LECTURE NOTES

16MEC423A – TOTAL QUALITY MANAGEMENT

Course Educational Objectives:

CEO1: To understand the concepts of total quality management, and Contributions of TQM Gurus

CEO2: To learn TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.

CEO3: To study the basic need of quality control and process control in an organization

CEO4: To learn the traditional and modern TQM tools and techniques

CEO5: To study the quality standard, requirements and elements in Quality management system

UNIT – 1: INTRODUCTION

Introduction **–** Need for quality **–** Evolution of quality **–** Definition of quality **–** Dimensions of manufacturing and service quality **–** Basic concepts of TQM **–** Definition of TQM – TQM frame work **–** Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT – 2: TQM PRINCIPLES

Leadership – Strategic quality planning **–** Quality statements **–** Customer focus, customer orientation, customer satisfaction, customer complaints and customer retention **–** Employee involvement – Motivation – Empowerment **–** Team and teamwork **–** Recognition and reward **–** Performance appraisal **–** Continuous process improvement – PDSA cycle, 5s, Kaizen **–** Supplier partnership – Partnering, supplier selection and supplier rating.

UNIT – 3: QUALITY CONTROL

Control chart for attributes – Control chart for non-conforming – *p* chart and *np* chart – Control chart for nonconformities: C and U charts **–** Control chart for variables: X chart, R chart and σ chart **–** State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT – 4: TQM TOOLS AND TECHNIQUES

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector – Bench marking – Reason to bench mark **–** Bench marking process – FMEA – Stages – Types **–** Quality circles – Quality function development (QFD) – Taguchi quality loss function – TPM – Concepts **–** Improvement needs – Cost of quality – Performance measures.

UNIT – 5: QUALITY SYSTEMS

Need for ISO 9000 **–** ISO 9001-2008 Quality System **–** Elements, documentation, quality auditing **–** QS 9000 **–** ISO 14000 **–** Concepts, requirements and benefits **–** TQM implementation in manufacturing and service sectors.

Course Outcomes:

On successful completion of the course, Students will be able to		POs related to COs
CO1	Describe the concepts of total quality management, and Contributions of TQM Gurus	**PO1,PO8, PO12**
CO2	Understand the TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.	**PO1,PO8, PO9,PO12**
CO3	Illustrate the basic need of quality control and process control in an organization	**PO1,PO5,PO9,PO12**
CO4	Summarize the traditional and modern TQM tools and techniques	**PO1,PO2,PO12**
CO5	Realize the quality standard, requirements and elements in Quality management system	**PO1,PO8,PO12**

Text Books:

1. Total Quality Management, Dale.H.Besterfiled, 3/e, 2010, Pearson Education, New Delhi.
2. The Management and Control of Quality, James R.Evans and William M.Lindsay, 6/e, 2005, South-Western (Thomson Learning) Publications, New Delhi.

Reference Books:

1. Total Quality Management, Suganthi.L and Anand Samuel, 2006, Prentice Hall (India) Pvt. Ltd.
2. Total Quality Management-Text and Cases, Janakiraman. B and Gopal .R.K., 2006, Prentice Hall (India) Pvt. Ltd.
3. Introduction to Statistical Quality Control, Douglas.C. Montgomery, 7/e, 2012, John Wiley.
4. Quality Management, Kaniskha Bedi, 1/e, 2006, Oxford University Press, New Delhi.
5. TQM-Text with Cases, Oakland, J.S. Butterworth, 3/e, 2003, Oxford University Press, New Delhi.

Codes/Tables: Use of approved statistical table permitted in the examination.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	2	-	-	-	2
CO.2	3	-	-	-	-	-	-	2	2	-	-	2
CO.3	3	-	-	-	2	-	-	-	3	-	-	2
CO.4	3	2	-	-	-	-	-	-	-	-	-	2
CO.5	3	-	-	-	-	-	-	2	-	-	-	2
CO*	3	2	-	-	2	-	-	2	2.5	-	-	2

UNIT 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 same 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 prodect/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 of service.

ELEMENTS OF QUALITYCOST:-

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

ANALYSIS OF QUALITY COSTS:-

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

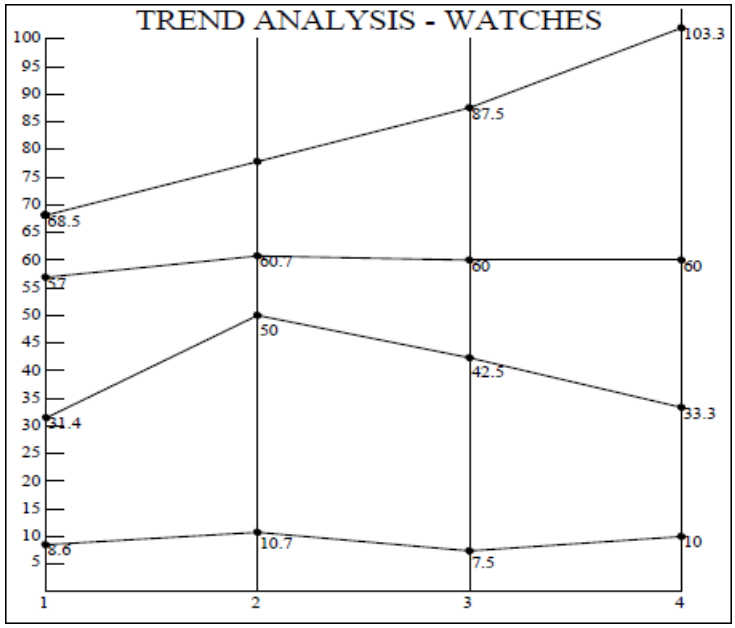
Cost Index in quarter t = (Cost in quarter t / Base period cost) x 100

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

TREND ANALYSIS :

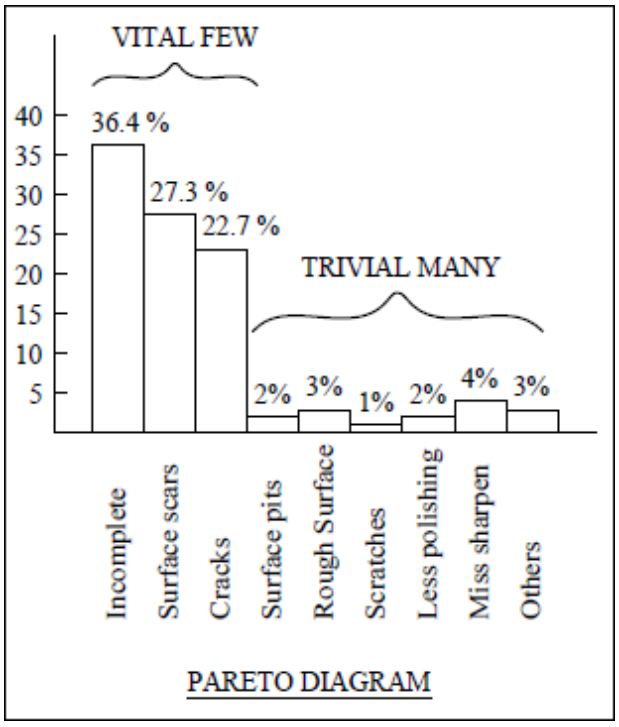
- Good visual aids are important communication tools.
- Graphs are particularly useful in presenting comparative results to management.

