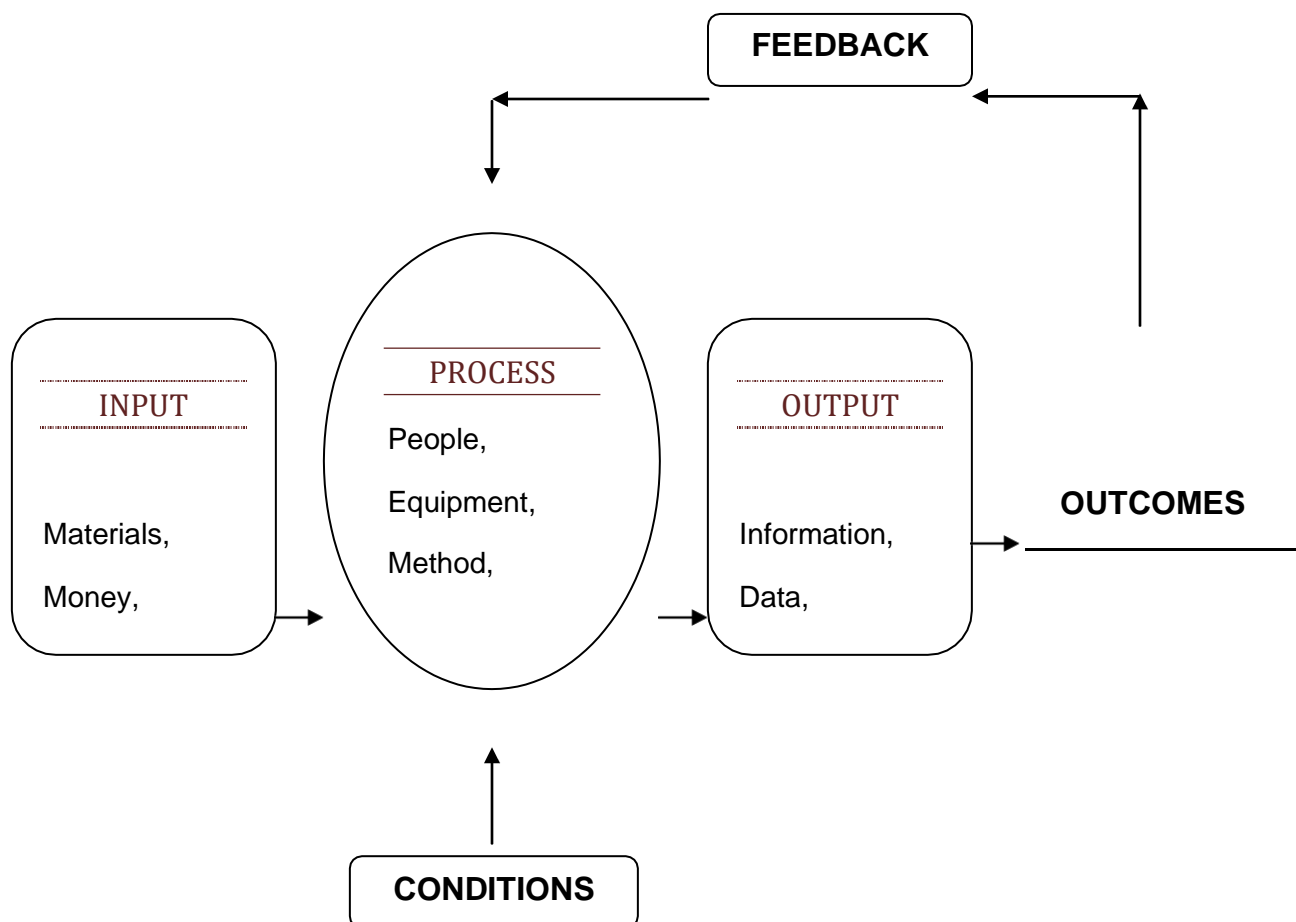
Improvement is made by

- Viewing all work as process.

- Making all process effective, efficient and adaptable.
- Anticipating changing customer needs.
- Controlling in-process performance using measures such as scrap reduction, control charts etc.
- Eliminating waste and re-work.
- Eliminating non-value added activities.
- Eliminating non-conformities.
- Using Benchmarking.
- Incorporating learned lessons into future activities.
- Using technical tools such as SPC, benchmarking, experimental design, QFD etc.

PROCESS :

Process refers to business and production activities of an organization.



INPUT / OUTPUT PROCESS MODEL

There are five basic ways for improvement.

- Reduce resources.
- Reduce errors.
- Meet or exceed expectations of downstream customers.
- Make the process safer.
- Make the process more satisfying to the person doing it.

THE JURAN TRILOGY

1. PLANNING

- Determine internal & external customers.
- Their needs are discovered.
- Develop product / service features.
- Develop the processes able to produce the product / service features.
- Transfer plans to operations.

2. CONTROL

Control is used by operating forces to help meet the product, process and service requirements.

It consists of the following steps

1. Determine items to be controlled.
2. Set goals for the controls.
3. Measure actual performance.
4. Compare actual performance to goals.
5. Act on the difference.

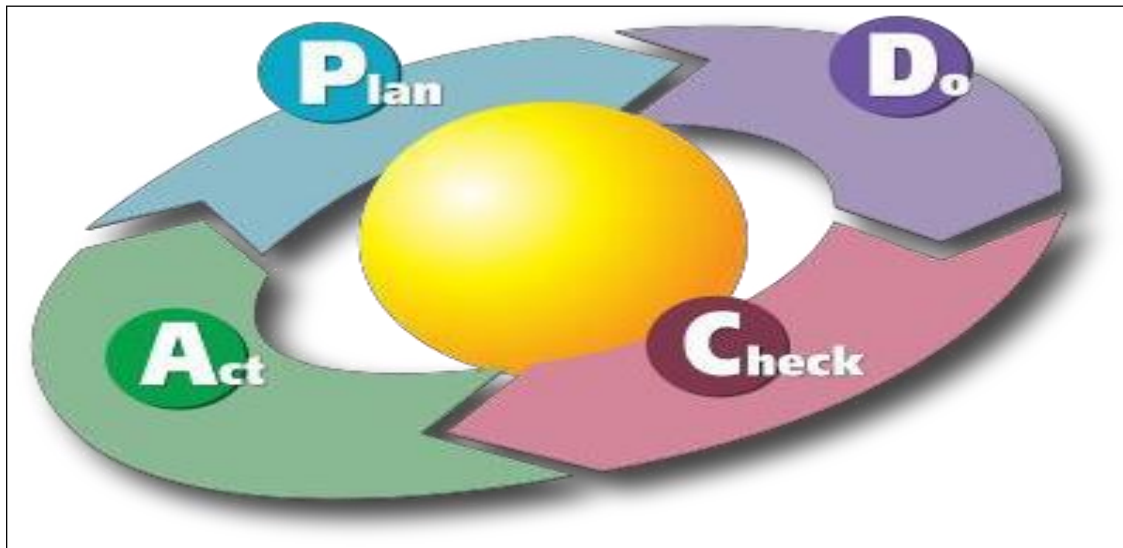
3. IMPROVEMENT

Aims to attain levels of performance that are higher than current levels.

It consists of the following steps

- Establishment of quality council.
- Identify the improvement projects.
- Establish the project teams with a project leader.
- Provide the team with the resources.

THE PDCA CYCLE :



PROBLEM SOLVING METHOD :

1. IDENTIFY THE OPPORTUNITY

- Identify the Problem
 - Pareto analysis of external alarm signals.
 - Pareto analysis of internal alarm signals.
 - Proposals from key insiders.
 - Proposals from suggestion schemes.
 - Field study of user" s needs.
 - Comments of key people outside the organization.
 - Customer surveys.

- Employee surveys.
- Brainstorming by work groups.
- Form the Team
 - Team should be selected.
 - Goals and milestones are established.
- Define the Scope.

Criteria for a good problem statement is as follows

- It clearly describes the problem.
- It states the effect.
- It focuses on what is known, unknown etc.
- It emphasizes the impact on the customer.

2. ANALYZE THE CURRENT PROCESS

The objective is to understand the process and how it is currently performed.

Step 1 : The team to develop a process flow diagram.

Step 2 : The target performance measures are defined.

Step 3 : Collection of all available data and information.

Common items of data and information are

- | | |
|-------------------------|----------------------------|
| 1. Customer information | 2. Design information |
| 3. Process information | 4. Statistical information |
| 5. Quality information | 6. Supplier information |

3. DEVELOP THE OPTIMAL SOLUTION(S)

This phase has the objective of establishing potential and feasible solutions and recommending the best solution to improve the process.

- Creativity plays the major role, and brainstorming is the principal technique.
- There are three types of creativity:
 - Create new processes
 - Combine different processes
 - Modify the existing process

4. IMPLEMENT CHANGES

This phase has the objective of preparing the implementation plan, obtaining approval and implementing the process improvements.

- Approval of the quality council.
- Obtain the advice and consent of departments, functional areas, teams, individuals etc.

- Monitor the activity.

5. STUDY THE RESULTS

This phase has the objective of monitoring and evaluating the change by tracking and studying the effectiveness of the improvement efforts.

