



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L1

EEE

III/IV

**Course Name : 19EEE09 & Total Quality Management**

**Faculty Name : Mrs.M.Selvakumari**

**Unit : I - Introduction**

**Date of Lecture:**

**Topic of Lecture:** Definition of Quality, Dimensions of Quality

## **Introduction :**

1. Quality could be defined as a basic tool for a natural property of any good or service that allows it to be compared with any other good or service of its kind.
2. The word quality has many meanings, but basically, it refers to the set of inherent properties of an object that allows satisfying stated or implied needs.
3. Dimension of quality involves measurable attributes; brands can usually be ranked objectively on individual aspects of performance.
4. Features: Features are additional characteristics that enhance the appeal of the product or service to the user.

## **Prerequisite knowledge for Complete understanding and learning of Topic:**

- Communicative in English
- Statistical Approach for Quality Control

## **Detailed content of the Lecture:**

### **Definition of Quality**

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

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

1. **Performance:** How well the product or service delivers on expectations, based on measurable attributes

**Example:** Acceleration or handling of a car; average speed to resolve customer issues

2. **Features:** Characteristics that supplement the basic function – in other words, the “bells and whistles”

**Example:** Voice-activated remote control on a television; customer service offered through live chat

3. **Reliability:** Probability of the product or service failing within a specific time period  
**Example:** Average time to first failure for a computer; first-contact response time for a call center

4. **Conformance:** The extent to which a product or service meets established standards  
**Example:** Defect rates in a factory; accuracy and timeliness of processing customer inquiries

5. **Durability:** Amount of use before a product or service is no longer usable and purchasing a replacement is the preferable (or only) solution

**Example:** The expected life span of a light bulb’s filament; the warranty offered by a contractor

6. **Serviceability:** The ease, promptness, competence and courtesy of repair or services  
**Example:** Service offered across multiple channels, such as toll-free hotlines or through social media; an airline’s provision of self-service options

7. **Aesthetics:** Subjective view of product’s appearance, smell, feeling, etc.

**Example:** The “rich and full flavor” of a food; the appearance of a service business’s office, website or personnel

8. **Perceived quality:** Indirect measure based on a company’s general reputation

**Example:** Assumption that a product or service offered by a reliable company such as Apple, Sony or Zappo’s will be of high quality.

**Video Content / Details of website for further learning (if any):**

1. <https://www.vidyarthiplus.com/vp/attachment.php?aid=2756>
2. <https://8e0a7590-a-62cb3a1a-s-sites.googlegroups.com/site/rejinpaul11/GE2022TQM-Notes.pdf>
3. <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

**Important Books/Journals for further learning including the page nos:**

Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 13-21).

**Course Faculty**



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LECTURE HANDOUTS

L2

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : I - Introduction

Date of Lecture:

**Topic of Lecture:**Quality Planning, Quality Cost

### Introduction :

1. A quality plan is a document, or several documents, that together specify quality standards, practices, resources, specifications, and the sequence of activities relevant to a particular product, service, project, or contract.
2. Quality plans should define: A method for measuring the achievement of the quality objectives.
3. Quality costs are the all the costs that a manufacturer incurs to ensure it produces a quality product.
4. Quality costs include both costs to prevent low-quality production and costs that arise after a low quality product is produced.

### Prerequisite knowledge for Complete understanding and learning of Topic:

(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

### Detailed content of the Lecture:

A quality plan is a document, or several documents, that together specify quality standards, practices, resources, specifications, and the sequence of activities relevant to a particular product, service, project, or contract.

### Quality plans should define:

- Objectives to be attained (for example, characteristics or specifications, uniformity, effectiveness, aesthetics, cycle time, cost, natural resources, utilization, yield, dependability, and so on)
- Steps in the processes that constitute the operating practice or procedures of the organization
- Allocation of responsibilities, authority, and resources during the different phases of the process or project
- Specific documented standards, practices, procedures, and instructions to be applied
- Suitable testing, inspection, examination, and audit programs at appropriate stages
- A documented procedure for changes and modifications to a quality plan as a process is improved

- A method for measuring the achievement of the quality objectives
- Other actions necessary to meet the objectives
- At the highest level, quality goals and plans should be integrated with overall strategic plans of the organization. As organizational objectives and plans are deployed throughout the organization, each function fashions its own best way for contributing to the top-level goals and objectives.
- At lower levels, the quality plan assumes the role of an actionable plan. Such plans may take many different forms depending on the outcome they are to produce. Quality plans may also be represented by more than one type of document to produce a given outcome.

**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**

**Prevention Cost**

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

**Appraisal Cost**

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

**Internal Failure Cost**

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

**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

**Video Content / Details of website for further learning (if any):**

- <https://www.vidyarthiplus.com/vp/attachment.php?aid=2756>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 184-194)

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LECTURE HANDOUTS

L3

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : I - Introduction

Date of Lecture:

**Topic of Lecture:** Analysis Techniques for Quality Costs , Basic concepts of Total Quality Management

**Introduction : ( Maximum 5 sentences)**

1. Quality costs are the costs associated with preventing, finding, and correcting defective work. Examples of “poor quality” include coding errors, design errors, mistakes in the user manuals, as well as badly documented or unmaintainably complex code.
2. The costs that are associated with preventing, finding, and correcting defective work are Quality Costs. Normally, these costs are running at 20% – 30% of sales.
3. Many of these costs can be significantly reduced or completely avoided. One of the key functions of a Quality Analysis / Engineer is the reduction of the total cost of quality associated with a product / service.
4. The basic concept of TQM are : customers-orientation (both internal and external), never-ending improvement , statistical control of business processes, upstream preventive maintenance, participative management, ongoing preventive action, cross-functional management and committed leadership and commitment.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Analysis Techniques Of Quality Cost**

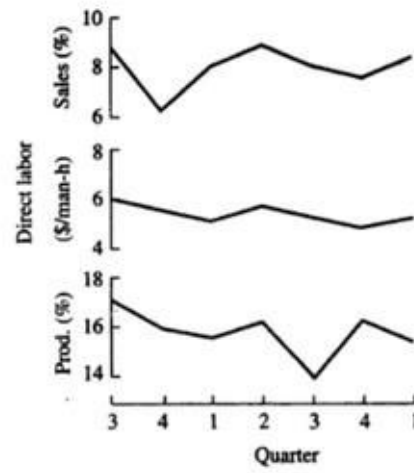
- The purpose of quality cost analysis is to determine the cost of maintaining a certain level of quality
- Such activity is necessary to provide feedback to management on the performance of quality assurance and to assist management in identifying opportunities.

**Trend analysis :**

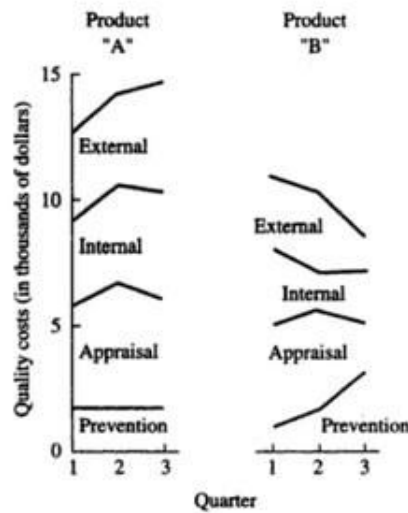
- Good visual aids are important communication tools.
- Graphs are particularly useful in presenting comparative results to management. Trend Analysis is one where Time – to - Time comparisons can be made which Illustrates the changes in cost over time.