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.



PARETO DIAGRAM

BASIC CONCEPTS OF TOTAL QUALITY MANGEMENT:-

- T o p management committed to quality in all aspects C u s t o
- me r s focus of the organization
- Process focus and improvement
- Measurement of performance
- E mp l o ye e invalment and empowerment C o n t i
- n u o u s improvement
- B e n c h marking

- Supplier teaming
- Training of employees Inventory
- management Communication
- Quality cost.

PILLARS OF TQM:-

- Problem solving discipline Inter
- personal 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

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 Teamwork
- Working relationships
- Customer satisfaction
- Employee satisfaction
- Productivity
- Communication
- Profitability

- Market share 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.

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.

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 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 : in 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
2. Customer positioning
3. Predict the future
4. Gap analysis
5. Closing the gap
6. Alignment
7. Implementation

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

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.

UNIT II – TQM PRINCIPLES

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.

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

Customer complaints:-

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

1. Comment Card
2. Customer Questionnaire

		Highly Satisfied		Neutral		Highly Dissatisfied
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 analysis and interpretation

- Focus Groups
- These groups are very effective for gathering information on customer expectations and requirements.
- Toll – Free Telephone Numbers
- Customer Visits
- Report Card
- The Internet and Computers
- Employee Feedback

3. Mass Customization

USING CUSTOMER COMPLAINTS : 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 of view.
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.

LEADERSHIP

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.

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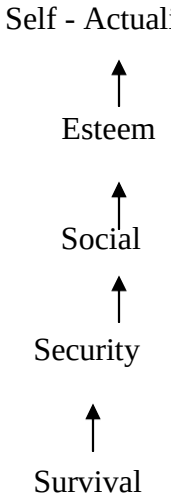
MOTIVATION :**MASLOW'S HIERARCHY OF NEEDS :**



EMPLOYEE WANTS :

---------- FACTOR

EMPLOYEE RATING MANAGER RATING

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 alearning 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 empowermentare Capability

- Alignment and Trust

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 :

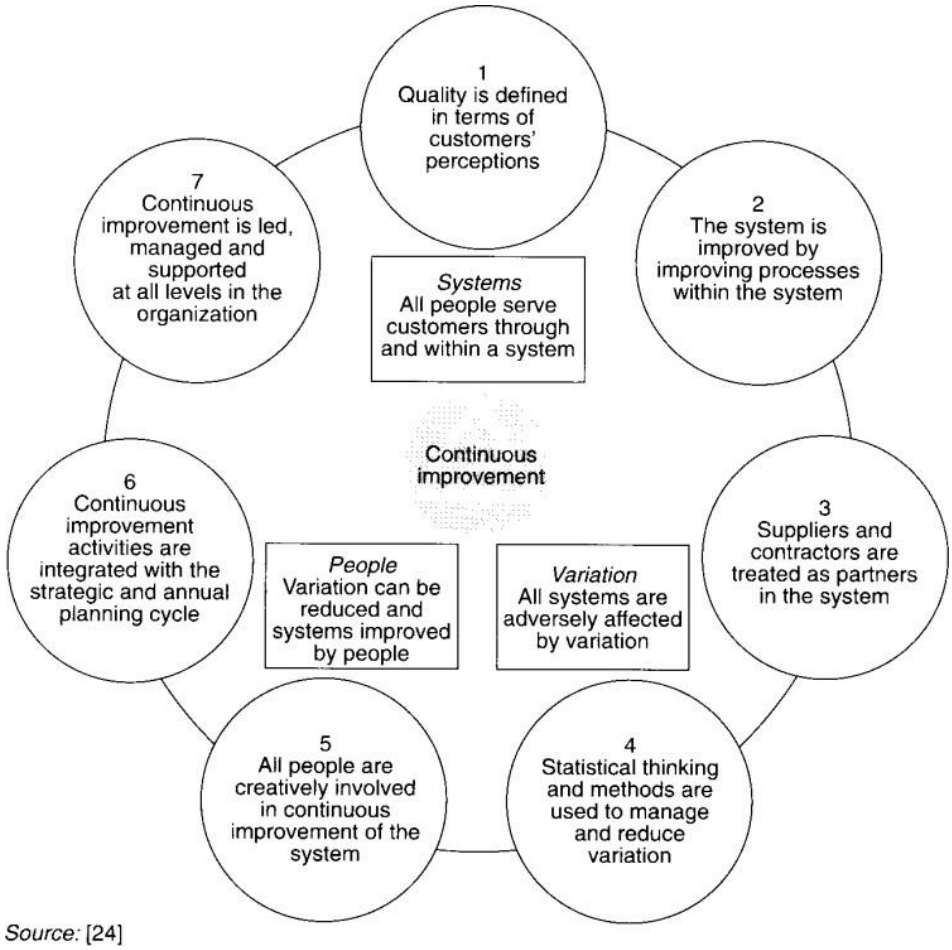
Employee involvement improves quality and increases productivity because

- Employees make better decisions using their expert knowledge of the process
- Employees are better able to spot and pin-point areas for improvement. te
- Employees are better able to take immedia 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.

- alue added activities.

- Eliminating non
- Eliminating non-conformities.

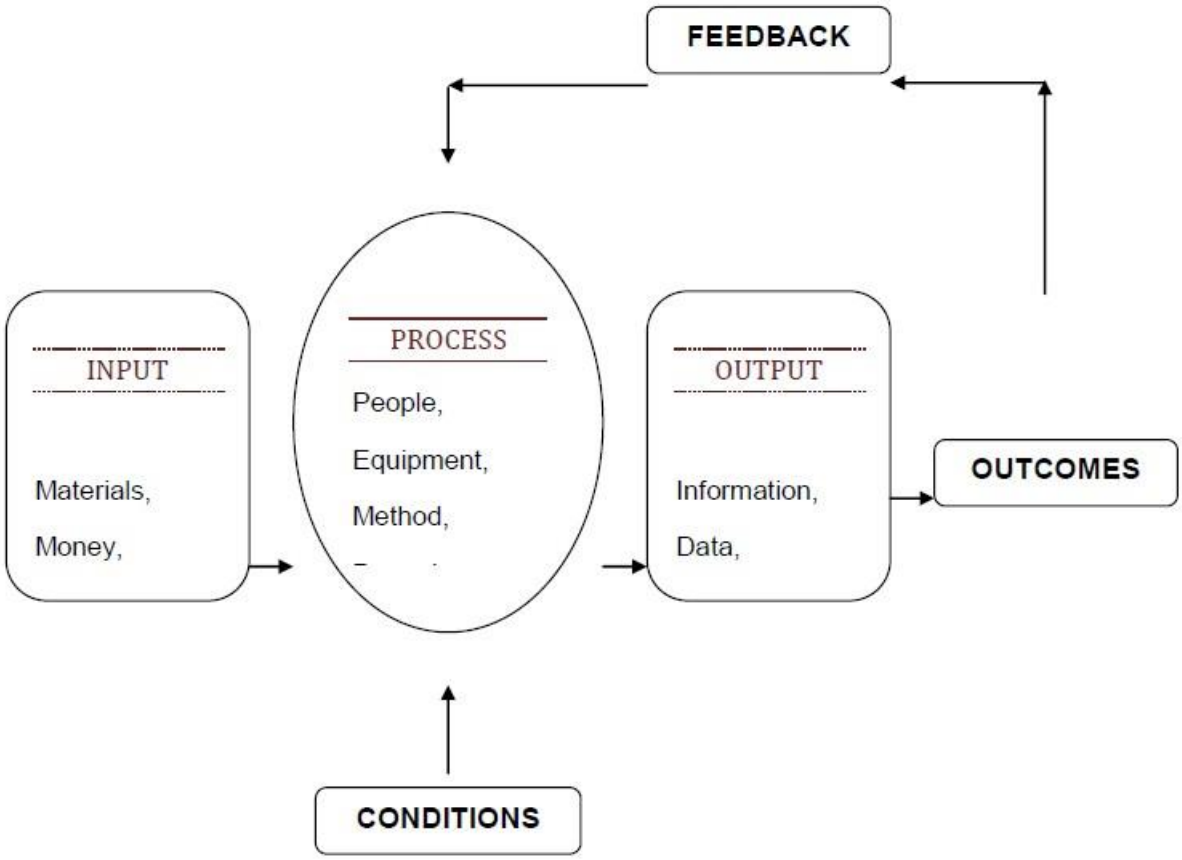
- Using Benchmarking.