6. STANDARDIZE THE SOLUTION

- Institutionalize by positive control of the process.
- The quality peripherals – the system, environment and supervision must be certified.
- Operators must be certified.

7. PLAN FOR THE FUTURE

The objective is to achieve improved level of process performance.

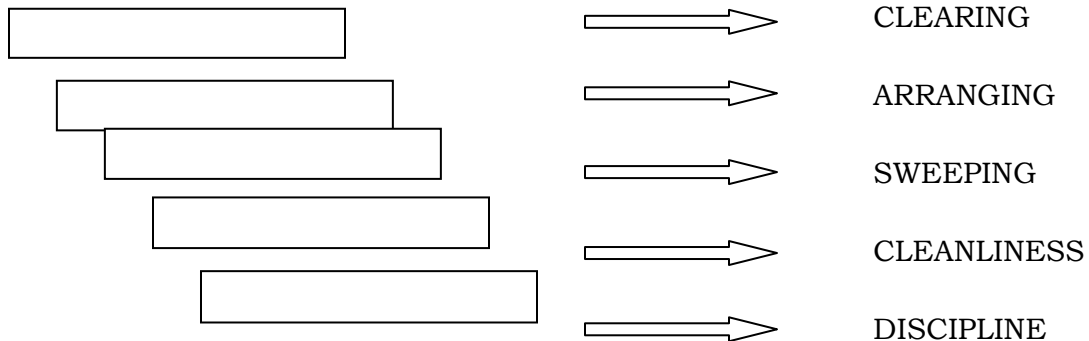
- Regularly conduct reviews of progress by the quality council.
- Establish the systems to identify area for future improvements.
- Track performance with respective internal & external customers.
- TQM tools and techniques are used to improve quality, delivery and cost.

TQM, PDCA, Six Sigma, & Lean Overlay



5-S : HOUSEKEEPING

5-S MEANS EVERYTHING IN ITS PLACE



- There can be no TQM without 5-S.
- A dirty factory cannot produce quality products.
- Clutter hides problems. A neat workplace promotes easy discovery of abnormalities.

The First S : SEIRI : CLEARING

Factory Floor

- ◆ Machines to be scrapped
- ◆ Rejected material
- ◆ Expired goods
- ◆ Broken tools, pallets, bins, trolleys.
- ◆ Old notices

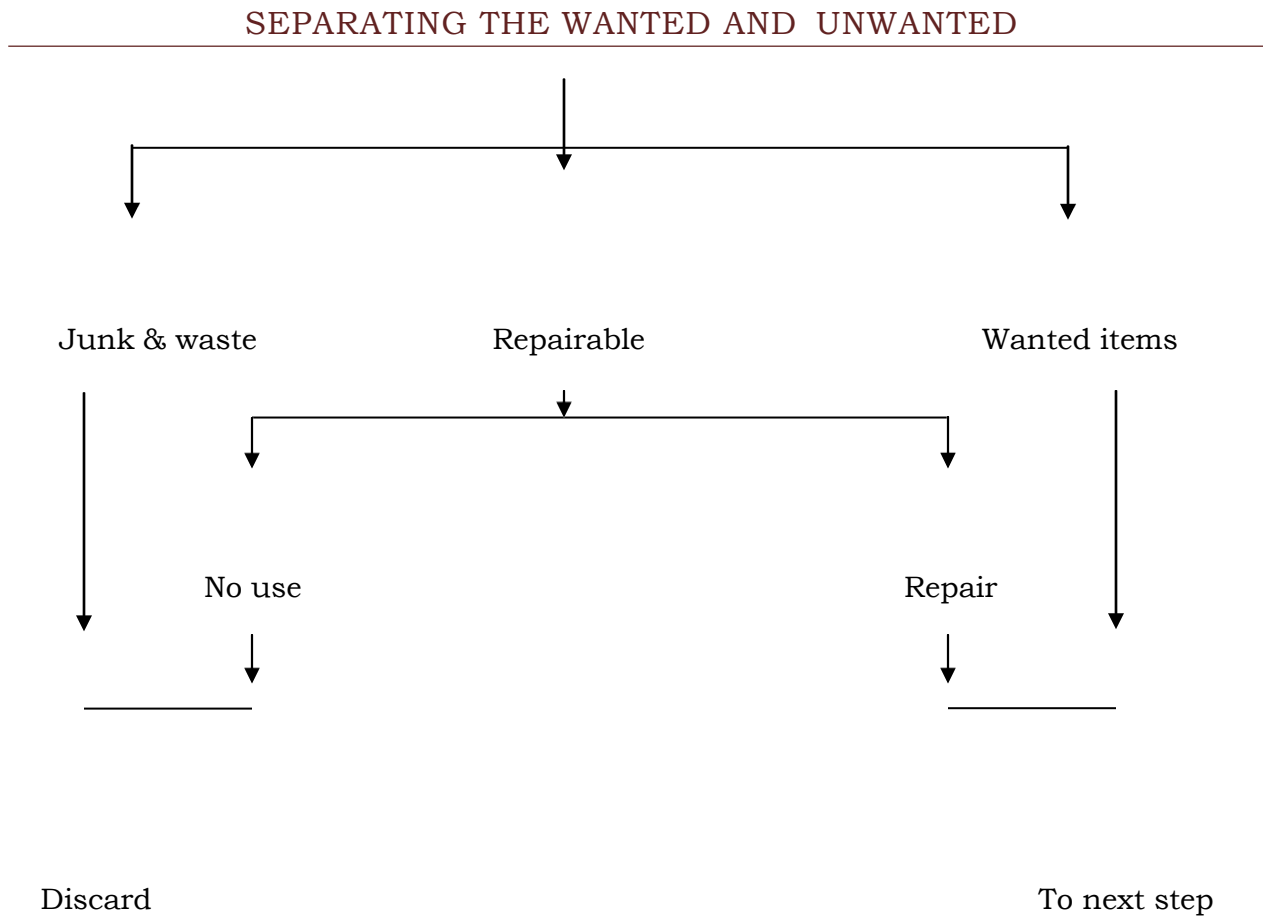
Office

- ◆ Used / Broken pens
- ◆ Useless paper
- ◆ Old diaries
- ◆ Broken furnitures

Home

- ◆ Broken toys
- ◆ Old clothes
- ◆ Broken suitcases

Flow Chart :



Consequences of not practicing SEIRI :

- The unwanted clutters up the place and the wanted are hard to find.
- Every place can only hold so much.
- Clutter sometimes causes misidentification.

THE SECOND S : SEITON : ARRANGING

ARRANGE EVERYTHING IN PROPER ORDER SO THAT IT CAN BE
EASILY PICKED UP FOR USE.

Factory Floor

- ◆ Unlabelled tool crib
- ◆ Cluttered shelves
lockers etc.
- ◆ Stores – no clear
location system.
- ◆ Things on the floor

Office

- ◆ Unlabelled file cabinet
- ◆ Cluttered drawer,
shelves, book cases,
tables
- ◆ Records & documents
Not arranged well
- ◆ File heaps and papers

Home

- ◆ Clutter
- ◆ No orderly
arrangement in
the rooms

Consequences of not practicing SEITON :

- Things are seldom available when needed.
- Items are “lost” in stores.
- Items – defectives and good ones get mixed up.
- Accidents or near-accidents occur due to clutter.
- Visual control of the shop floor is not possible.

- Sometimes, production is lost because an item required is available but cannot be found.
- In some offices, Critical Excise records or tax records may not be traceable. This can lead to finance loss, prosecution or embarrassment.

THE THIRD S : SEISO : SWEEPING

SWEEP YOUR WORKPLACE THOROUGHLY SO THAT THERE IS NO DUST ANYWHERE.

Factory Floor

- ◆ Dirty machines
- ◆ Dust on product parts, R.Mtls.
- ◆ Dirty jigs, fixtures
- ◆ Dirty walls, roofs
- ◆ Littered floor

Office

- ◆ Dirty table & furniture
- ◆ Dirty office equipments
- ◆ Littered floor
- ◆ Dirty windows

Home

- ◆ Dirty furniture, floor, window, grills, bookshelves.

Consequences of not practicing SEISO :

- Most machines are affected by dust & dirt and hence their performance may go down.
- Dust and dirt on products, materials, packing boxes etc. will affect either their performance quality or their aesthetic look.
- Unpleasant to work in.

THE FOURTH S : SEIKETSU : CLEANLINESS

WASHING WITH A STRONG OVERTONE OF KEEPING THINGS
DISINFECTED AS WELL AS FREE OF HAZARDOUS CHEMICALS.

Factory Floor

- ◆ Handling hazardous chemicals
- ◆ Control of fumes, hazardous dust.
- ◆ Disinfecting, Personal hygiene

Office

- ◆ Free of pests
- ◆ Personal hygiene

Home

- ◆ Pest control
- ◆ Personal hygiene

Consequences of not practicing SEIKETSU :

- Good health and safety require the practice of Seiketsu.
- Hazardous chemicals, dusty chemicals, fumes etc. can make it a dangerous place to work in.
- Washing thoroughly and cleaning a place makes the workplace pleasant.
- Personal hygiene is essential for healthy workforce.