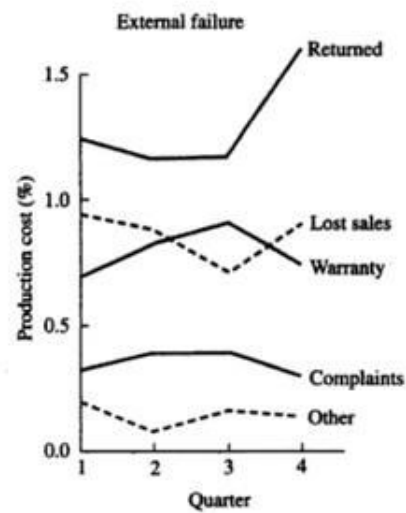
(a) By cost category



(b) By index



(c) By product

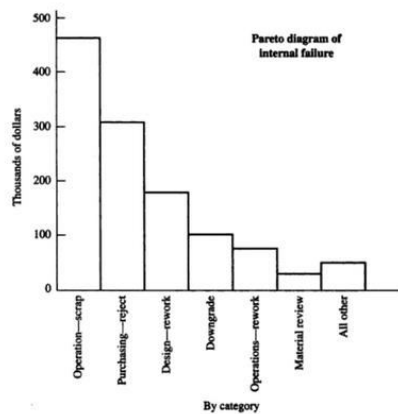


(d) Within a category

**Typical Long-Range Trend Time-Series Graphs**

**Pareto Analysis :**

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



**Total Quality Management**

**Total** - Made up of the whole

**Quality**- Degree of excellence a product or service provides

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



## **Why TQM**

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

### **Definition:**

1. TQM is the management approach of an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction and benefits to all members of the organization and to society.- ISO
2. TQM is an integrated organizational approach in delighting customers (both internal and external) by meeting their expectations on a continuous basis through everyone involved with the organization working on continuous improvement in all products, services, and processes along with proper problem solving methodology - INDIAN STATISTICAL INSTITUTE ( ISI )
3. TQM is a people - focused management system that aims at continual increase in customer satisfaction at continually lower cost. TQM is a total system approach (not a separate area of program), and an integral part of high level strategy. It works horizontally across functions and departments, involving all employees, top to bottom, and extends backwards and forward to include the supply chain and the customer chain – TOTAL QUALITY FORUM OF USA

### **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

### **Video Content / Details of website for further learning (if any):**

- <http://www.qasigma.com/2008/12/quality-cost-analysis.html>
- <https://www.vidyarthiplus.com/vp/attachment.php?aid=2756>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>

### **Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfeldt, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 194-198)

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LECTURE HANDOUTS

L4

EEE

III/IV

**Course Name : 19EEE09 & Total Quality Management**

**Faculty Name : Mrs.M.Selvakumari**

**Unit : I - Introduction**

**Date of Lecture:**

**Topic of Lecture:** Historical Review, Principles of TQM

### **Introduction :**

1. Total quality management is the management approach of an organization, centered on quality, based on the participation of all of its members, and aiming at long-term success through customer satisfaction and benefits to all members of the organization and to society.
2. Total Quality Management is a structured system for satisfying internal and external customers and suppliers by integrating the business environment, continuous improvement, and breakthroughs with development, improvement, and maintenance cycles while changing organizational culture.
3. The roots of Total Quality Management (TQM) can be traced back to early 1920s when statistical theory was first applied to product quality control.
4. This concept was further developed in Japan in the 40s led by Americans, such as Deming, Juran and Feigenbaum.

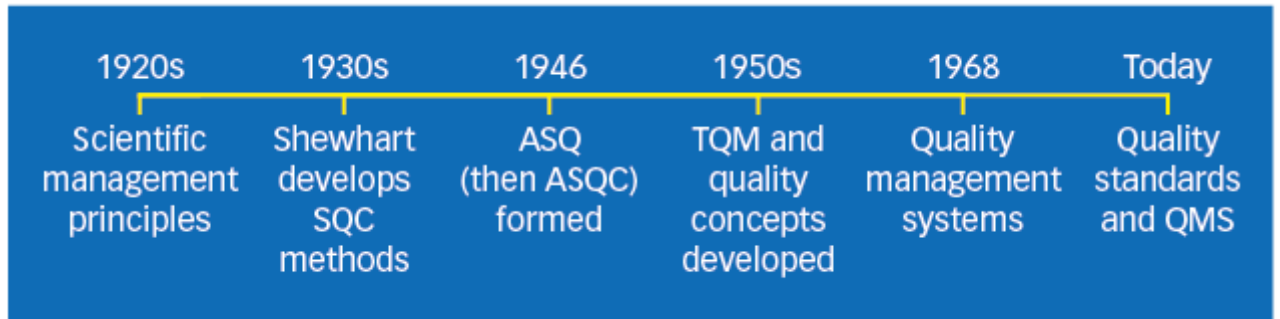
### **Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

### **Detailed content of the Lecture:**

- The history of total quality management (TQM) began initially as a term coined by the Naval Air Systems Command to describe its Japanese-style management approach to quality improvement. An umbrella methodology for continually improving the quality of all processes, it draws on a knowledge of the principles and practices of: The behavioral sciences, The analysis of quantitative and non quantitative data, Economics theories, Process analysis
- Joseph Juran was one of the founders of total quality management just like William E. Deming. Total quality management originated in the industrial sector of Japan (1954).
- W. Edwards Deming, Joseph Juran and Philip B. Crosby are three of the most influential people involved in the shift from production and consumption to total quality management (TQM).
- Their work significantly impacted how industries view customer satisfaction, employee needs and supplier relations.



## Historical Review

The history of quality control is undoubtedly as old as industry itself. During the middle Ages, quality was to a large extent controlled by the long periods of training required by the guilds. This training instilled pride in workers for quality of a product.

- In 1924, W. A. Shewhart of Bell Telephone Laboratories developed a statistical chart for the control of product variables.
- This chart is considered to be the beginning of statistical quality control. Later in the same decade, H. F. Dodge and H. G. Romig, both of Bell Telephone Laboratories, developed the area of acceptance sampling as a substitute for 100% inspection.
- In 1946, the American Society for Quality Control was formed. Recently, the name was changed to American Society for Quality (ASQ).
- This organization, through its publications, conferences, and training sessions, has promoted the use of quality for all types of production and service.
- In 1950, W. Edwards Deming, who learned statistical quality control from Shewhart, gave a series of lectures on statistical methods to Japanese engineers and on quality responsibility to the CEOs of the largest organizations in Japan.
- Joseph M. Juran made his first trip to Japan in 1954 and further emphasized management's responsibility to achieve quality. Using these concepts the Japanese set the quality standards for the rest of the world to follow.
- In 1960, the first quality control circles were formed for the purpose of quality improvement.
- Simple statistical techniques were learned and applied by Japanese workers.
- In the late 1980s the automotive industry began to emphasize statistical process control (SPC).
- Suppliers and their suppliers were required to use these techniques.
- Taguchi introduced his concepts of parameter and tolerance design and brought about a resurgence of design of experiments (DOE) as a valuable quality improvement tool.

## Principles of TQM:

TQM is broadly based on the following principles:

1. **Customer Centric Approach** – Consumers are the ultimate judge to determine whether products or services are of superior quality or not. No matter how many resources are pooled in training employees, upgrading machines and computers, incorporating quality design process and standards, bringing new technology, etc.; at the end of the day, it is the customers who have the final say in judging your company. Companies must remember to implement TQM across all fronts keeping in mind the customers.
2. **Employee Involvement** – Ensuring total employee involvement in achieving goals and business objectives will lead to employee empowerment and active participation from the employees in decision making and addressing quality related problems. Employee empowerment and

involvement can be increased by making the workspace more open and devoid of fear.

3. **Continual Improvement** – A major component of TQM is continual improvement. Continual improvement will lead to improved and higher quality processes. Continual improvement will ensure companies will find new ways and techniques in producing better quality products, production, be more competitive, as well as exceed customer expectations.
4. **Strategic Approach to Improvement** – Businesses must adopt a strategic approach towards quality improvement to achieve their goals, vision, and mission. A strategic plan is very necessary to ensure quality becomes the core aspect of all business processes.
5. **Integrated System** – Businesses comprise of various departments with different functionality purposes. These functionalities are interconnected with various horizontal processes TQM focuses on. Everyone in the company should have a thorough understanding of the quality policies, standards, objectives, and important processes. It is very important to promote a quality work culture as it helps to achieve excellence and surpass customer expectations. An integrated system ensures continual improvement and helps companies achieve a competitive edge.
6. **Decision Making** – Data from the performance measurement of processes indicates the current health of the company. For efficient TQM, companies must collect and analyze data to improve quality, decision making accuracy, and forecasts. The decision making must be statistically and situational based in order to avoid any room for emotional based decisions.
7. **Communications** – Communication plays a crucial role in TQM as it helps to motivate employees and improve their morale during routine daily operations. Employees need to be involved as much as possible in the day to day operations and decision making process to really give them a sense of empowerment. This creates the environment of success and unity and helps drive the results the TQM process can achieve.