- 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.

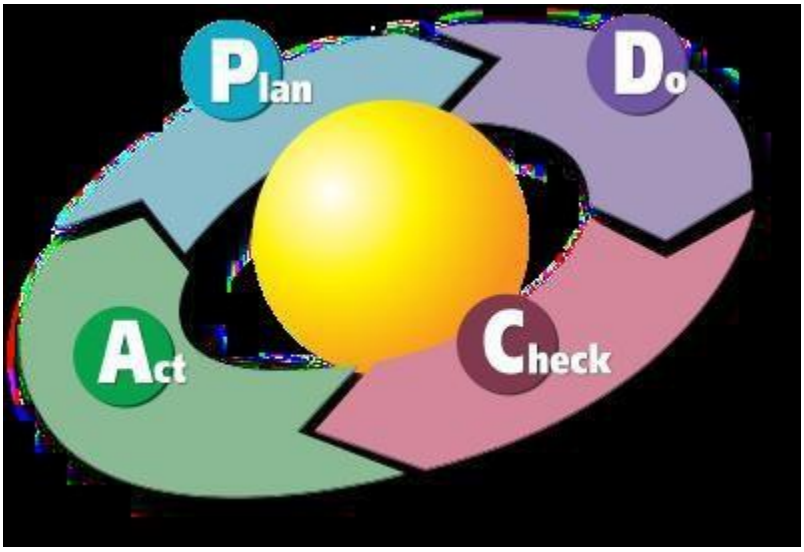
3. IMPROVEMENT

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 organiz ation.
- 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.

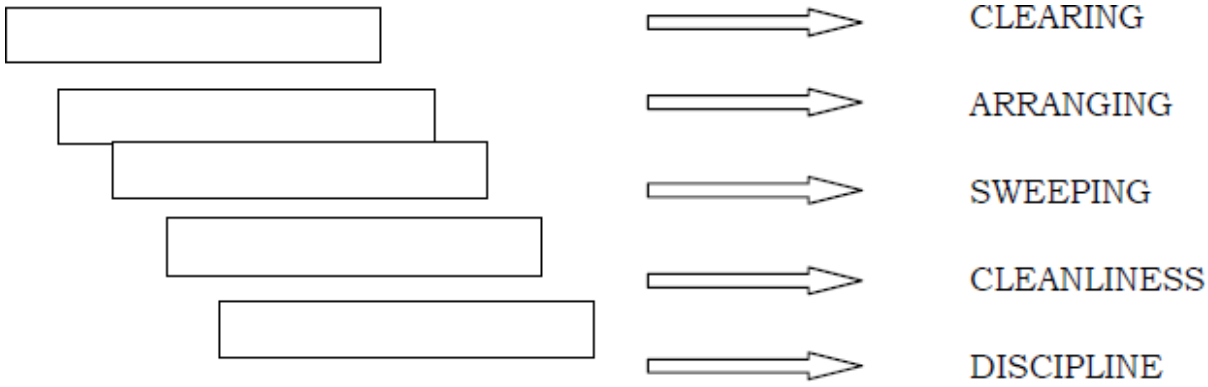
7. PLAN FOR THE FUTURE

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.

5-S : HOUSEKEEPING

5-S MEANS EVERYTHING IN ITS PLACE



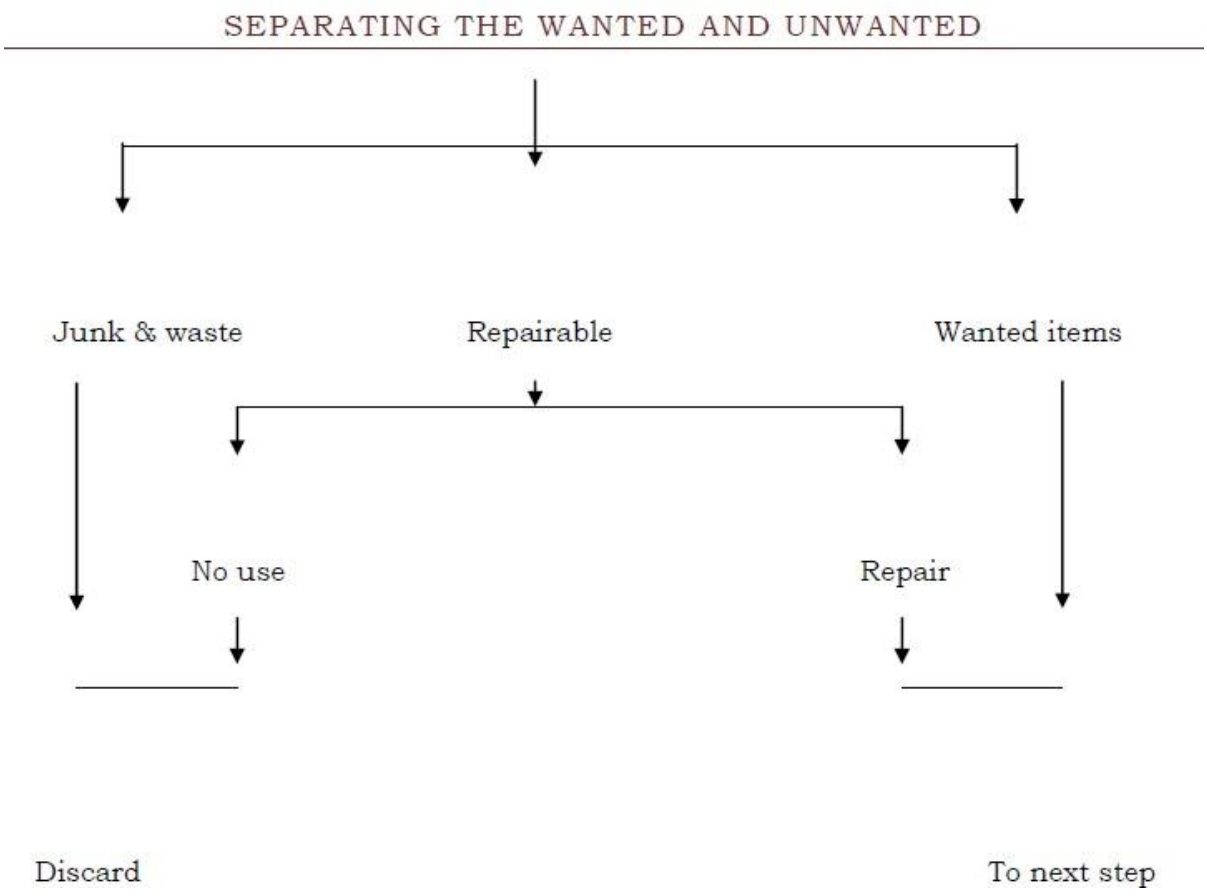
There can be no TQM without 5-S.