THE FIFTH S : SHITSUKI : DISCIPLINE

DISCIPLINE ESPECIALLY WITH REGARD TO SAFETY RULES AND

Consequences of not practicing SEIKETSU :

- If discipline is not practiced, then the first 4-S would backslide.
- Lack of Shitsuki means not following the standards. Then, all activities related to safety and quality will be affected.

IMPLEMENTING 5-S

1. Top Management resolve and training.
2. Formation of a top level team.
3. Understanding current circumstances.
4. Establishing priorities and targets.
5. Forming sub-teams and training.
6. Major cleaning.
7. Establishing improvement plans in each priority area.
8. Implementing the plan.
9. Verifying results.
10. Standardizing.
11. Establishing full control.
12. Looking for further improvements.

KAIZEN

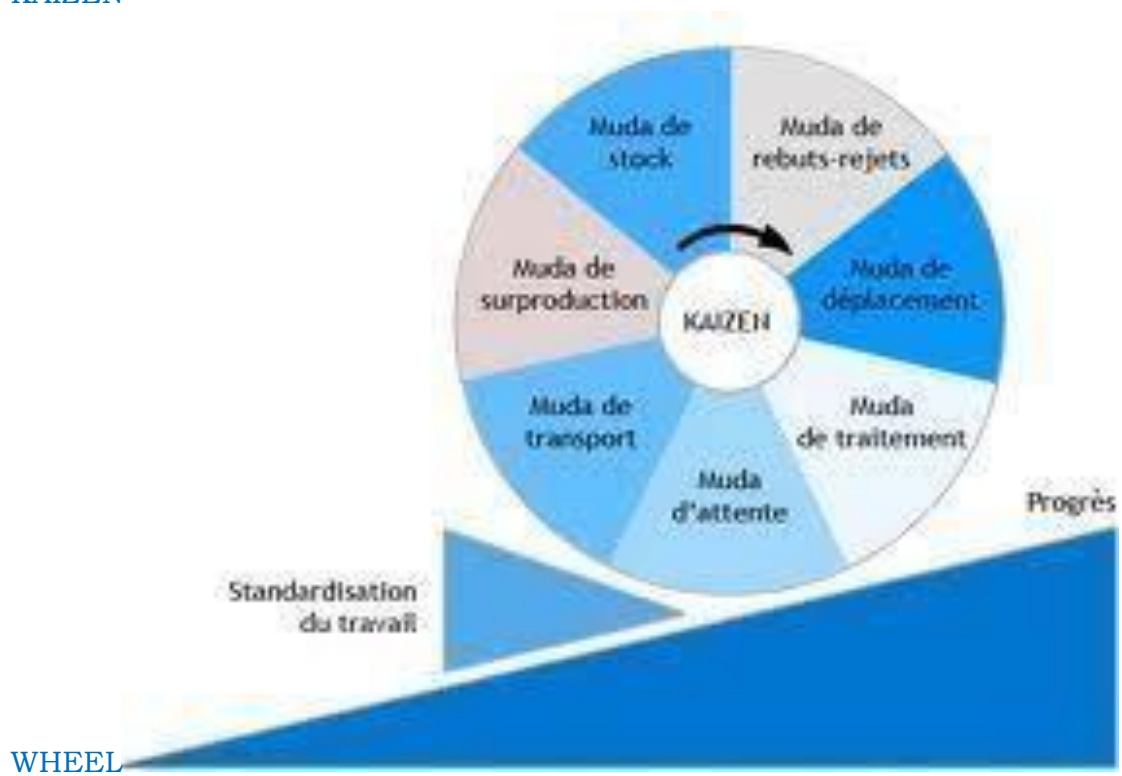
Kaizen is a Japanese word for the philosophy that defines management's roles in continuously encouraging and implementing small improvements involving everyone.

It focuses on simplification by breaking down complex processes into their sub-processes and then improving them.

The Kaizen improvement focuses on the use of :

- Value – added and non – value work activities.
- Muda, which refers to the seven classes of waste – over-production, delay, transportation, processing, inventory, wasted motion, and defective parts.
- Principles of motion study and the use of cell technology.
- Principles of materials handling and use of one – piece flow.
- Documentation of standard operating procedures.
- The five S's for workplace organization.
- Visual management.
- Just – in – time principles.
- Poka – Yoke.
- Team dynamics.

KAIZEN



RE-ENGINEERING

It is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical measures of performance.

SUPPLIER PARTNERSHIP



The suppliers should be treated as partners to achieve the same quality level as attained within the organization.

The following forces need Supplier Partnership to improve quality, reduce costs and increase market share.

- Deming Philosophy (Deming's 4th point)
- Just-in-time
- Continuous process improvement
- ISO 9000

CUSTOMER – SUPPLIER RELATIONS :

Dr. Kaoru Ishikawa has given ten principles of customer-supplier relations. They are

1. Both the customer and supplier are fully responsible for the control of quality.
2. Both the customer and supplier should be independent of each other.
3. The customer is responsible for providing the supplier with clear and sufficient requirements so that the customer can know precisely what to produce.
4. Both the customer and supplier should enter into a non-adversarial contract.
5. The supplier is responsible for providing the quality that will satisfy the customer.
6. Both the customer and supplier should decide the method to evaluate the quality of the product or services.
7. Both the customer and supplier should establish in the contract the method by which they can reach an amicable settlement in case of any dispute.
8. Both the customers and supplier should continually exchange information.
9. Both the customer and supplier should perform business activities.
10. Both the customer and supplier should have the best interest of the end user in mind.

PARTNERING

Partnering is a relationship between two or more parties based upon trust, dedication to common goals.

The benefits of partnering are

- Improved quality
- Increased efficiency
- Lower cost
- Increased opportunity for innovation
- Continuous improvement

The three key elements to a partnership relationship are

- Long term commitment
- Trust
- Shared Vision

SOURCING

The three types of sourcing are

- Sole sourcing
- Multiple sourcing
- Single sourcing

SUPPLIER SELECTION

The suppliers should be selected with the following ten conditions

1. The supplier should understand clearly the management philosophy of the organization.
2. The supplier should have stable management system.
3. The supplier should maintain high technical standards.
4. The supplier should provide the raw materials and parts which meet quality specifications required by the purchaser.
5. The supplier should have the required capability in terms of production.
6. The supplier should not leak out the corporate secrets.
7. The supplier should quote right price and should meet the delivery schedule. The supplier should be accessible with respect to transportation and communication.
8. The supplier should be sincere in implementing the contract provisions.
9. The supplier should have an effective quality system such as ISO / QS 9000.
10. The supplier should be renowned for customer satisfaction.

SUPPLIER CERTIFICATION :

A certified supplier is one which, after extensive investigation, is found to supply material of such quality that is not necessary to perform routine testing.

The Eight criteria for supplier certification are

1. No product related lot rejections for atleast 1 year.
2. No non-product related rejections for atleast 6 months.
3. No production related negative incidents for atleast 6 months.
4. Should have passed a recent on-site quality system evaluation.
5. Having a fully agreed specifications.

6. Fully documented process and quality system.
7. Timely copies of inspection and test data.
8. Process that is stable and in control.

SUPPLIER RATING :

Supplier Rating is done

- To obtain an overall rating of supplier performance.
- To communicate with suppliers regarding their performance.
- To provide each supplier with a detailed and true record of problems for corrective action.
- To enhance the relationship between the buyer and the supplier.

RELATIONSHIP DEVELOPMENT :

For establishment of supplier relationship, the following are necessary.

- (a) Partnering
- (b) Supplier selection
- (c) Principles of customer / supplier relations
- (d) Certification
- (e) Periodic rating

For relationship development, the following are necessary.

- (a) Inspection
 - 100% inspection
 - Sampling
 - Audit

- Identity check
- (b) Training
- (c) Teams
- (d) Recognition and Reward

PERFORMANCE MEASURES

Performance measures are required for the managers for managing an organization perfectly.

Performance measures are used to achieve the following objectives.

- To establish performance measures and reveal trend.
- To identify the processes to be improved.
- To determine the process gains and losses.
- To compare the actual performance with standard performance.
- To provide information for individual and team evaluation.
- To determine overall performance of the organization.
- To provide information for making proper decisions.

WHAT SHOULD BE MEASURED?

HUMAN RESOURCES

1. Lost time due to accidents, absenteeism.
2. Employee turnover.
3. Employee satisfaction index.
4. Training cost per employee.
5. Number of grievances.

CUSTOMERS

1. Number of complaints from customers.
2. Number of on-time deliveries.
3. Warranty data.
4. Dealer satisfaction.

PRODUCTION

2. Inventory.
3. SPC Charts.
4. Amount of scrap / rework.
5. Machine down time.

RESEARCH AND DEVELOPMENT

2. New product time to market.
3. Design change orders.
4. Cost estimating errors.

SUPPLIERS

2. On-time delivery.
3. Service rating.
4. Quality performance.
5. Average lead time.

MARKETING / SALES

2. Sales expense to revenue.
3. New product sales to total sales.
4. New customers.

ADMINISTRATION

1. Revenue per employee.
2. Purchase order error.
3. Billing accuracy.
4. Cost of poor quality.

STRATEGY :

The quality council has the overall responsibility for the performance measures. It ensures that all the measures are integrated into a total system of measures.