**Video Content / Details of website for further learning (if any):**

- <https://www.vidyarthiplus.com/vp/attachment.php?aid=2756>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 21-22)

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LECTURE HANDOUTS

L 5

EEE

III/V

**Course Name : 19EEE09 & Total Quality Management**

**Faculty Name : Mrs.M.Selvakumari**

**Unit : I - Introduction**

**Date of Lecture:**

**Topic of Lecture:** Quality Statement, Strategic Planning

### **Introduction :**

1. Quality means providing our external and internal customers with innovative products and services that fully satisfy their requirements.
2. Quality is the job of every employee". It is a short declaration of what an organization aspires to be tomorrow.
3. A quality statement lays out your firm's working practices and commitment to providing a good service. It should explain how effective and efficient your methods for carrying out the project will be.
4. Total Quality Management focuses the organization's goals on a system of quality and meeting the needs of the customer.
5. Strategic planning is a tool that helps to prioritize the efforts of the organization in the implementation of a Total Quality Management approach.

### **Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

### **Detailed content of the Lecture:**

#### **Quality statements:**

Quality statements are established by the quality council to provide overall direction for achieving the total quality culture.

Three elements of quality statements are:

1. Vision statements
2. Mission statement
3. Quality policy statement

#### **1. Vision statement:**

- The vision statement is a short declaration of what an organization aspires to be tomorrow.
- The vision should be coined in such a way that the leaders and the employees working in the organization should work towards the achievements of the vision statement.
- A well-written vision statement, regardless of the type of organization, has the following characteristics:
- Is easily understood by all stakeholders
- Is briefly stated, yet clear and comprehensive in meaning
- Is challenging, yet attainable etc. Example: "to be the leading customer battery company in the world"- Duracell International

## 2. Mission statement:

The Mission statement is usually one paragraph, describes the function of the organization. It provides a clear statement of purpose for employees, customers and suppliers.

### Key elements of a mission statement:

**Obligation to stakeholders:** The most important stakeholder and the relative emphasis placed on meeting the needs of various stakeholders.

**Scope of the business:** The areas in which the company will compete defined by the customers served, the functions provided, and the technology employed.

**Sources of competitive advantage:** The skills that the company will develop/leverage to achieve its vision and a description of how the company intends to exceed in creating customer value and competitive advantage

**View of the future:** The anticipated regulatory, competitive and economic environment in which the company must compete.

**Example:** "We exist to create, make, and market useful products and services to satisfy the needs of the customer throughout the world"-Texas Instruments.

## 3. Quality policy statement:

- The quality policy is a guide for everyone in the organization as to how they provide products and service to the customers.
- A quality policy is an important requirement of ISO 9000 quality systems. ISO 9000, the international standard for quality for quality assurance, requires a quality policy as a declaration of intent to meet the needs of the customers.

## Strategic Planning:

In order to understand the concept of strategic management, first we need to understand the literal meaning of the word "strategy". The definition is mentioned below:

1. The science and art of using all the forces of a nation to execute approved plans as effectively as possible during peace or war. The science and art of military command as applied to the overall planning and conduct of large-scale combat operations.
2. A plan of action resulting from strategy or intended to accomplish a specific goal.

3. The art or skill of using stratagems in endeavors such as politics and business

When an organizations chooses to make quality a major competitive edge (differentiation), it becomes the central issue in strategic planning. This is especially reflected in vision, mission and policy guidelines of an organization

An essential idea behind strategic quality planning is that the product is customer value rather than a physical product or service. This feat cannot be achieved unless an organization creates a culture of quality and no strategy and plan can be worthwhile unless it is carefully implemented.

**Video Content / Details of website for further learning (if any):**

<https://totalqualitymanagement.wordpress.com/2008/10/04/strategic-quality-planning/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 46-47,53-56)

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LECTURE HANDOUTS

L6

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : I - Introduction

Date of Lecture::

**Topic of Lecture:** Deming Philosophy , Crosby philosophy

**Introduction : ( Maximum 5 sentences)**

1. Deming promoted the Plan-Do-Check-Act approach to process analysis and improvement.
2. Emphasize training and education so everyone can do their jobs better. Use kaizen as a model to reduce waste and to improve productivity, effectiveness, and safety.
3. Throughout his work, Crosby's thinking was consistently characterised by four absolutes: The definition of quality is conformance to requirements.
4. The system of quality is prevention. The performance standard is zero defects. The measurement of quality is the price of non-conformance.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

(Max. Four important topics)

- Communicative in English
- TQM Concepts

**Detailed content of the Lecture:**

**The 14 Points**

1. **Create a constant purpose toward improvement.**
  - Plan for quality in the long term.
  - Resist reacting with short-term solutions.
  - Don't just do the same things better – find better things to do.
  - Predict and prepare for future challenges, and always have the goal of getting better.
2. **Adopt the new philosophy.**
  - Embrace quality throughout the organization.
  - Put your customers' needs first, rather than react to competitive pressure – and design products and services to meet those needs.
  - Be prepared for a major change in the way business is done. It's about leading, not simply managing.
  - Create your quality vision, and implement it.
3. **Stop depending on inspections.**
  - Inspections are costly and unreliable – and they don't improve quality, they merely find a lack of quality.
  - Build quality into the process from start to finish.
  - Don't just find what you did wrong – eliminate the "wrongs" altogether.



- Use statistical control methods – not physical inspections alone – to prove that the process is working.
4. **Use a single supplier for any one item.**
- Quality relies on consistency – the less variation you have in the input, the less variation you'll have in the output.
  - Look at suppliers as your partners in quality. Encourage them to spend time improving their own quality – they shouldn't compete for your business based on price alone.
  - Analyze the total cost to you, not just the initial cost of the product.
  - Use quality statistics to ensure that suppliers meet your quality standards.
5. **Improve constantly and forever.**
- Continuously improve your systems and processes. Deming promoted the **Plan-Do-Check-Act** approach to process analysis and improvement.
  - Emphasize training and education so everyone can do their jobs better.
  - Use **kaizen** as a model to reduce waste and to improve productivity, effectiveness, and safety.
6. **Use training on the job.**
- Train for consistency to help reduce variation.
  - Build a foundation of common knowledge.
  - Allow workers to understand their roles in the "big picture."
  - Encourage staff to learn from one another, and provide a culture and environment for effective teamwork.
7. **Implement leadership.**
- Expect your supervisors and managers to understand their workers and the processes they use.
  - Don't simply supervise – provide support and resources so that each staff member can do his or her best. Be a coach instead of a policeman.
  - Figure out what each person actually needs to do his or her best.
  - Emphasize the importance of participative management and transformational leadership.
  - Find ways to reach full potential, and don't just focus on meeting targets and quotas.
8. **Eliminate fear.**
- Allow people to perform at their best by ensuring that they're not afraid to express ideas or concerns.
  - Let everyone know that the goal is to achieve high quality by doing more things right – and that you're not interested in blaming people when mistakes happen.
  - Make workers feel valued, and encourage them to look for better ways to do things.
  - Ensure that your leaders are approachable and that they work with teams to act in the company's best interests.
  - Use open and honest communication to remove fear from the organization.
9. **Break down barriers between departments.**
- Build the "internal customer" concept – recognize that each department or function serves other departments that use their output.
  - Build a shared vision.
  - Use cross-functional teamwork to build understanding and reduce adversarial relationships.
  - Focus on collaboration and consensus instead of compromise.
10. **Get rid of unclear slogans.**
- Let people know exactly what you want – don't make them guess. "Excellence in service" is short and memorable, but what does it mean? How is it achieved? The message is clearer in a slogan like "You can do better if you try."
  - Don't let words and nice-sounding phrases replace effective leadership. Outline your expectations, and then praise people face-to-face for doing good work.

11. **Eliminate management by objectives.**
  - Look at how the process is carried out, not just numerical targets. Deming said that production targets encourage high output and low quality.
  - Provide support and resources so that production levels and quality are high and achievable.
  - Measure the process rather than the people behind the process.
12. **Remove barriers to pride of workmanship.**
  - Allow everyone to take pride in their work without being rated or compared.
  - Treat workers the same, and don't make them compete with other workers for monetary or other rewards. Over time, the quality system will naturally raise the level of everyone's work to an equally high level.
13. **Implement education and self-improvement.**
  - Improve the current skills of workers.
  - Encourage people to learn new skills to prepare for future changes and challenges.
  - Build skills to make your workforce more adaptable to change, and better able to find and achieve improvements.
14. **Make "transformation" everyone's job.**
  - Improve your overall organization by having each person take a step toward quality.
  - Analyze each small step, and understand how it fits into the larger picture.
  - Use effective change management principles to introduce the new philosophy and ideas in Deming's 14 points.