- A dirty factory cannot produce quality products.

- Clutter hides problems. A neat workplace promotes easy discovery of abnormalities.

The First S : SEIRI : CLEARING

Flow Chart :



IMPLEMENTING 5-S

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 progress 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 te chnology.
- Principles of materials handling and use of one – piece flow.
- Documentation of standard operating procedures

The five S‟ s for workplace organization.

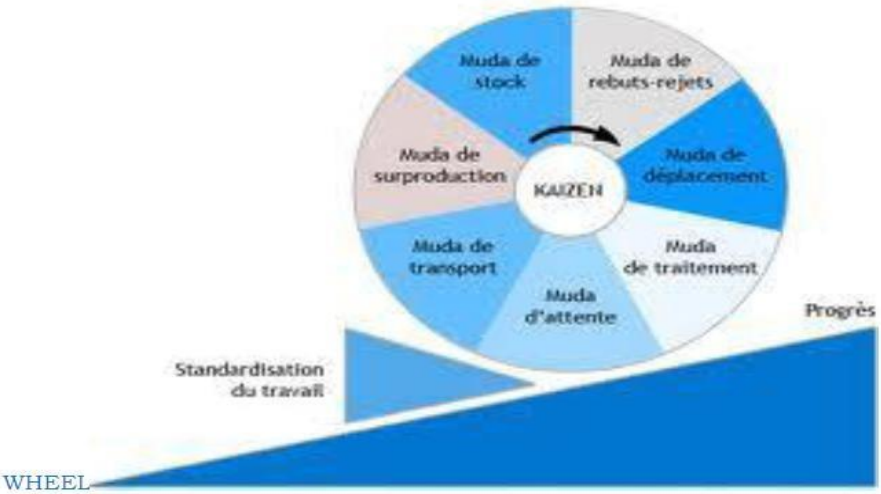
- Visual management.

- Just – in – time principles.

- Poka – Yoke.

- Team dynamics

KAIZEN



WHEEL

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

(b) Training
To
(c) Teams

(d) Recognition and Reward

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.

five categories are analyzed. They are

a) Manufacturing

b) Service

c) Small business

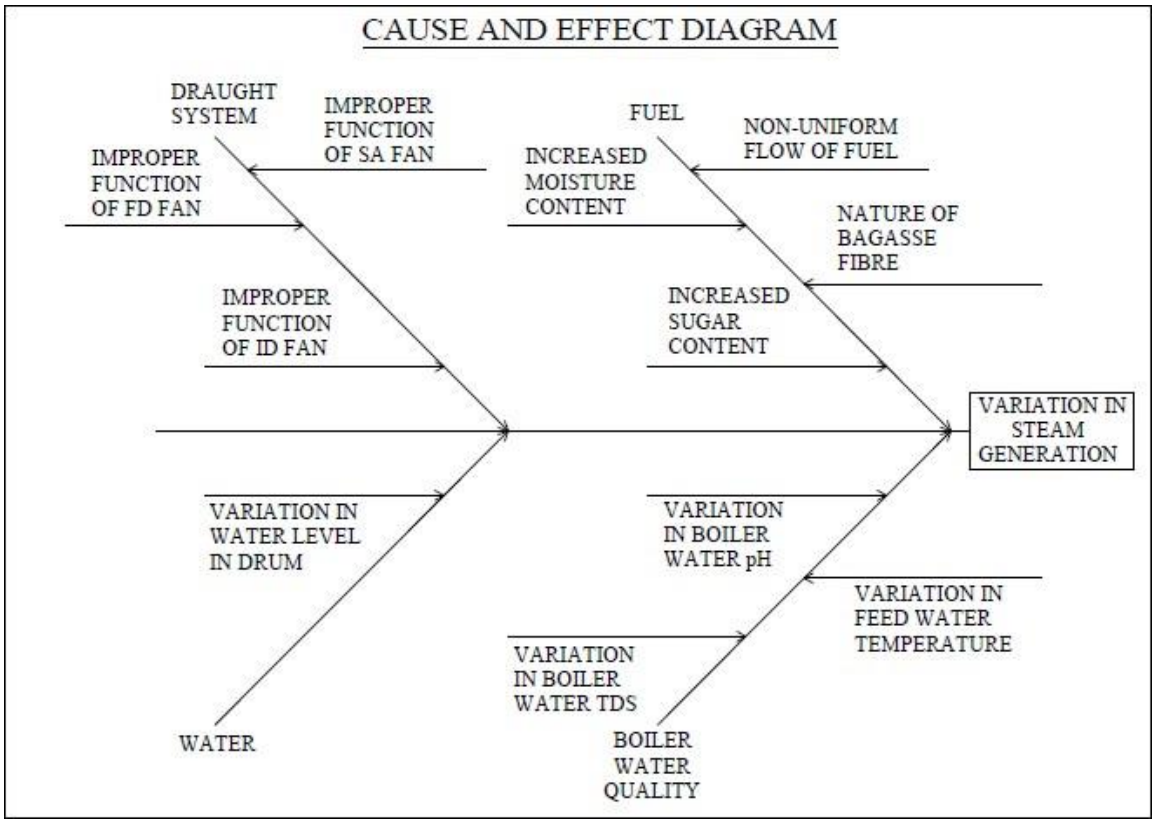
d) Health care

e) Education

UNIT III – QUALITY CONTROL

1. PARETO DIAGRAM

2. FLOW DIAGRAM



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

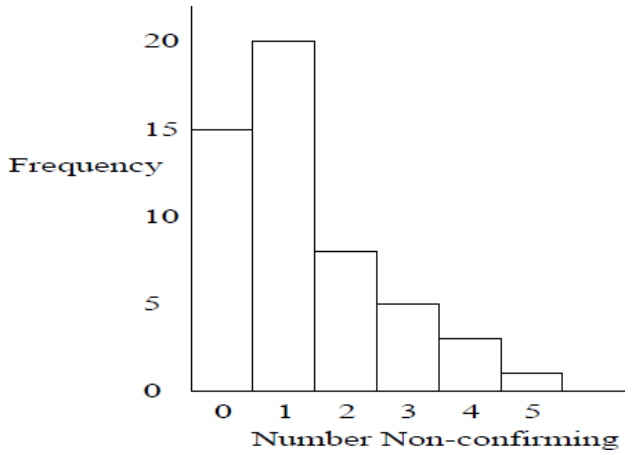
CHECK SHEET

Product : Bicycle

Nonconformity Type	Check	Total
Blister	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ I	21
Light spray	~~IIII~~ ~~IIII~~ ~~IIII~~	15
Drips	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~	25
Others	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~	25
	TOTAL	86

5. **HISTOGRAM**

NUMBER OF ERRORS								TALLY OF NUMBER OF ERRORS				
0	1	3	0	1	0	1	0	Number Non-conforming	Tabulation			Freq.
1	5	4	1	2	1	2	0					
1	0	2	0	0	2	0	1					
2	1	1	1	2	1	1		0	~~IIII~~ ~~IIII~~ ~~IIII~~			15
0	4	1	3	1	1	1		1	~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~			20
1	3	4	0	0	0	0		2	~~IIII~~ III			8
1	3	0	1	2	2	3		3	~~IIII~~			5
								4	III			3
								5	I			1



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

PROMOTING FORCES	INHIBITING FORCES
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.