A typical system contains the following function

- Quality
- Cost
- Flexibility
- Reliability
- Innovation

PERFORMANCE MEASURE PRESENTATION :

There are six basic techniques for presenting performance measures. They are

1. Time series graph.

2. Control charts.
3. Capability Index.
4. Taguchi's loss function.
5. Cost of poor quality.
6. Malcolm Baldrige National Quality Award.

In MBNQA, five categories are analyzed. They are

- a) Manufacturing
- b) Service
- c) Small business
- d) Health care
- e) Education

Module - II

TQM PRINCIPLES

PART – A

1. What is a mission statement?
2. What is a vision statement?
3. What are the important factors that influenced purchases?
4. Give the need for a feedback in an organization?
5. List the tools used for feedback?
6. What are the activities to be done using customer complaints?
7. What are the elements of customer service?
8. Define Customer Retention?
9. Define Employee Involvement?

10. State Maslow" s Hierarchy ofNeeds?
11. State Frederick Herzberg" s Two-factortheory?
12. What does an employee want?
13. What are the concepts to achieve a motivated work force?
14. Define Empowerment?
15. What are the three conditions necessary to create the empowered environment?
16. What are the types of teams?
17. What are the characteristics of successful teams?
18. What are the decision-making methods?
19. What are the stages of team development?
20. Give some common team problems?
21. What are the common barriers to team progress?
22. Give the steps involved in training process?
23. Define Recognition and Reward?
24. What are the types of appraisal formats?
25. What are the benefits of employee involvement?
26. What are the basic ways for a continuous process improvement?
27. What are the three components of the Juran Trilogy?
28. What are the steps in the PDSA cycle?
29. What are the phases of a Continuous Process Improvement Cycle?
30. Define 5S?
31. What is a Kaizen?
32. What are the three key elements to a partnering relationship?
33. What are the three types of sourcing?
34. What are the ten conditions for the selection and evaluation of suppliers?
35. What are the characteristics used to measure the performance of a particular process?
36. Give the six basic techniques for presenting performance measures?

37. Give the usage of an effective recognition and reward system?
38. How will you improve the performance appraisal system?
39. What are the typical measurements frequently asked by managers and teams?

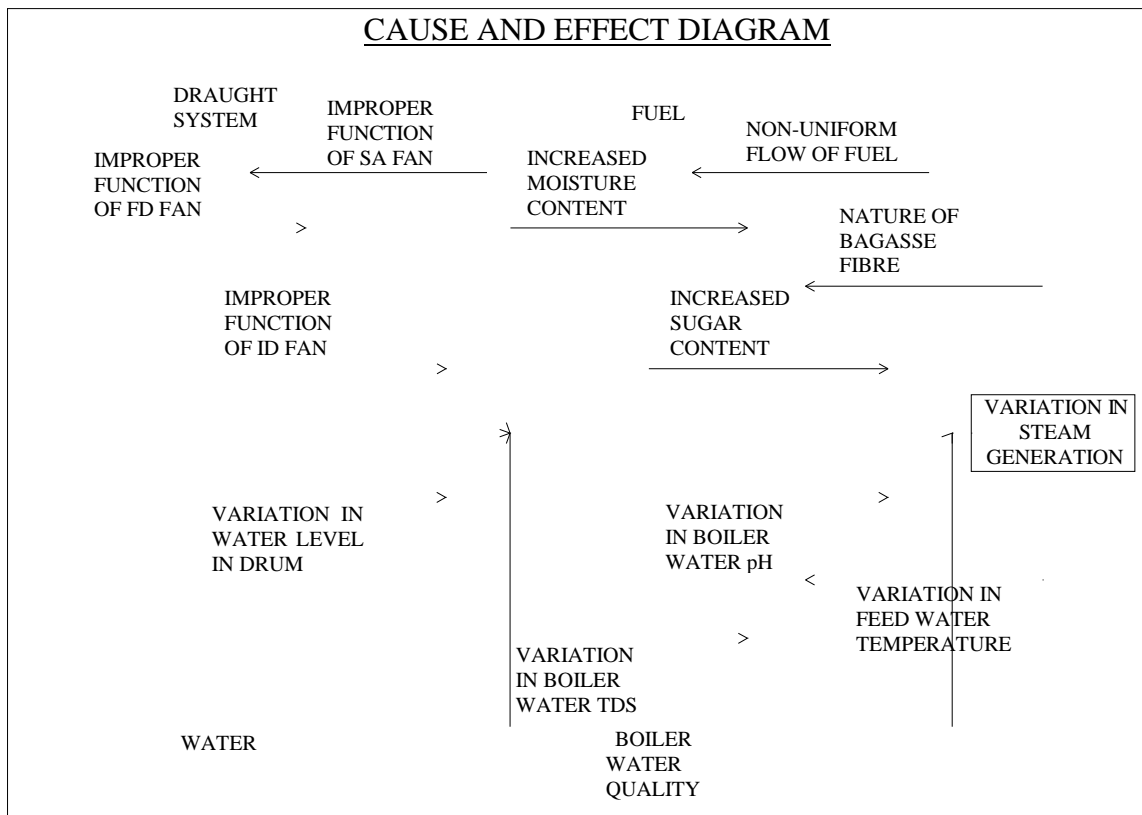
PART – B

1. Explain Juran trilogy for Continuous Process Improvement? (16)
2. Explain the PDCA cycle? (16)
3. Explain Kaizen principle? (16)
4. Explain how the employee will be involved in doing a process? (16)

T Q M T O O L S (S E V E N T O O L S O F Q U A L I T Y)

1. PARETO DIAGRAM

2. FLOW DIAGRAM



3. CAUSE AND EFFECT DIAGRAM

STEPS IN CONSTRUCTING A CAUSE & EFFECT DIAGRAM :

- a. Define the problem or effect to be analyzed.
- b. Form the team to perform the analysis. Often the team will uncover potential causes through brainstorming.
- c. Draw the effect box and the centerline.

- d. Specify the major potential cause categories and join them as boxes connected to the centerline.
- e. Identify the possible causes and classify them into the categories in step d. Create new categories, if necessary.
- f. Rank order the causes to identify those that seem most likely to impact the problem.
- g. Take corrective action.

4. CHECK SHEETS

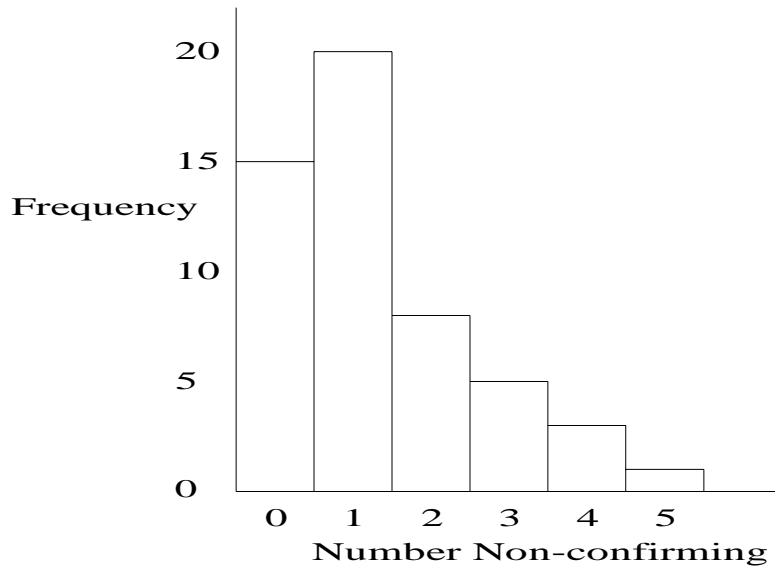
CHECK SHEET						
Product : Bicycle						
Nonconformity Type	Check					Total

Blister	III	III	III	III	I	21
Light spray		III	III	III		15
Drips		III	III	III	III	25
Others		III	III	III	III	25
-----TOTAL						86

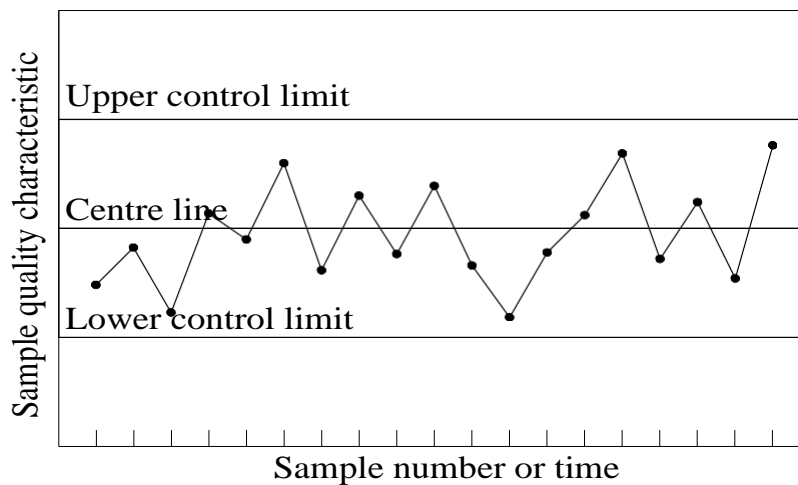
5. HISTOGRAM

NUMBER OF ERRORS								TALLY OF NUMBER OF ERRORS			
								ERRORS			

0	1	3	0	1	0	1	0	Number Non	Tabulation	Freq.	
1	5	4	1	2	1	2	0	-conforming			
1	0	2	0	0	2	0	1	-----			
2	1	1	1	2	1	1		0	III III III	15	
0	4	1	3	1	1	1		1	III III III III	20	
1	3	4	0	0	0	0		2	III III	8	
1	3	0	1	2	2	3		3	III	5	
-----								4	III	3	
								5	I	1	



6. CONTROL CHARTS



A typical control chart

7. SCATTER DIAGRAM

In scatter diagram, three types of co-relations exist.