## Crosby's Philosophy

- Crosby's philosophy differs significantly from both Deming's and Juran's. Deming, in fact, would assert that Crosby's philosophy is entirely misguided in that it exhorts workers to improve the system and only management can do that.
- Crosby's approach revolves around **Zero Defects**. Doing things right the first time is always cheaper than trying to fix defects after they have been created. Thus, quality is free. According to Crosby, costs of poor quality are higher than organizations realize.
- Organizations should spend more effort tracking costs of quality in track the reduction is costs as quality is improved.

1. Commitment of Management
2. Formulate the Quality Improvement Team
3. Measure for Quality in Current Practices
4. What Will the Cost of Quality Be?
5. Quality Awareness is Central to Success
6. Remember the Quality Problems? Take Corrective Action
7. Plan for Zero Defects
8. Practice Effective Training for Supervisors
9. Happy Zero Defects Day!
10. Involve Everyone in Goal Setting
11. Eliminate Causes of Errors
12. Implement Recognition for Participants
13. Create Quality Councils
14. Lather...Rinse...REPEAT

- Crosby's fourteen steps rely on the foundational thought that any money a company spends upon quality improvement is money that is well-spent.

- Quality improvement doesn't end because you have run out of the 14 Steps of Crosby! In order to really make improvements in the quality of your products and services, you will need to do it over again and again. Now go get started on your quality improvement projects!

**Video Content / Details of website for further learning (if any):**

[https://www.mindtools.com/pages/article/newSTR\\_75.htm](https://www.mindtools.com/pages/article/newSTR_75.htm)

<https://www.brighthubpm.com/methods-strategies/94048-fourteen-steps-of-crosby/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 39-43)

**Course Faculty**



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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 7

EEE

III/IV

**Course Name : 19EEE09 & Total Quality Management**

**Faculty Name : Mrs.M.Selvakumari**

**Unit : I - Introduction**

**Date of Lecture:**

**Topic of Lecture:** Continuous Process Improvement , Juran Trilogy

## **Introduction :**

1. A continual improvement process, also often called a continuous improvement process (abbreviated as CIP or CI), is an ongoing effort to improve products, services, or processes. These efforts can seek "incremental" improvement over time or "breakthrough" improvement all at once.
2. Delivery (customer valued) processes are constantly evaluated and improved in the light of their efficiency, effectiveness and flexibility.
3. A broader definition is that of the Institute of Quality Assurance who defined "continuous improvement as a gradual never-ending change which is: "focused on increasing the effectiveness and/or efficiency of an organisation to fulfil its policy and objectives. It is not limited to quality initiatives.
4. Improvement in business strategy, business results, and customer, employee and supplier relationships can be subject to continual improvement. Put simply, it means 'getting better all the time

## **Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

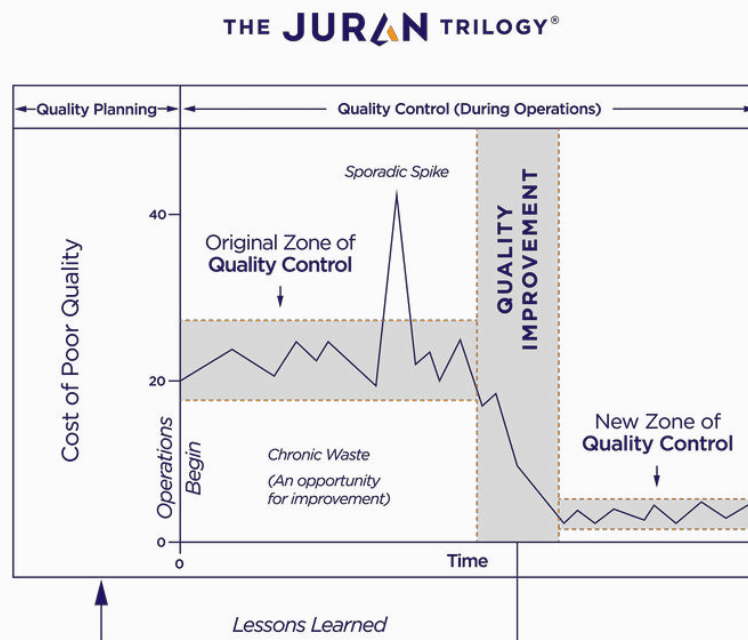
- Communicative in English
- TQM Concepts

## **Detailed content of the Lecture:**

- The Juran Trilogy, also called Quality Trilogy, was presented by Dr. Joseph M. Juran in 1986 as a means to manage for quality.
- The traditional approach to quality at that time was based on quality control, but today, The Trilogy has become the basis for most quality management best practices around the world.
- The Juran Trilogy diagram is often presented as a graph, with time on the horizontal axis and cost of poor quality on the vertical axis. The initial activity is quality planning, or as we refer to it today, 'quality by design' – the creation of something new. This could be a new product,

service, process, etc.

- As operations proceed, it soon becomes evident that delivery of our products is not 100 percent defect free. Why? Because there are hidden failures or periodic failures (variation) that require rework and redoing. In the diagram, more than 20 percent of the work must be redone due to failures. This waste is considered chronic—it goes on and on until the organization decides to find its root causes and remove it. We call it the Cost of Poor Quality. The design and development process could not account for all unforeseen obstacles in the design process.
- Under conventional responsibility patterns, the operating forces are unable to get rid of the defects or waste. What they can do is to carry out control—to prevent things from getting worse, as shown.
- The figure shows a sudden sporadic spike that has raised the failure level to more than 40 percent. This spike resulted from some unplanned event such as a power failure, process breakdown, or human error. As a part of the control process, the operating forces converge on the scene and take action to restore the status quo. This is often called corrective action, troubleshooting, firefighting, and so on. The end result is to restore the error level back to the planned chronic level of about 20 percent.



- The chart also shows that in due course the chronic waste was driven down to a level far below the original level. This gain came from the third process in Juran's Trilogy—improvement. In effect, it was seen that the chronic waste was an opportunity for improvement, and steps were taken to make that improvement.
- In essence, the Juran Trilogy is a universal way of thinking about quality—it fits all functions, all levels, and all product and service lines. The underlying concept is that managing for quality consists of three universal processes:

- Quality Planning (Quality by Design)
- Quality Control (Process Control & Regulatory)
- Quality Improvement (Lean Six Sigma)

**Video Content / Details of website for further learning (if any):**

<https://www.juran.com/blog/the-juran-trilogy-quality-planning/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No)

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LECTURE HANDOUTS

L8

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : I - Introduction

Date of Lecture::

**Topic of Lecture:** PDSA Cycle, 5S, Kaizen

### Introduction :

1. The PDSA cycle is shorthand for testing a change by developing a plan to test the change (Plan), carrying out the test (Do), observing and learning from the consequences (Study), and determining what modifications should be made to the test (Act).
2. PDSA, or Plan-Do-Study-Act, is an iterative, four-stage problem-solving model used for improving a process or carrying out change.
3. The customer defines quality, so it would make sense to also involve them in the process when appropriate or feasible, to increase acceptance of the end result.
4. 5S stands for the 5 steps of this methodology: Sort, Set in Order, Shine, Standardize, Sustain. These steps involve going through everything in a space, deciding what's necessary and what isn't, putting things in order, cleaning, and setting up procedures for performing these tasks on a regular basis.
5. Kaizen is a concept referring to business activities that continuously improve all functions and involve all employees from the CEO to the assembly line workers. Kaizen is the Sino-Japanese word for "improvement"

### Prerequisite knowledge for Complete understanding and learning of Topic:

(Max. Four important topics)

- Communicative in English
- TQM Concepts

### Detailed content of the Lecture:

Variations: plan-do-study-act (PDSA) cycle, Deming cycle, Shewhart cycle. Understand the evolution of these variations. The Plan-do-check-act cycle (Figure) is a four-step model for carrying out change. Just as a circle has no end, the PDCA cycle should be repeated again and again for continuous improvement. The PDCA cycle is considered a project planning tool.