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

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 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.

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.

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

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.

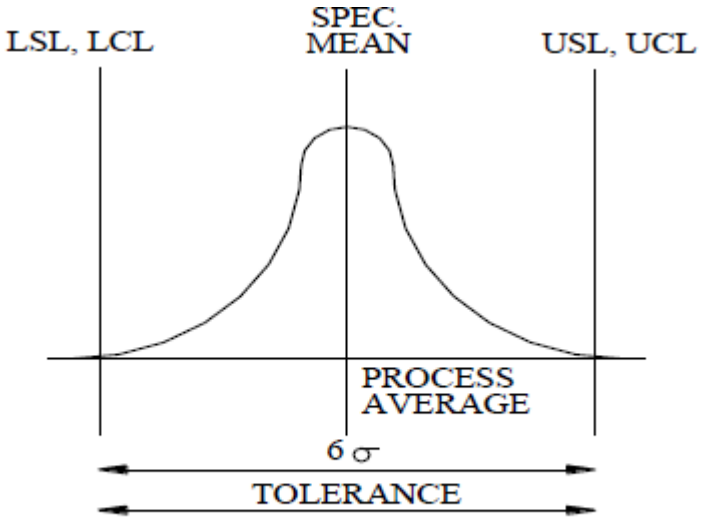


Figure 3.2 : Normal curve tolerance limits

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

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

$$\bar{R} = \frac{\Sigma R}{N}$$

Where, N = Total number of observations.

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.

X – CHART		**R - CHART**	
CL	$= \overline{\overline{X}}$	CL	$= \overline{R}$
$UCL_{\overline{X}}$	$= \overline{\overline{X}} + A_2 . \overline{R}$	UCL_R	$= D_4 . \overline{R}$
$LCL_{\overline{X}}$	$= \overline{\overline{X}} - A_2 . \overline{R}$	LCL_R	$= D_3 . \overline{R}$

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

$$\overline{\overline{X}} = \frac{\Sigma \overline{X}}{N}$$

$$\overline{S} = \frac{\Sigma S}{N}$$

Where, N = Total number of observations.

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		S - CHART	
CL	$= \overline{\overline{X}}$	CL	$= \overline{S}$
$UCL_{\overline{X}}$	$= \overline{\overline{X}} + A_3 . \overline{S}$	UCL_S	$= B_4 . \overline{S}$
$LCL_{\overline{X}}$	$= \overline{\overline{X}} - A_3 . \overline{S}$	LCL_S	$= B_3 . \overline{S}$

CONTROL CHART FOR ATTRIBUTES

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

PROCESS CAPABILITY INDEX (*CP*, *CPK*)

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.

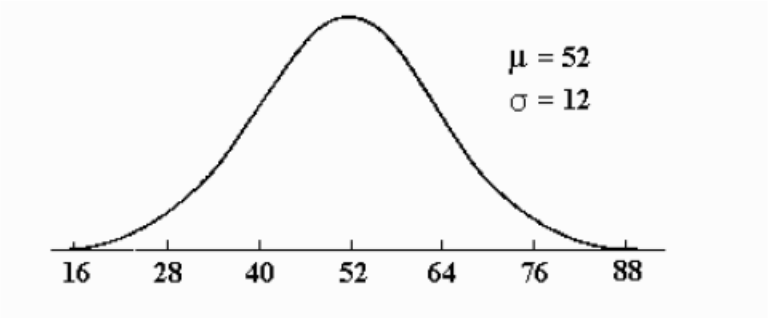
NORMAL CURVE

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.

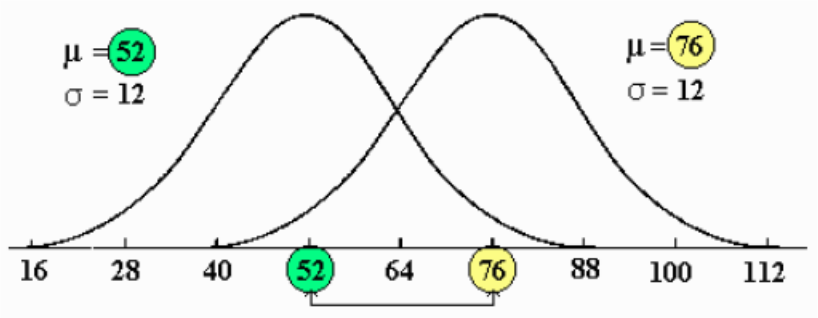
The normal curve is not a single curve, rather it is an infinite number of possible curves, all described by the same algebraic expression:

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

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...

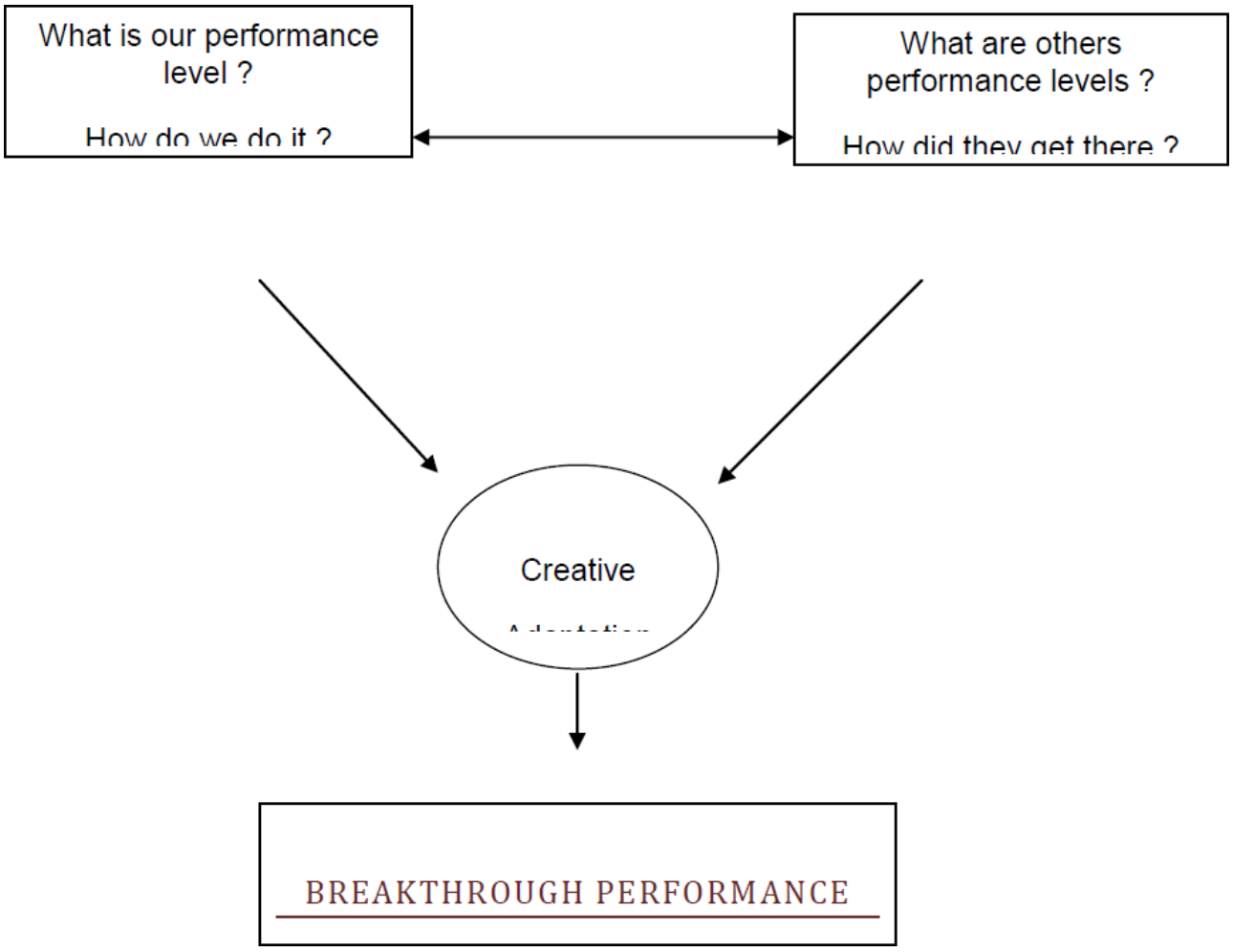
In other words ... HOW CAN YOU DO YOUR WORK BETTER?