1. Positive correlation.
2. Negative correlation.
3. No correlation.

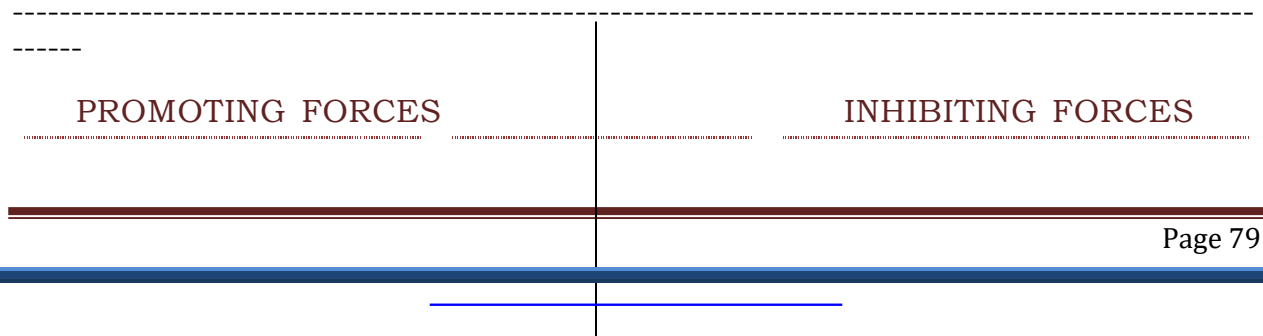
NEW MANAGEMENT TOOLS

1. WHY, WHY

2. FORCED FIELD ANALYSIS

- Define the objective.
- Determine criteria for evaluating the effectiveness of the improvement action.
- Brainstorm the forces.
- Prioritize the forces from greatest to least.
- Take action.

Objective : Stop Smoking



Poor Health

Habit

Smelly Clothing

Addiction

Poor Example

Taste

Cost

Stress

Impact on Others

Advertisement

3. NOMINAL GROUP TECHNIQUE

4. AFFINITY DIAGRAM

5. INTER-RELATIONSHIP DIGRAPH

6. TREE DIAGRAM

7. MATRIX DIAGRAM

8. PRIORITIZATION MATRICES

9. PROCESS DECISION PROGRAM CHART

10. ACTIVITY NETWORK DIAGRAM

STATISTICAL FUNDAMENTALS

Statistics is defined as the science that deals with the collection, tabulation, analysis, interpretation and presentation of quantitative data.

Data collected for quality control purposes are obtained by direct observation and are classified as

1. Variables (Measurable quality characteristics like length measured in metres)
2. Attributes (Quality characteristic which are classified as either **conforming** (or) **non-conforming** to specifications, such as “go & no-go” gauge.

MEASURES OF CENTRAL TENDENCY AND DISPERSION

There are two important analytical methods of describing a collection of data as

1. Measures of central tendency.
2. Measures of dispersion.

A measure of central tendency of a distribution is a numerical value that describes how the data tend to build up in the centre. There are three measures in quality as

1. Average
2. Median
3. Mode

Average is the sum of observations divided by the number of observations.

$$\text{Average} = \bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

where, n = number of observations
 X_i = observed value

Median is the value which divides a series of ordered observations so that the number of items above it is equal to the number of items below it.

Mode is the value which occurs with the greatest frequency in a set of numbers. Mode can again be classified as

- No mode
- Uni mode
- Bi mode
- Multimode

Measure of dispersion describes how the data are spread out on each side of the central value.

The two measures of dispersion are

1. Range
2. Standard Deviation

Range is the difference between the largest and smallest values of observations in a series of numbers.

$$\text{Range} = R = X_h - X_l$$

Where,	R	=	Range
	X_h	=	highest observation in a series
	X_l	=	lowest observation in a series

Standard Deviation measures the spreading tendency of the data. Larger the standard deviation, greater the variability of data.

$$S = \frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1}$$

where S = sample standard deviation

X_i = observed value

n = number of observations

POPULATION AND SAMPLE

In order to construct a frequency distribution of the outer diameter of shafts, a small portion (or) sample is selected to represent all the shafts. The population is the whole collection of shafts.

The population may be an hour's production, a week's production, 10000 pieces and so on.

It is not possible to measure all of the population. Hence, we go for sampling. Sampling becomes necessary

1. When it is impossible to measure the entire population.
2. When it is more expensive to observe all the data.
3. When the required inspection destroys the product.
4. When a test of the entire population may be too dangerous as in the case of new medical drug.

—

- X is for sample average or sample mean.
 μ is for population mean.
S is for sample standard deviation.
 σ is for population standard deviation.

NORMAL CURVE

Normal curve is common type of population. The normal curve is symmetrical, unimodal, bell – shaped distribution with the mean, median and mode all having the same value.

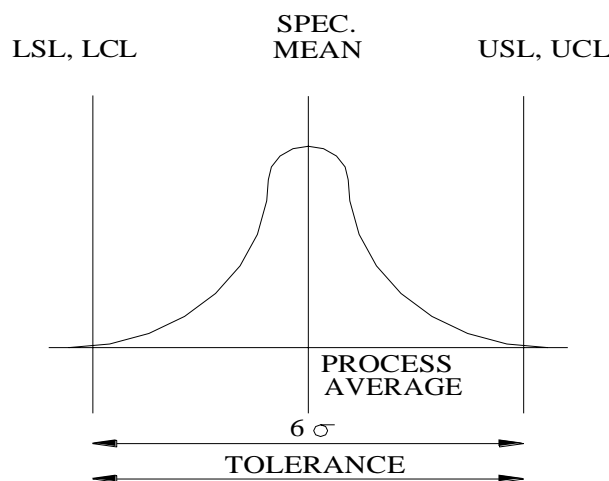


Figure 3.2 : Normal curve tolerance limits

CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES

Variation is a law of nature because no two natural items in any category are the same. Variations are due to the following reasons.

1. Chance causes or Natural causes.
2. Assignable causes.

Chance causes of variation are inevitable. Chance causes affect almost every production process and are inherent in the process. They are purely random, unidentifiable sources of variations.

Hence, when only chance causes are present in a process, the process is said to be in Statistical Control.

Assignable causes result in unnatural variations. The sources of variations may be due to

- Equipments
- Materials
- Environment
- Operator etc.

The **Control chart** is used to look at variations, seek assignable causes and chance causes. The control chart is a line chart with control limits.

All control charts have three basic components.

1. A centre line, usually the mathematical average of all the samples plotted.
2. Upper and Lower Control Limits that define the constraints of common cause variations.
3. Performance data plotted over time.

A typical control chart is a graphic display of a quality characteristic that has been measured or computed from a **sample** versus **sample number** or **time**. If the process

is in control, nearly all of the sample points will fall between **Upper Control Limit (UCL)** and **Lower Control Limit (LCL)**.

CONTROL CHART FOR VARIABLES

1. Mean chart – X chart & Range Chart – R Chart

$$\bar{X} = \frac{\sum X}{N}$$

Where, N = Total number of observations.

$$R = \frac{\sum R}{N}$$

n = Sample size (for finding out the value of A_2 and D_4 and D_3 from the table)

Control limits for the charts are given by the following equation.

<u>X – CHART</u>		<u>R - CHART</u>	
CL	$= \bar{X}$	CL	$= \bar{R}$
	$\pm A_2 \bar{R}$		$\pm D_4 \bar{R}$

$$UCL_{\bar{X}} = \bar{X} + A_2 \cdot R$$

$$UCL_R = D_4 \cdot R$$

$$LCL_{\bar{X}} = \bar{X} - A_2 \cdot R$$

$$LCL_R = D_3 \cdot R$$

2. Mean chart – X chart & Standard Deviation chart – S Chart

$$\bar{X} = \frac{\sum X}{N}$$

Where, N = Total number of observations.

$$S = \frac{\sum S}{N}$$

n = Sample size (for finding out the value of A_3 and B_4 and B_3 from the table)

Control limits for the charts are given by the following equation.

X – CHART

$$CL = \bar{X}$$

$$UCL_{\bar{X}} = \bar{X} + A_3 \cdot S$$

S - CHART

$$CL = S$$

$$UCL_S = B_4 \cdot S$$

$$LCL_{\bar{X}} = \bar{X} - A_3 \cdot S$$

$$LCL_s = B_3 \cdot S$$

CONTROL CHART FOR ATTRIBUTES

1. p chart
2. np chart
3. c chart
4. u chart

PROCESS CAPABILITY INDEX (C_P , C_{PK})

These calculators compute the process capability index which shows the process potential of meeting the specifications. Enter the process parameters and specifications in one of the following tables, depending on whether you have a double-sided or single-sided specification

POPULATION AND SAMPLE

- ✓ The major use of inferential statistics is to use information from a **sample** to infer something about a **population**.
- ✓ A **population** is a collection of data whose properties are analyzed. The population is the *complete* collection to be studied, it contains *all* subjects of interest.
- ✓ A **sample** is a *part* of the population of interest, a sub-collection selected from a population

Population: the universal set of all objects under study.