### Use the PDCA cycle when:

Starting a new improvement project

Developing a new or improved design of a process, product, or service

Defining a repetitive work process

Planning data collection and analysis in order to verify and prioritize problems or root causes

Implementing any change and Working toward continuous improvement



### The Plan-do-check-act Procedure

**Plan:** Recognize an opportunity and plan a change.

**Do:** Test the change. Carry out a small-scale study.

**Check:** Review the test, analyze the results, and identify what you've learned.

**Act:** Take action based on what you learned in the study step. If the change did not work, go through the cycle again with a different plan. If you were successful, incorporate what you learned from the test into wider changes. Use what you learned to plan new improvements, beginning the cycle again.

### 5S:

5S is a system for organizing spaces so work can be performed efficiently, effectively, and safely. This system focuses on putting everything where it belongs and keeping the workplace clean, which makes it easier for people to do their jobs without wasting time or risking injury.



### 5S Translation

The term 5S comes from five Japanese words:

- Seiri
- Seiton
- Seiso
- Seiketsu
- Shitsuke

In English, these words are often translated to:

- Sort
- Set in Order
- Shine
- Standardize
- Sustain

Each 5S represents one part of a five-step process that can improve the overall function of a business.

### Kaizen:

- Kaizen is an approach to creating continuous improvement based on the idea that small, ongoing positive changes can reap major improvements. Typically, it is based on cooperation and commitment and stands in contrast to approaches that use radical changes or top-down edicts to achieve transformation. Kaizen is core to lean manufacturing, or The Toyota Way.



- It was developed in the manufacturing sector to lower defects, eliminate waste, boost productivity, encourage worker purpose and accountability, and promote innovation.

### **Ten principles of Kaizen:**

Because executing Kaizen requires enabling the right mindset throughout the company, 10 principles that address the Kaizen mindset are commonly referenced as core to the philosophy. They are:

1. Let go of assumptions.
2. Be proactive about solving problems.
3. Don't accept the status quo.
4. Let go of perfectionism and take an attitude of iterative, adaptive change.
5. Look for solutions as you find mistakes.
6. Create an environment in which everyone feels empowered to contribute.
7. Don't accept the obvious issue; instead, ask "why" five times to get to the root cause.
8. Cull information and opinions from multiple people.
9. Use creativity to find low-cost, small improvements.
10. Never stop improving.

### **Video Content / Details of website for further learning (if any):**

<https://asq.org/quality-resources/pdca-cycle>

<https://searcherp.techtarget.com/definition/kaizen-or-continuous-improvement>

### **Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No)

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LECTURE HANDOUTS

L9

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : I - Introduction

Date of Lecture:

**Topic of Lecture:** Obstacles to TQM Implementation

**Introduction : ( Maximum 5 sentences)**

1. The major barriers to TQM success is cited as non inclusion of management's compensation to achieving quality goals and lack of training in areas such as group discussions, communication techniques, quality improvement skills, problem identification and problem-solving techniques
2. The Barriers to Implementing Total quality management (TQM) know no limits; they show up in all sector manufacturing, services, government, and education.
3. Therefore, it is important for all organizations to understand and avoid these barriers both before and during TQM implementation.
4. A preliminary step in TQM implementation is to assess the organization's current reality. A management audit is a good assessment tool to identify current levels of organizational functioning and areas in need of change.

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Management Principles
- Basics of TQM

**Detailed content of the Lecture:**

**GENERIC STRATEGY MODEL FOR IMPLEMENTING TQM SYSTEMS**

- Top management learns about and decides to commit to TQM. TQM is identified as one of the organization's strategies.
- The organization assesses current culture, customer satisfaction, and quality management systems.
- Top management identifies core values and principles to be used, and communicates them.
- A TQM master plan is developed on the basis of steps 1, 2, and 3.
- The organization identifies and prioritizes customer demands and aligns products and services to meet those demands.
- Management maps the critical processes through which the organization meets its customers' needs.
- Management oversees the formation of teams for process improvement efforts.
- The momentum of the TQM effort is managed by the steering committee.
- Managers contribute individually to the effort through proper planning, training, coaching, or other methods.

- Daily process management and standardization take place.
- Progress is evaluated and the plan is revised as needed.
- Constant employee awareness and feedback on status are provided and a reward/recognition process is established.

### **Barriers to TQM Implementation**

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

### **Video Content / Details of website for further learning (if any):**

- <https://www.vidyarthiplus.com/vp/attachment.php?aid=2756>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>

### **Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 22-25)

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LECTURE HANDOUTS

L10

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:**Principles of TQM, Leadership Concepts, Role of Senior Management

**Introduction : ( Maximum 5 sentences)**

1. Leadership in TQM thinking requires a continuous cultural change and people need to be guided through the change.
2. This leadership works for continuous learning, service orientated attitude, full of positive energy and trusts in other people of the organization because TQM is people oriented.
3. A leader in total quality management as a person who inspires, by appropriate means, sufficient competence to influence a group of individuals to become willing followers in the achievement of organizational goals.
4. Like all managers, the senior manager is responsible for planning and directing the work of a group of individuals. They monitor their work and takes corrective actions when necessary.
5. The senior manager often supervises the largest or most important group or groups in a company

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

- The core principles of TQM are addressed and a number of propositions are developed, identifying both generic and specific leader behaviours in the domains of customer focus, teamwork and participation, and continuous improvement

**Five Principles of TQM**

- Produce quality work the first time.
- Focus on the customer.
- Have a strategic approach to improvement.
- Improve continuously.
- Encourage mutual respect and teamwork.

**Leadership Concepts**

- In order to become successful, Leadership Concepts requires an intuitive understanding of the human nature – the basic needs, wants and abilities of people. To be effective, a leader understands the following:
  - People, paradoxically, need security and independence at the same time.
  - People are sensitive to external rewards and punishments and yet are strongly self-motivated.
  - People like to hear a kind word of praise. Catch people doing something right, so you can pat

them on the back.



- A leader will focus on a few key values and objectives. Focusing on few values or objectives gives the employees the ability to discern on a daily basis what is important and what is not. Employees, upon understanding the objectives, should be given personal control over the task in order to make the task their own and thereby something to which they can commit.
- A leader, by giving the employees a measure of control over an important task, will tap into the employees' inner drive. Employees, led by the manager, can become excited participants in the organisation.
- Having a worthwhile cause such as total quality management is not always enough to get employees to participate. People (and, in turn, employees) follow a leader, not a cause. Indeed, when people like the leader but not the vision, they will try to change the vision or reconcile their vision to the leader's vision. If the leader is liked, people will not look for another leader.
- This is especially evident in politics. If the leader is trusted and liked, then the employees will participate in the total quality management cause. Therefore, it is particularly important that a leader's character and competence, which is developed by good habits and ethics, be above reproach. Effective leadership begins on the inside and moves out.

## **Role of Senior Management**

### **Common Responsibilities**

- Like all managers, the senior manager is responsible for planning and directing the work of a group of individuals. They monitor their work and takes corrective actions when necessary.
- Senior managers might guide workers directly or they might direct several supervisors, who in turn directly manage the workers. The senior manager often supervises the largest or most important group or groups in a company.

### **Core responsibilities of the senior manager include:**

- Providing guidance to direct reports, typically comprising first-line managers and supervisors
- Ensuring clarity around priorities and goals for the entire functional area
- Approving requests for investment to a certain level of authority
- Managing overall financial budgeting for her function
- Approving hiring and firing requests within her group
- Guiding the talent identification and development processes for a group or function
- Working across functions with peers in other groups to ensure collaboration for shared goals
- Interacting with senior management for reporting
- Working with senior management and other peers for strategy development and execution planning
- Communicating financial and goal results and key performance indicators to direct reports
- Facilitating goal-level creation for the broader function and working with managers to ensure the goals cascade to all workers
- Implementing the role of a senior manager makes good business sense under a number of

circumstances. The senior manager can serve as the "adult" in the group at times when the team is growing quickly and chaotically. He can interface with other functions for needed resources and provide mature guidance to managers and workers during a period of change.