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

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

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

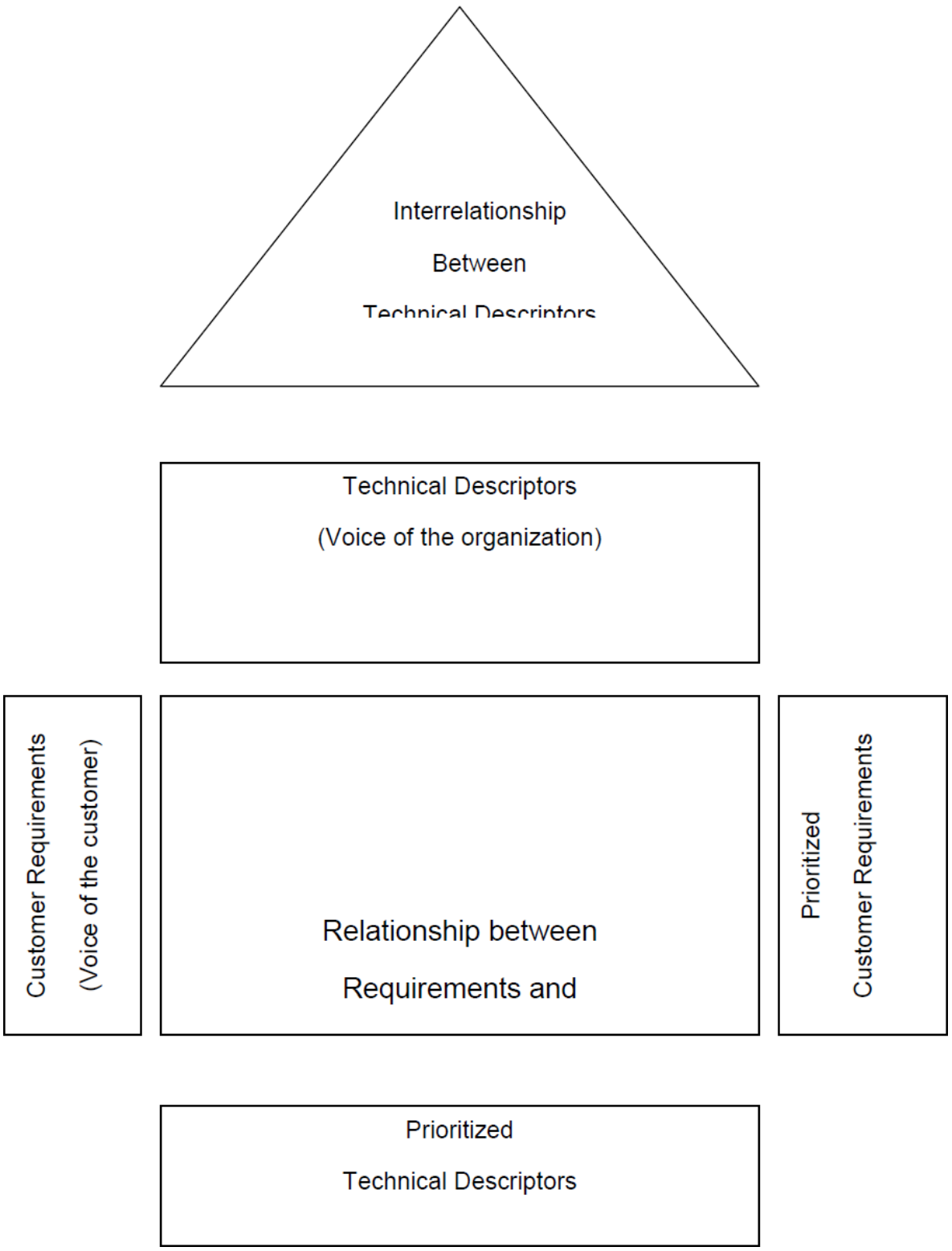
3. Promotes Team Work

- 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.

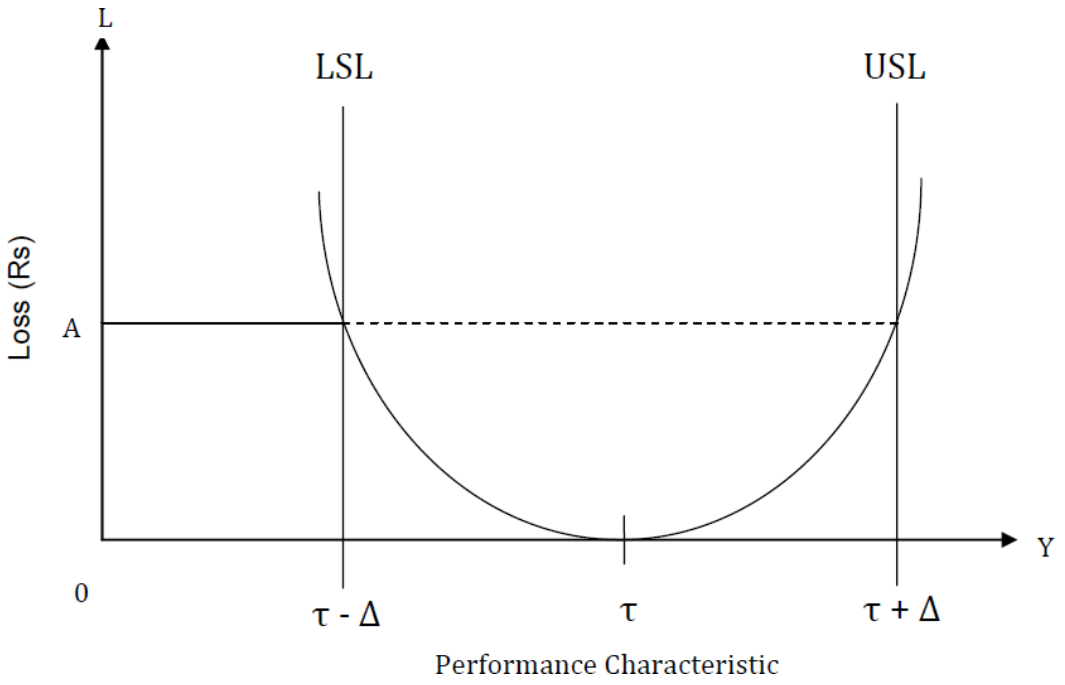
There are three common quality loss functions
1. Nominal - the - best.