Sample: Any subset of the population.

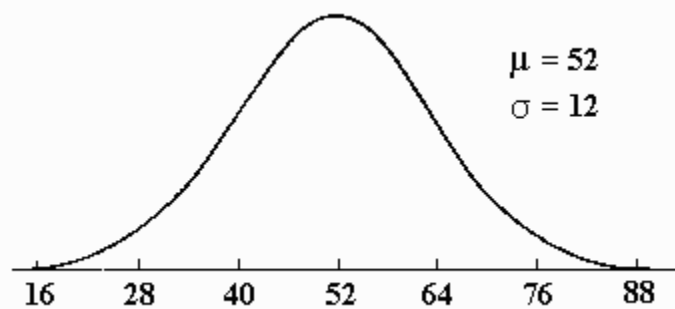
NORMAL CURVE

As discussed in the previous chapter, the normal curve is one of a number of possible models of probability distributions. Because it is widely used and an important theoretical tool, it is given special status as a separate chapter.

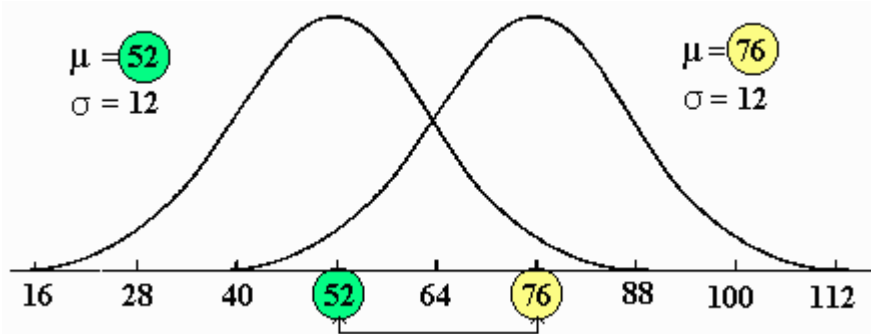
The normal curve is not a single curve, rather it is an infinite number of possible curves, all described by the same algebraic expression:

$$p(X) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-(X-\mu)^2}{2\sigma^2}}$$

DRAWING A MEMBER OF THE FAMILY OF NORMAL CURVES



DIFFERENCES IN MEMBERS OF THE FAMILY OF NORMAL CURVES



THE SIX STEPS TO SIX SIGMA.

STEP #1 - IDENTIFY THE PRODUCT YOU CREATE OR THE SERVICE YOU PROVIDE

In other words ... WHAT DO YOU DO?

STEP #2 - IDENTIFY THE CUSTOMER(S) FOR YOUR PRODUCT OR SERVICE, AND DETERMINE WHAT THEY CONSIDER IMPORTANT I.E.
CUSTOMER REQUIREMENTS

In other words ... WHO USES YOUR PRODUCT AND SERVICES?

STEP #3 - IDENTIFY YOUR NEEDS (TO PROVIDE PRODUCT/SERVICE SO THAT IT SATISFIES THE CUSTOMER)

In other words ... WHAT DO YOU NEED TO DO YOUR WORK?

STEP #4 - DEFINE THE PROCESS FOR DOING YOUR WORK

In other words ... HOW DO YOU DO YOUR WORK?

STEP #5 - MISTAKE-PROOF THE PROCESS AND ELIMINATE WASTED EFFORTS USING...

In other words ... HOW CAN YOU DO YOUR WORK BETTER?

Step #6 - Ensure continuous improvement by measuring, analyzing and controlling the improved process using control charts

Module- IV

STATISTICS PROCESS CONTROL

PART – A

- 1 Define Statistics?
2. What is a measure of central tendency?
3. What is Measures of dispersion?
4. What is a normal curve?
5. What is the use of the control chart?
6. Give the objectives of the attribute charts?
7. Define Six Sigma Problem Solving Method?
8. What are the new seven management tools?
9. Give the seven tools of quality?
10. Give the usage of C&E diagrams?
11. Define Six Sigma?
12. What are the various histogram shapes?
13. Differentiate Population & Sample?
14. Give the sources of variation?
15. Define Run chart?
16. Define Control chart?
17. What are the various patterns of scatter diagrams?
18. What is the procedure for constructing the tree diagram?
19. Give at least five standard formats of matrix diagram?
20. What are the benefits of an activity network diagram?

PART – B

1. Explain the QC or SPC tools? (16)
2. Explain the Seven Management Tools? (16)
3. Plot the control chart for variables and attributes (16)
4. Explain the concepts of Six Sigma? (16)

Module 5 – T Q M T O O L S

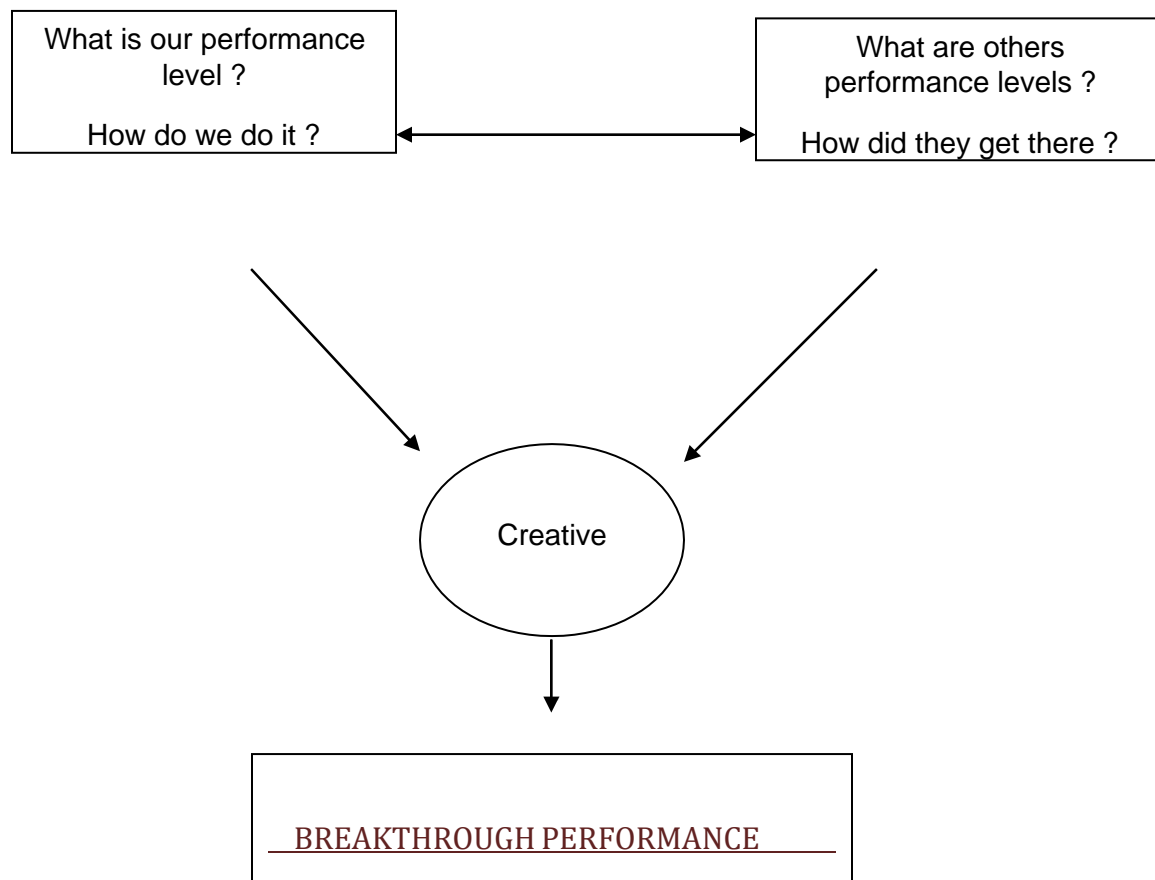


BENCHMARKING

Benchmarking is a systematic method by which organizations can measure themselves against the best industry practices.

- Benchmarking is a systematic search for the best practices, innovative ideas, and highly effective operating procedures.

BENCHMARKING CONCEPT



REASONS TO BENCHMARK :

- It is a tool to achieve business and competitive objectives
- It can inspire managers (and Organizations) to compete
- It is time and cost effective
- It constantly scans the external environment to improve the process
- Potential and useful technological breakthroughs can be located and adopted early

PROCESS OF BENCHMARKING

The following six steps contain the core techniques of Benchmarking

1. Decide what to benchmark

- Benchmarking can be applied to any business or production process
- The strategy is usually expressed in terms of mission and vision statements
- Best to begin with the mission and critical factors
- Choosing the scope of the Benchmarking study
- Pareto analysis – what process to investigate
- Cause and Effect diagram – for tracing outputs back
-

2. Understand current performance

- Understand and document the current process
- Those working in the process are the most capable of identifying and correcting problems
- While documenting, it is important to quantify
- Care should be taken during accounting information

3. Plan

- A benchmarking team should be chosen
- Organizations to serve as the benchmark need to be identified
- Time frame should be agreed upon for each of the benchmarking tasks

There are three types of benchmarking

- a. Internal
- b. Competitive
- c. Process

4. Study Others

Benchmarking studies look for two types of information

- How best the processes are practiced
- Measurable results of these practices

Three techniques for conducting the research are

- Questionnaires
- Site visits
- Focus groups

5. Learn from the data

Answering a series of questions like

- Is there a gap between the organization" s performance and the performance of the best-in-class organizations?