- This position can represent a tangible target or step up as part of a manager's career development plan and responsibilities when there's a clear distinction between the role of manager and senior manager.
- The senior manager can also support managers and take on responsibility for discrete work teams when the span of control for a group's managers is too broad.

**Video Content / Details of website for further learning (if any):**

<http://www.iibmindialms.com/library/management-basic-subjects/total-quality-management/leadership-concepts/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 13-21)

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LECTURE HANDOUTS

L11

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:**Quality Council, Customer satisfaction, Customer Perception of Quality

**Introduction : ( Maximum 5 sentences)**

1. Quality Council is the instrument for maintaining the idea of never-ending quality improvement. It is driver for the TQM engine.
2. Develop the strategic long-term plan with goals and the annual quality improvement program with objectives.
3. Customer satisfaction determines the success of your company's TQM project or strategy. If customers are happy, your improvements worked. If they're dissatisfied, it's time to reevaluate your strategy.
4. Total employee involvement: Every employee is involved in working towards the common goal of continuous improvement.
5. Perceived quality can be defined as the customer's perception of the overall quality or superiority of a product or service with respect to its intended purpose, relative to alternatives.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

- Organizations need to build quality culture in the organization. For this purpose, Quality council is established to provide overall direction.
- Quality Council is the instrument for maintaining the idea of never-ending quality improvement. It is driver for the TQM engine.

**STRUCTURE OF QC:**

Quality council is composed of,

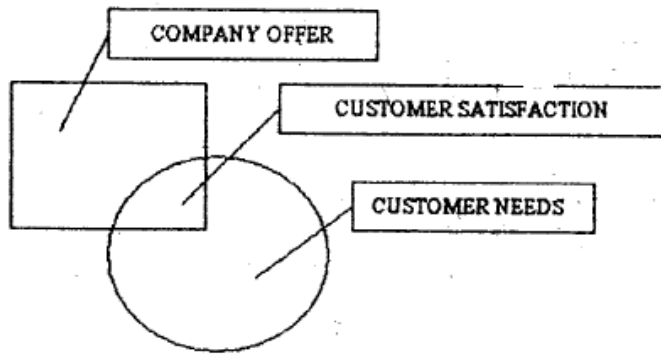
- 1.ChiefExecutive Officer
- 2.Senior managers of functional areas (marketing, finance, HR, Quality)
- 3.Coordinator/consultant (big organizations prefer coordinator while small organizations prefer consultant)
- 4.Union representative
- 5.Front-line representatives

**Customer satisfaction:**

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

## CUSTOMER SATISFACTION MODEL

Teboul's Model of customer satisfaction as shown in figure



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

### The customers are

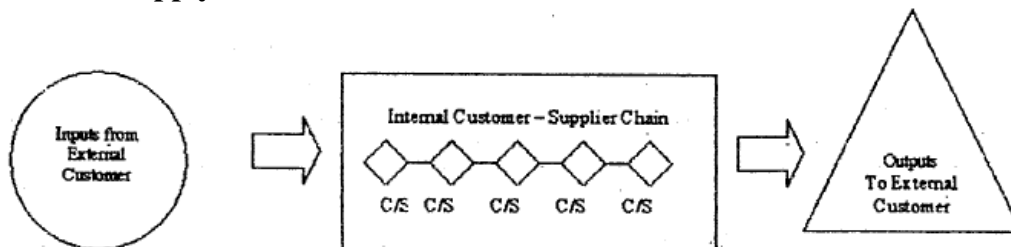
The most important people in the business

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

### Types Of Customers

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

### Customer Supply Chain



### Customer Perception of Quality

One of the basic concepts of the TQM philosophy is continuous process improvement. This concept implies that there is no acceptable quality level because the customer's needs, values, and expectations are constantly changing and becoming more demanding. An American Society for Quality (ASQ) survey on end user perceptions of important factors that influenced purchases showed the following ranking.

- Performance
- Features
- Service



- Warranty
- Price
- Reputation

The factors of performance, features, service, and warranty are part of the product service quality; therefore, it is evident that product quality and service are more important than price.

### **Performance**

Performance involves “fitness for use” a phrase that indicates that the product and service is ready for the customer’s use at the time of sale. Other considerations are

- Availability, which is the probability that a product will operate when needed
- Reliability, which is freedom from failure over time; and
- Maintainability is the ease of keeping the product in operating condition

### **Features**

- Identifiable features or attributes of a product or service are psychological, time
- Oriented, contractual, ethical, and technological.
- Features are secondary characteristics of the product or service.

### **Service**

- Customer service is emerging as a method for organizations to give the customer added value.
- Customer service is an intangible it is made up of many small things, all geared to
- Changing the customer’s perception. Intangible characteristics are those traits that are not quantifiable, yet contribute greatly to customer satisfaction.
- Providing excellent customer service is different from and more difficult to achieve than excellent product quality.

### **Warranty**

- The product warranty represents an organization’s public promise of a quality product backed up by a guarantee of customer satisfaction.
- A warranty generates feedback by providing information on the product and service quality.
- It also forces the organization to develop a corrective action system.
- Finally, a warranty builds marketing muscle.
- The warranty encourages customers to buy a service by reducing the risk of the purchase decision, and it generates more sales from existing customers by enhancing loyalty.

### **Price**

- Today’s customer is willing to pay a higher price to obtain value.
- Customers are constantly evaluating one organization’s products and services against those of its competitors to determine who provides the greatest value.
- However, in our highly-competitive environment, each customer’s concept of value is continually changing. Ongoing efforts must be made by everyone having contact with customers to identify, verify, and update each customer’s perception of value in relation to each product and service.

### **Reputation**

- Most of us find ourselves rating organizations by our overall experience with them.
- Total customer satisfaction is based on the entire experience with the organization, not just the product.
- Customers are willing to pay a premium for a known or trusted brand name and often become customers for life. Because it costs five times as much to win a new
- Customer as it does to keep an existing one, customer retention is an important economic strategy for any organization.
- Investment in customer retention can be a more effective bottom-line approach than concentrating on lowering operational costs.

- An effective marketing retention strategy is achieved through using feedback from information collecting tools.

**Video Content / Details of website for further learning (if any):**

1. <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
2. <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
3. <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
4. <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
5. [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 19-21)

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LECTURE HANDOUTS

L 12

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:** Customer Complaints ,Service Quality, Customer Retention

**Introduction : ( Maximum 5 sentences)**

1. A **consumer complaint** or **customer complaint** is “an expression of dissatisfaction on a consumer’s behalf to a responsible party” (Landon, 1980).
2. It can also be described in a positive sense as a report from a consumer providing documentation about a problem with a product or service.
3. Customer retention is the activity that a selling organization undertakes in order to reduce customer defections.
4. Successful customer retention starts with the first contact an organization has with a customer and continues throughout the entire lifetime of a relationship.
5. The process of managing the quality of services delivered to a customer according to his expectations is called Service Quality Management. It basically assesses how well a service has been given, so as to improve its quality in the future, identify problems and correct them to increase customer satisfaction.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Customer Complaints (Feedback)**

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

**Customer Feedback Or Customer Complaint Is Required**

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

**Tools Used For Collecting Customer Complaints**

- **Comment card** - Low cost method, usually attached to warranty card
- **Questionnaire** - Popular tool, costly and time consuming - by mail or telephone preferably multiple choice questions or a point rating system (1 to 5) or (1 to 10)
- **Customer Focus groups** - Meeting by a representative of the company with the group of customers. Imprint analysis is an emerging technique to obtain intrinsic feelings using customer meetings, word associations, discussion, relaxation **techniques etc.**
- **Phone** - Toll free Telephone numbers
- **Customer visits** - Visit customer's place of business.
- **Report cards** - Usually, send to customer on a quarterly basis.
- **The internet and computer** - It includes newsgroups, electronic bulletin board mailing lists, Employee feedback.
- **Mass Customization** - Capturing the voice of customers using data of what customer want instead of what customer is thinking about buying and manufacturing exact what they want.

### **Steps To Solve Customer Complaints**

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

Identify customer's expectations beforehand rather than afterward through complaint analysis.

### **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**

- Identify each market segment.
- Write down the requirements.
- Communicate the requirements.
- Organize processes.
- Organize physical spaces.