2. Smaller - the - better.

3. Larger - the - better.

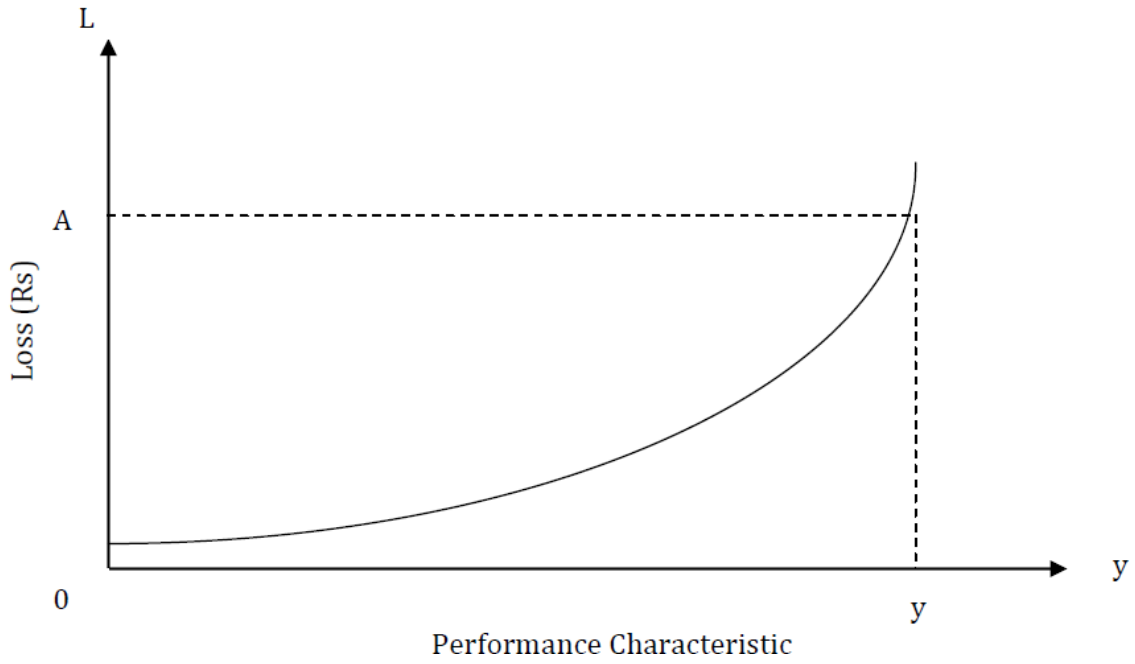
NOMINAL – THE – BEST :

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



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

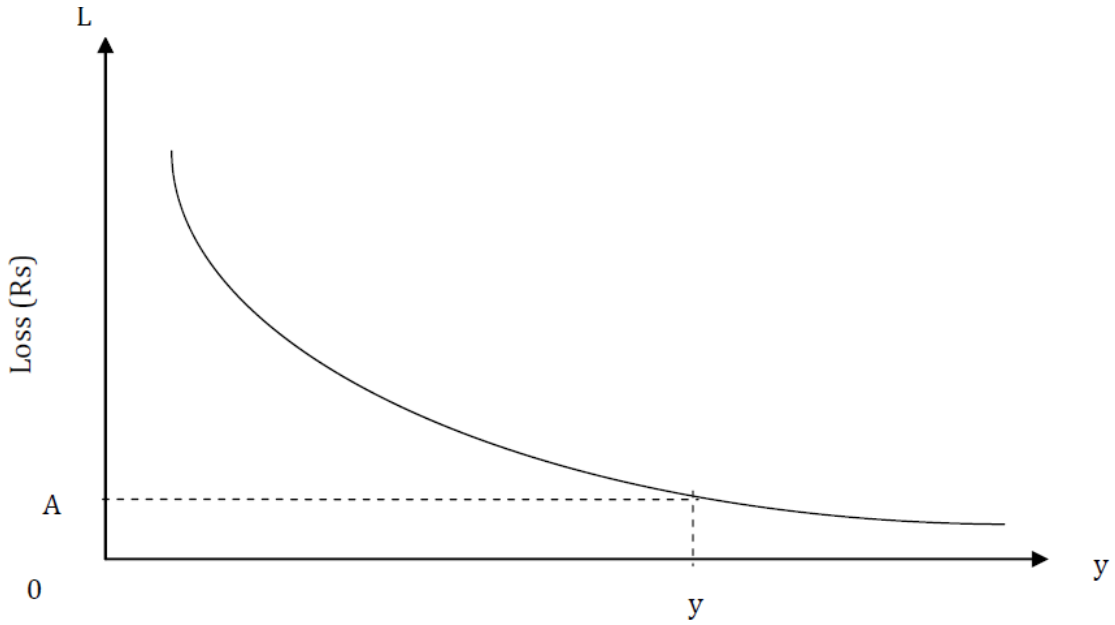
SMALLER – THE – BETTER :



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



Performance Characteristic

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 worth 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

 To d esign and manufacture using these collective thoughts (promotes team approach)

UNIT V – QUALITY SYSTEMS

ISO 9000 STANDARDS

ISO 9000:2000

ISO 9000

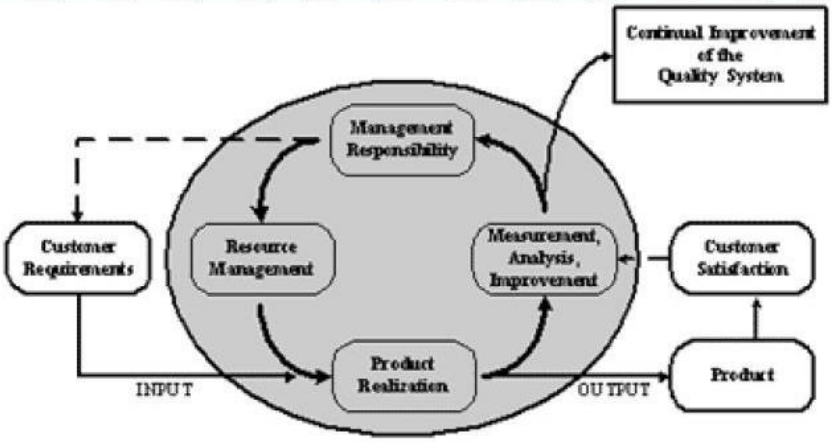
- ISO 9001
- ISO 9002
- ISO 9003

ISO 9001
Design, Development, Production, Installation & Servicing
ISO 9002
Production, Installation & Servicing