- What is the gap? How much is it?
- Why is there a gap? What does the best-in-class do differently that is better?
- If best-in-class practices were adopted, what would be the resulting improvement?

Benchmarking studies can reveal three different outcomes

- Negative gap
- Parity
- Positive gap

6. Using the findings

The objective is to close the gap. For this

- Findings must be communicated to the people within the organization
- Action plans must be developed to implement new processes

Groups that must agree on the change

- Process owners
- Upper management

Steps for the development and execution of action plans are

1. Specify tasks
2. Sequence tasks
3. Determine resources needs
4. Establish task schedule
5. Assign responsibility for each task
6. Describe expected results
7. Specify methods for monitoring results

PITFALLS AND CRITICISMS OF BENCHMARKING :

- Idea of copying others
- It is not a cure or a business philosophy
- Some process have to be benchmarked repeatedly
- It is not a substitute for innovation

QUALITY FUNCTION DEPLOYMENT

- Quality Function Deployment is a planning tool used to fulfill customer expectations.
- Quality Function Deployment focuses on customer expectations or requirements, often referred to as voice of the customer.

QFD TEAM :

There are two types of teams namely

1. Team for designing a new product
3. Team for improving an existing product

BENEFITS OF QFD :

1. Improves Customer satisfaction

- Creates focus on customer requirements
- Uses competitive information effectively
- Prioritizes resources
- Identifies items that can be acted upon

2. Reduces Implementation Time

- Decreases midstream design changes
- Limits post introduction problems
- Avoids future development redundancies

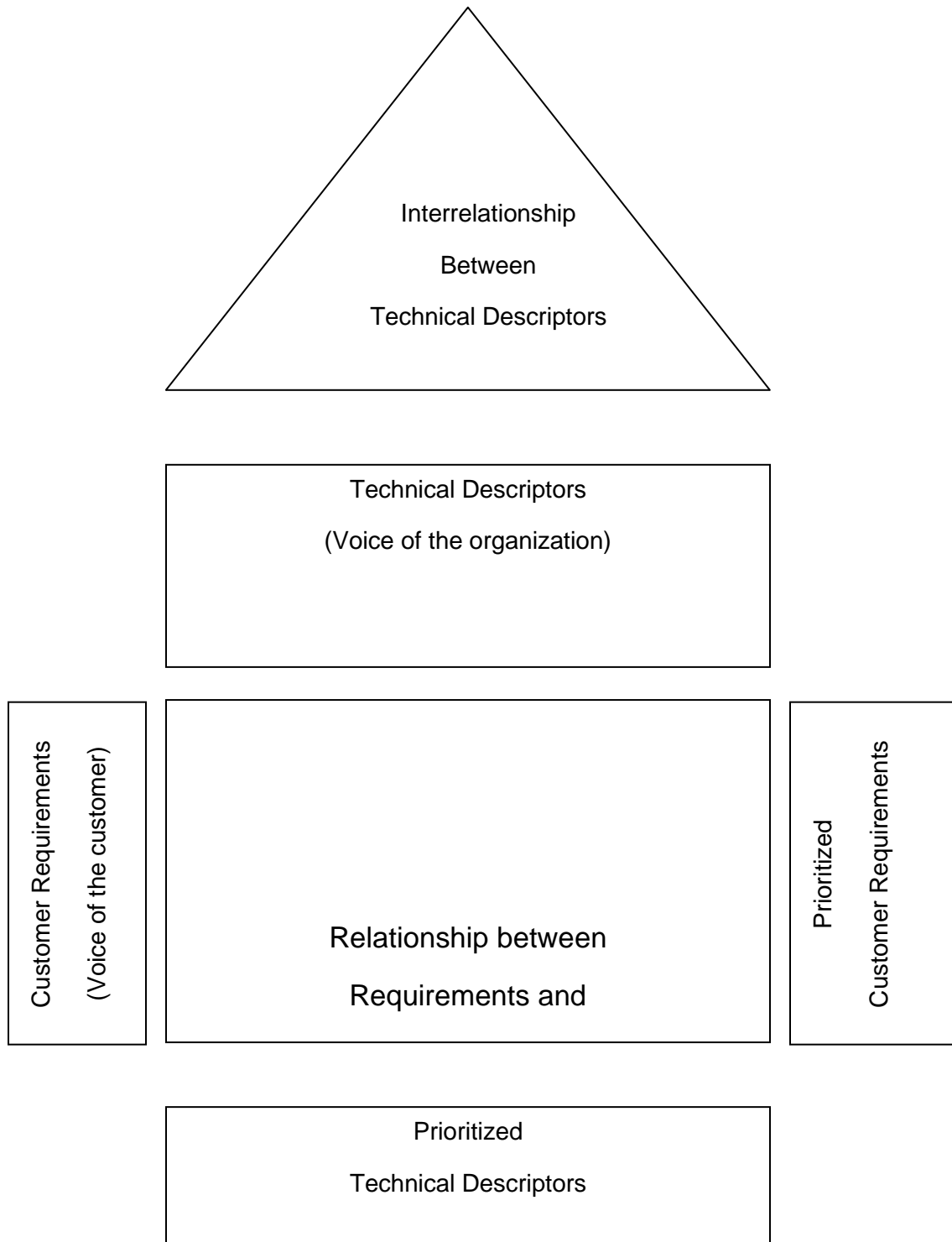
3. Promotes Team Work

- Based on consensus
- Creates communication
- Identifies actions

4. Provides Documentation

- Documents rationale for design
- Adds structure to the information
- Adapts to changes (a living document)

HOUSE OF QUALITY :



THE STEPS IN BUILDING A HOUSE OF QUALITY ARE :

1. List Customer Requirements (WHAT's)
2. List Technical Descriptors (HOW's)
3. Develop a Relationship Matrix Between WHAT" s and HOW" s
4. Develop an Inter-relationship Matrix between HOW" s
5. Competitive Assessments
 - a. Customer Competitive Assessments
 - b. Technical Competitive Assessments
6. Develop Prioritized Customer Requirements
7. Develop Prioritized Technical Descriptors

TAGUCHI'S QUALITY LOSS FUNCTION

Taguchi' s Quality Loss Function concept combines cost, target and variation in one metric with specifications being of secondary importance.

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 ideal performance and harmful side effects.

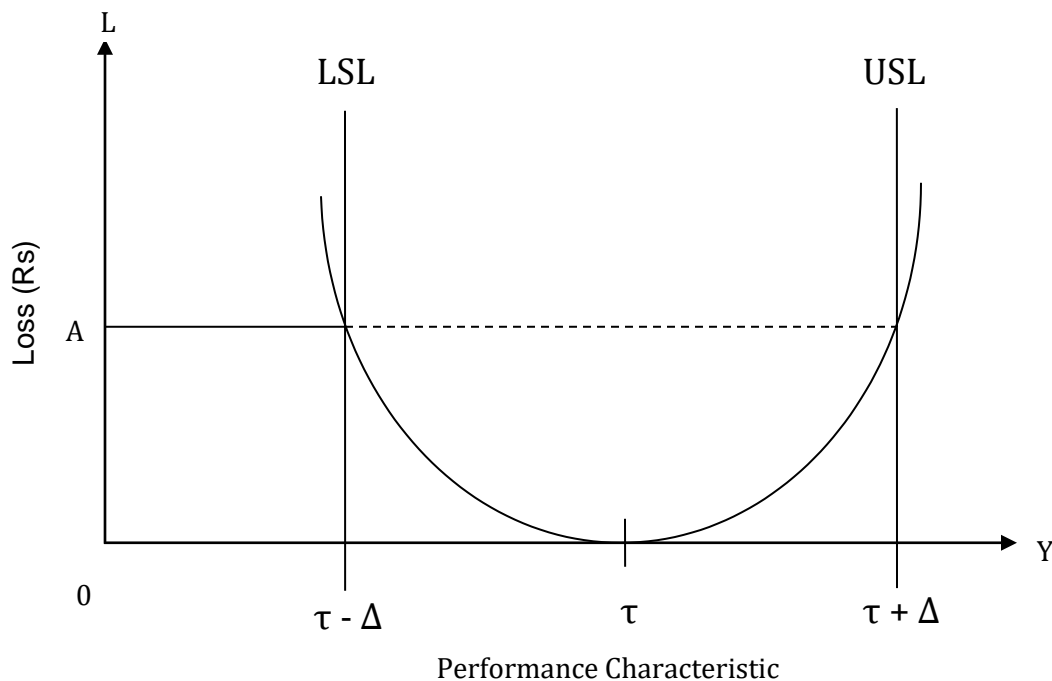
- **CUSTOMERS PERCEIVE QUALITY AS MEETING THE TARGET RATHER THAN JUST MEETING THE SPECIFICATIONS.**

There are three common quality loss functions

1. Nominal - the - best.
2. Smaller - the - better.
3. Larger - the - better.

NOMINAL – THE – BEST :

Although Taguchi developed so many loss functions, many situations are approximated by the quadratic function which is called the **Nominal – the – best** type.