#### **Customer Care**

- Meet the customer's expectations.
- Get the customer's point of view.
- Deliver what is promised.
- Make the customer feel valued.
- Respond to all complaints.
- Over – respond to the customer.
- Provide a clean and comfortable customer reception area.

### **Communication**

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

### **Front-Line people**

- Hire people who like people.
- Challenge them to develop better methods.
- Give them the authority to solve problems.
- Serve them as internal customers.
- Be sure they are adequately trained.
- Recognize and reward performance.

### **Leadership**

- Lead by example.
- Listen to the front-line people.
- Strive for continuous process improvement.

### **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.**

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

#### **Video Content / Details of website for further learning (if any):**

- <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
- [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

#### **Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 67-88)



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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L13

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:** Employee Involvement – Motivation, Empowerment

**Introduction : ( Maximum 5 sentences)**

1. At the heart of the TQM is the concept of intrinsic motivation-involvement in decision making by the employees.
2. Employee involvement is a process for empowering members of an organization to make decisions and to solve problems appropriate to their levels in the organization.
3. Employee involvement reduces labor/management friction by encouraging more effective communication and cooperation.
4. Employee involvement increases morale by creating feeling of belonging to the organization. Employees are better able to accept change because they control the work environment
5. Motivation: the most basic process in TQM/CQI. A process model is used to demonstrate that satisfaction of the higher-level needs of esteem and self-actualization is required to produce true motivation. By understanding the process of motivation, we may become more effective in improving patient care

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

- Employee involvement means that every employee is regarded as a unique human being, not just a cog in a machine, and each employee is involved in helping the organization meet its goals.
- Each employee's input is solicited and valued by his/her management. Employees and management recognize that each employee is involved in running the business.
- Employee involvement is a process for empowering employees to participate in managerial decision-making and improvement activities appropriate to their levels in the organization. Since McGregor's Theory Y first brought to managers the idea of a participative management style, employee involvement has taken many forms, including the job design approaches and special activities such as quality of work life (QWL) programs.
- Employee involvement and empowerment is a long – term commitment, a new way of doing business, a fundamental change in culture. Employees who have been trained, empowered, and recognized for their achievements see their jobs and their companies from a different perspective. They no longer punch a clock, do what they are told, and count the minutes until

the weekend rolls around. They “own” the company, in the sense that they feel personally responsible for its performance.

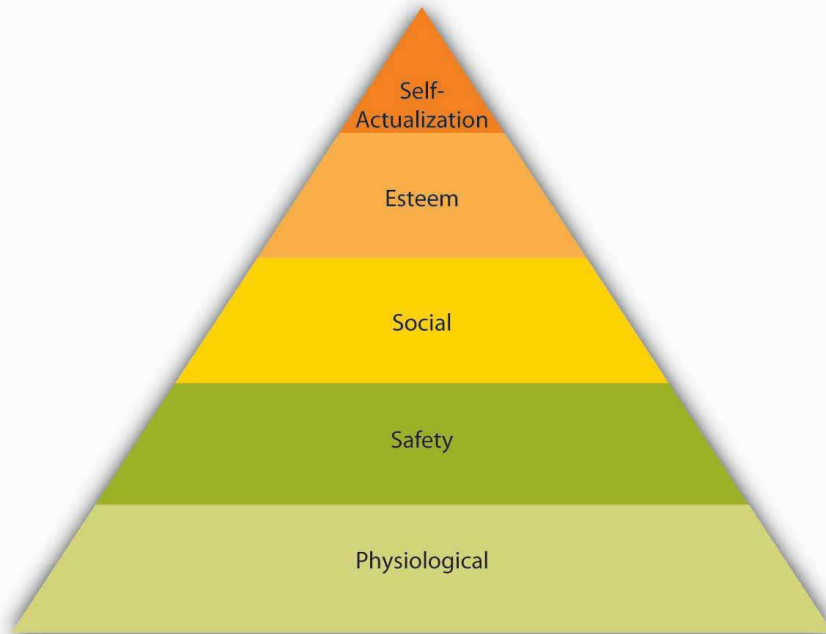
- The best way to obtain a genuine commitment from people is to involve them in the project from the beginning. Even if the original ideas are not theirs, the process of designing, planning and assessing will automatically pull them into the stream of things. Managers who try to take back some of that power end up with bitter, frustrated, and disillusioned employees. Performance will suffer, and future attempts to involve employees will be met with cynicism
- Employee involvement and empowerment is worldwide applicable technique. There is no single option for employee involvement. It includes suggestion systems, teams, focus groups, surveys, self-directed work groups, incentive programs and more. The goal is to determine the most effective employee involvement options that will be linked to specific organizational goals. In order to implement employee involvement and empowerment to an enterprise the following key actions need to take place:
  - Giving employee the responsibility
  - Training employee to accept responsibility
  - Communicating and giving feedback
  - Giving rewards and recognition

#### Motivation

- Various theories have been associated with motivation - need theories, expectancy theories, reinforcement theory, equity theory etc. **Maslow theory** states that individuals have a hierarchy of needs—from the most basic needs to the highest level of self - actualization.
- Motivation is one of the forces that lead to performance. Motivation is defined as the desire to achieve a goal or a certain performance level, leading to goal-directed behavior. When we refer to someone as being motivated, we mean that the person is trying hard to accomplish a certain task. Motivation is clearly important if someone is to perform well; however, it is not sufficient. Ability—or having the skills and knowledge required to perform the job—is also important and is sometimes the key determinant of effectiveness.
- Finally, environmental factors such as having the resources, information, and support one needs to perform well are critical to determine performance. At different times, one of these three factors may be the key to high performance. For example, for an employee sweeping the floor, motivation may be the most important factor that determines performance. In contrast, even the most motivated individual would not be able to successfully design a house without the necessary talent involved in building quality homes. Being motivated is not the same as being a high performer and is not the sole reason why people perform well, but it is nevertheless a key influence over our performance level.

#### Maslow’s Hierarchy of Needs

- Abraham Maslow is among the most prominent psychologists of the twentieth century. His hierarchy of needs is an image familiar to most business students and managers. The theory is based on a simple premise: Human beings have needs that are hierarchically ranked.



### **Employee Wants**

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

### **Achieving A Motivated Work Force**

The building of a motivated work force is 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 Empowerment**

It is an environment in which people have the ability, the confidence and the commitment to take his responsibility and ownership to improve the process and initiate the necessary steps to satisfy customer



requirements within well-defined boundaries in order to achieve organizational values and goals.

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

#### **General Principles Or Characteristics For' Empowering Employees**

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

#### **Conditions To Create The Empowered Environment**

1. Everyone should understand the need to change
2. The system need to change to new paradigm.
3. The organization must provide information, education, and skill to its employees

#### **Video Content / Details of website for further learning (if any):**

- [https://www.urenio.org/tools/en/employee\\_involvement.pdf](https://www.urenio.org/tools/en/employee_involvement.pdf)
- [https://saylordotorg.github.io/text\\_organizational-behavior-v1.1/s09-theories-of-motivation.html](https://saylordotorg.github.io/text_organizational-behavior-v1.1/s09-theories-of-motivation.html)

#### **Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 101-108)

**Course Faculty**



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LECTURE HANDOUTS

L 14

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:** Teams, Recognition and Reward, Performance Appraisal, Benefits

**Introduction : ( Maximum 5 sentences)**

1. When employees and their work are valued, their satisfaction and productivity rises, and they are motivated to maintain or improve their good work. Praise and recognition are essential to an outstanding workplace.
2. People want to be respected and valued by others for their contribution.
3. A performance appraisal and reward system gives recognition or rewards to employees whose work advances your business goals. That's what makes the system different from regular raises or merit pay. Annual raises help employees stay ahead of inflation.
4. A performance appraisal is a regular review of an employee's job performance and overall contribution to a company. Also known as an "annual review," "performance review or evaluation," or "employee appraisal," a performance appraisal evaluates an employee's skills, achievements and growth, or lack thereof

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Teams and Team works**

A team can be defined as a group of people working together to achieve common objectives or goals

Team work is the cumulative actions of the team during which each member of the team subordinates his individual interest and opinions for the fulfilling of objectives of the group.