ISO 9003

Inspection & Testing

ISO 9004
Provides guidelines on the technical, administrative and human factors affecting the product or services



ISO 9000: 2000 Sector Standard

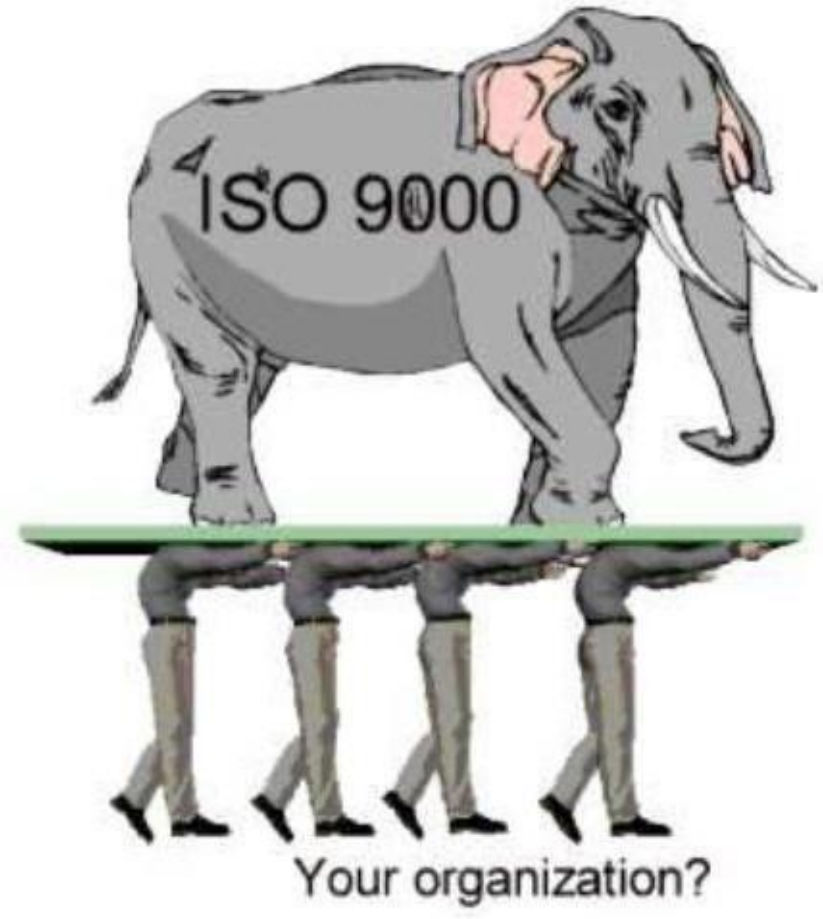
BENEFITS OF ISO 9000 STANDARDS:

- 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



CLAUSES (ELEMENTS) OF ISO 9000 (DURING THE YEAR 1987)

Management Responsibility

- Adequate resources for the verification activities
- Need for trained personnel
- Work and verification activities including audits
- A Management Repr

- Review the Quality System performance and customer complaints periodically

Quality System

Contract review

Design Control

Documents Control

Purchasing

Purchaser – Supplied

Product Identification and Traceability

Process Control

Inspection and Testing

Inspection Measuring and Test Equipment

Inspection and Test Status

Control of Non – Conforming Product

Corrective Action

Handling, Storage, Packaging and Delivery

Quality Records

Internal Quality Audits

Training

Servicing

Statistical Techniques

CLAUSES (ELEMENTS) OF ISO 9000 (During the year 2000)

1. Scope

2. Normative Reference

3. Terms and Definitions

4. Quality Management System (QMS)
General Requirements

Documentation

5. Management Responsibility
Management Commitment

Customer Focus

Quality Policy

Planning

Responsibility, Authority and Communication

Management Review

6. Resource Management
Provision of Resources

Human Resources

Infrastructure

Work Environment

7. Product Realization
Planning of Product Realization

Customer related processes

Design and Development

Purchasing

Production and Service Provision

Control of Monitoring and Measuring devices
8. Monitoring and Measurement
General

Monitoring and Measurement

Control of Non-Conforming Product

Analysis of Data

Improvement

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

PITFALLS OF SUCCESSFUL IMPLEMENTATION:

1. Using a generic documentation program or another organization‟s documentation program
2. Over-documentation or documentation that is too complex
3. Using External Consultants without involvement
4. Neglecting to obtain top management‟s involvement
5. Developing a system that does not represent what actually occurs

DOCUMENTATION

In every organization, the quality system must be documented properly. The documentation of the system can be seen as a hierarchical format as shown.

1 POLICY
2 PROCEDURES
3 PRACTICES
4 PROOFS

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.

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 – ENVIRONMENTAL MANAGEMENT SYSTEM

The overall aim of the Environmental Management systems is **to provide protection to the environment** and **to prevent pollution.**

- The success of ISO 9000 along with increased emphasis on Environmental issues were instrumental in ISO‟s decision to develop Environmental Management Standards.

- In 1991, ISO formed the Strategic Advisory Group on the Environment (SAGE) which led to the formation of Technical Committee (TC) 207 in 1992.

- Mission of TC207 is to develop standards for an Environmental Management System (EMS) which was identified as ISO 14000.

- TC 207 has Established six sub-committees

1. Environmental Management System (EMS)

2. Environmental Auditing (EA)

3. Environmental labeling (EL)

4. Environmental Performance Evaluation (EPE)

5. Life-Cycle Assessment (LCA)

6. Terms & Definitions

Environmental Management System (EMS) :
EMS has two Evaluation Standards. They are
1. Organization Evaluation Standards 2. Product Evaluation Standards

REQUIREMENT OF ISO 14001
There are six elements

1. GENERAL REQUIREMENTS

 EMS should include policy, planning implementation & operation, checking & corrective

action, management review.

2. ENVIRONMENTAL POLICY (Should be based on mission)

 The policy must be relevant to the organization"s nature.
 Management"s Commitment (for continual improvement & preventing pollution).
 Should be a framework (for Environmental objectives & Targets).
 Must be Documented, Implemented, & Maintained.

3. PLANNING

 Environmental Aspects
 Legal & other Requirements
 Objectives & Targets
 Environmental Management Programs

4. IMPLEMENTATION & OPERATION

 Structure & Responsibility
 Training, Awareness & Competency
 Communication
 EMS Documentation
 Document Control
 Operational Control
 Emergency Preparedness & Response

5. CHECKING & CORRECTIVE ACTION

 Monitoring & Measuring
 Nonconformance & Corrective & Preventive action
 Records
 EMS Audit

6. MANAGENMENT REVIEW

 Review of objectives & targets
 Review of Environmental performance against legal & other requirement
 Effectiveness of EMS elements
 Evaluation of the continuation of the policy

BENEFITS OF ENVIRONMENTAL MANAGEMENT SYSTEM :

GLOBAL BENEFITS

- Facilitate trade & remove trade barrier
- Improve environmental performance of planet earth
- Build consensus that there is a need for environmental management and a common terminology for EMS

ORGANIZATIONAL BENEFI

- Assuring customers of a commitment to environmental management
- Meeting customer requirement
- Improve public relation
- Increase investor satisfaction
- Market share increase
- Conserving input material & energy
- Better industry/government relation
- Low cost insurance, easy attainment of permits & authorization