Quadratic Loss Function

The quadratic function is shown in figure. In this situation, the loss occurs as soon as the performance characteristic, y , departs from the target τ .

At τ , the loss is Rs. 0.

At LSL (or) USL, the loss is Rs. A.

The quadratic loss function is described by the equation $L = k (y - \tau)^2$.

Where,

L = cost incurred as quality deviates from the target.

y = Performance characteristic

τ = target

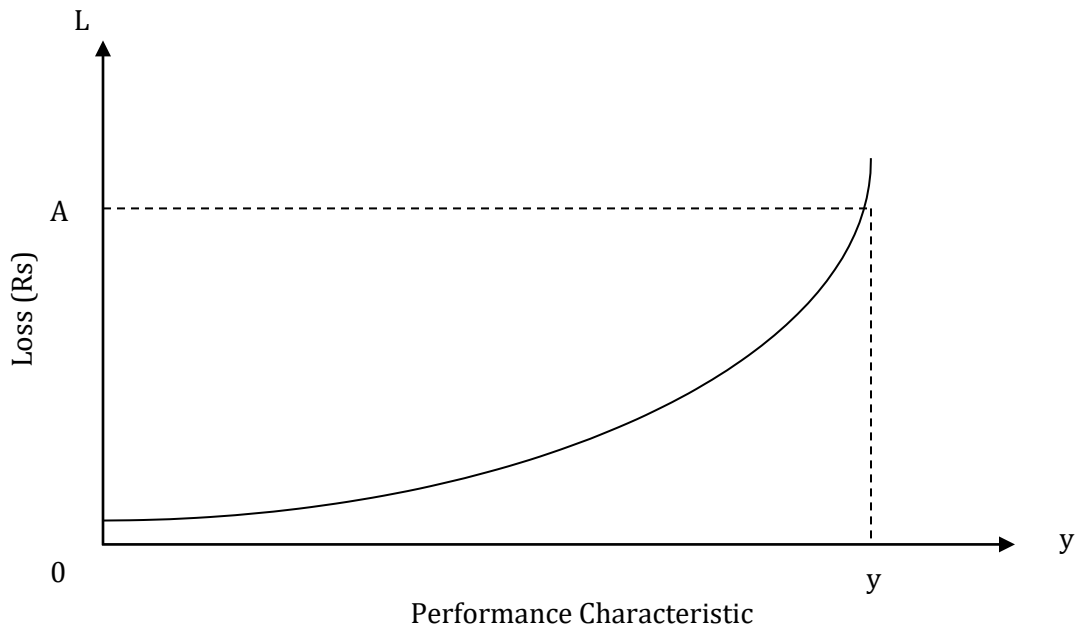
k = Quality loss coefficient.

The loss coefficient is determined by setting $\Delta = (y - \tau)$, the deviation from the target. When Δ is the USL (or) LSL, the loss to the customer of repairing (or) discarding the product is Rs. A.

Thus,

$$K = A / (y - \tau)^2 = A / \Delta^2 .$$

SMALLER – THE – BETTER :



The following figure shows the smaller – the – better concept.

Smaller-the-better

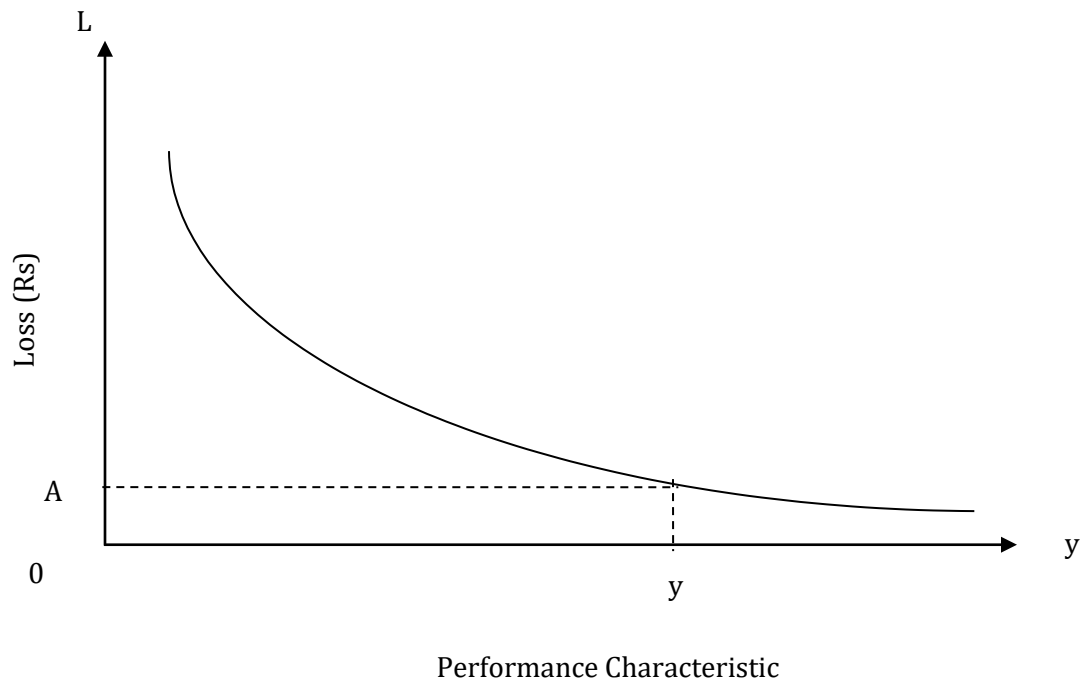
The target

value for **smaller – the – better** is 0. There are no negative values for the performance characteristic.

The radiation leakage from a microwave appliance, the response time for a computer, pollution from an automobile, out of round for a hole etc. are the performance characteristics for this concept.

LARGER – THE – BETTER :

The following figure shows the concept of the Larger – the – better.



In the Larger – the – better concept, the target value is ∞ (infinity), which

gives a **zero loss**. There are no negative values and the worst case is at $y = 0$. Actually, larger – the – better is the reciprocal of smaller – the – better. The performance characteristics in Larger – the – better are bond strength of adhesives, welding strength etc.

TOTAL PRODUCTIVE MAINTENANCE (TPM)

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 lubrication on the equipment to keep it running.

OBJECTIVES OF TPM :

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

TPM PHILOSOPHY – CONCEPT OF TPM :

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

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.

Loss measurements to identify improvement needs are

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

5. Performance goals should be formulated.

6. An implementation plan should be developed.

7. Autonomous work groups should be established.

FAILURE MODE AND EFFECTS ANALYSIS

FMEA is an analytical technique that combines the technology and experience of people in identifying foreseeable failure modes of a product or process and planning for its elimination.

It is a group of activities comprising the following :

1. Recognize the potential failure of a product or process.
2. Identify actions that eliminate / reduce the potential failure.
3. Document the process.

Two important types of FMEA are

- Design FMEA
- Process FMEA

INTENT OF FMEA :

- Continually measuring the reliability of a machine, product or process.
- To detect the potential product - related failure mode.
- FMEA evaluation to be conducted immediately following the design phase.

BENEFITS OF FMEA:

- Having a systematic review of components failure modes to ensure that any failure produces minimal damage.
- Determining the effects of any failure on other items.

- Providing input data for exchange studies.
- Determining how the high-failure rate components can be adapted to high-reliability components.
- Eliminating / minimizing the adverse effects that failures could generate.
- Helping uncover the misjudgements, errors etc.
- Reduce development time and cost of manufacturing.

FMEA TEAM :

Engineers from

- | | | | | |
|------------|-----------------|-------------|-----------|---|
| - Assembly | - Manufacturing | - Materials | - Quality | - |
| Service | - Supplier | - Customer | | |

FMEA DOCUMENTATION :

The purpose of FMEA documentation is

- To allow all involved Engineers to have access to others thoughts
- To design and manufacture using these collective thoughts (promotes team approach)

UNIT- V

TQM TOOLS

PART – A

1. Define Benchmarking?
2. Enumerate the steps to benchmark?
3. What are the types of benchmarking?
4. What is a QFD?
5. What are the benefits of QFD?
6. What are the steps required to construct an affinity diagram?
7. What are the parts of house of quality?
8. How will you build a house of quality?
- 9 .Define FMEA?
10. What are the stages of FMEA?
11. What are the goals of TPM?
12. Give the seven basic steps to get an organization started toward TPM?
13. What are the major loss areas?
14. What are the generic steps for the development and execution of action plans in benchmarking?
15. What are the phases of QFD process?
16. What are the several types of FMEA?
17. Define TPM?

PART – B

1. Explain the Bench marking Process and reasons to Benchmark? (16)
2. Explain the QFD process? (16)
3. Explain the House of Quality in Quality Function Deployment? (16)
4. What is FMEA? Explain the stages of FMEA? (16)