**Benefits Of Team Work**

Improved solutions to quality problems, ownership of solutions, communication and integration  
Objectives – Short Term Planning Goal – Long Term Planning

**Types Of Teams**

- **Process improvement team:** Involved in improvement of sub processes or processes. Usually has 6-10 members. Disbanded when the objective is reached. May include the local supplier and customer depending on the location
- **Cross functional teams:** 6-10 members temporary team. Members are Top management level from various functional areas of management. Discuss complex problems and break down into

smaller parts to refer it to various departmental teams for further solution.

- **Natural work teams:** Not voluntary and the total work unit is part of the team. Manager also a part of the team and the management selects the projects to be improved. Managers must also ensure that the entire team is comfortable with each other.
- **Self-directed / self-managed work team:** Extension of natural work teams but here the group of individuals is empowered not only to do work but manage it. No manager will present but a Coordinator (Which will be normally rotated among members) will be appointed. Additional responsibilities of the team hiring/ dismissal, performance evaluation, customer relations, supplier relations, recognition/rewards and training.

### **Characteristics Of Successful Teams**

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

### **Team Member Role**

Leader, Facilitator (One who helps the team gets started in the stages), Recorder, Time keeper and Team member.

### **Decision Making Methods**

Non decision, Unilateral decision, Handclasp decision (Two members with a good idea of the subject decide), Minority-rule decision, Majority rule decision, Consensus (Not everyone need to accept, But everyone should be willing to implement)

### **Elements Of Effective Team Work**

Regular scheduling with a fixed time limit, purpose, role and responsibilities, activities, decision, results and recognition.

### **Team Management Wheel**

To make a lean more effective a team management wheel has been evolved. The activities are advising, innovating, promoting, developing, organization, producing, inspecting, maintaining and linking. The roles of wheel are advisor, explore, organizer and controller.

### **Stages Of Team Development**

**Forming stage-** Initial stage with only group of individuals and no team work. Team purpose, roles are created.

**Storming Stage** -Initial agreement roles are challenged. Hostilities, emerge which may be resolved

**Norming Stage**-Formal informal relations get established.

**Performing Stage** -Team operates in a successful manner with trust, openness, healthy conflict and decisiveness among the members.

**Maintenance stage** – Functioning should not deteriorate with time

**Evaluating Stage** – Evaluating team performance

## Barriers To Team Progress

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

## Recognition And Reward

- Recognition is a process whereby management shows acknowledgement (Verbal or written) of an employee outstanding performance. Recognition is a form of employee +ve motivation. Reward is a tangible one such as increased salaries, commission, cash bonus, gain sharing etc., to promote desirable behavior. It can be even theatre tickets, dinner for two, a small cash awards, etc.,
- The employees are recognized to improve their morale, show the company's appreciation for Better Performance, create satisfied and motivated workplace and stimulate creative efforts.

## Intrinsic Vs Extrinsic Rewards

INTRINSIC REWARDS	EXTRINSIC REWARDS
Related to feeling of accomplishment or self worth	Related to pay or compensation issues
<ol style="list-style-type: none"> <li>1. Non monetary forms of recognition to acknowledge achievement of quality improvement goals</li> <li>2. Celebrations to acknowledge achievement of quality improvement goals</li> <li>3. Regular expression of appreciation by managers and leaders to employees to acknowledge achievement of quality improvement goals</li> <li>4. 360° performance appraisals feedback from co-workers, subordinates or customers is incorporated into performance appraisal</li> <li>5. Formal suggestion system available for individuals to make quality improvement suggestion</li> <li>6. Developmental based performance</li> </ol>	<ol style="list-style-type: none"> <li>1. Profit sharing</li> <li>2. Gain sharing</li> <li>3. Employment security</li> <li>4. Compensation time</li> <li>5. Individual based performance systems</li> <li>6. Quality based performance appraisals</li> </ol>

## Steve Smith's Twenty Different Ways To Recognize The Employees

- Send thank letter whenever possible
- Develop behind the scenes award
- Create the best ideas of the year booklet
- Feature the quality team of the month and put their picture in prominent place
- Honor peers by recognizing them
- Allow people to attend meetings in your name when you are not available
- Involve teams with external customers and suppliers by visiting them
- Invite a team for coffee or lunch whenever possible
- Create a visibility wall displaying posters, pictures, to thank the contributions of employee
- Credit the team to higher authorities when their ideas are accepted
- Take interest in employee's development
- Get the team picture in company newspaper
- Mention the ideas of others during your meetings, so that they are recognized

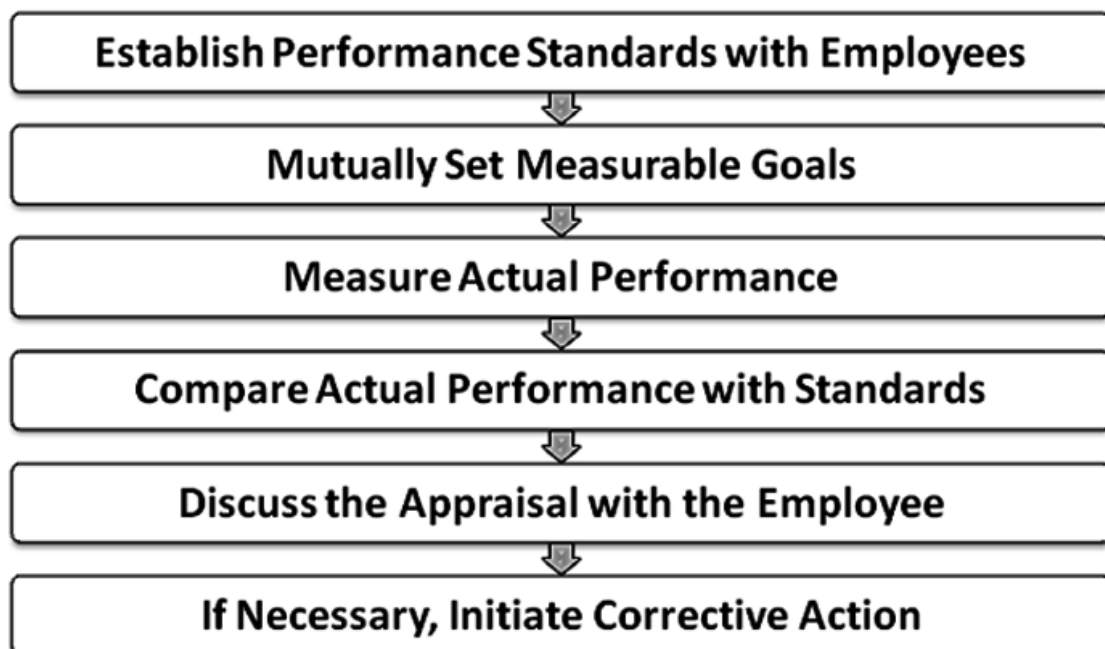
- Write a letter of praise to contributed team member and copy to boss
- Ask people to help you with the project which is difficult but challenging
- Send a team to special seminars, workshops to cover topics they are really interested in
- Ask your boss to send a letter of acknowledgement and thanks
- Honor outstanding contribution with awards
- Have a stock of small gifts to give to people on the spot whom you catch doing things right
- Promote or nominate for promotion, those people who contribute most

### **Performance Appraisal**

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

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

### **Appraisal Process**



### **Benefits of Performance Appraisal**

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

### **Video Content / Details of website for further learning (if any):**

1. <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
2. <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

3. <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
4. <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
5. [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

**Important Books/Journals for further learning including the page nos.:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 109-129)

**Course Faculty**



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LECTURE HANDOUTS

L 15

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:** Supplier Partnership –Partnering ,Sourcing

**Introduction : ( Maximum 5 sentences)**

1. Suppliers Partnership for the Environment (SP) is an innovative partnership between automobile original equipment manufacturers and their suppliers and the Environmental Protection Agency (EPA).
2. SP addresses the goals of the membership by creating new and innovative business-centered approaches to environmental protection that improve the environment while providing value throughout the automobile supply chain.
3. SP provides a forum for small, mid-sized and large automotive and vehicle suppliers to work together, learn from each other and share environmental best practices

**Prerequisite knowledge for Complete understanding and learning of Topic:**

(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Supplier Partnership**

- A commitment to continuous quality improvement cannot be translated into reality without treating supplier as partner.
- Both the customer and the supplier are fully responsible for the control quality
- Both the customer and the supplier should be independent of each other and respect each other's independence
- The customer is responsible for providing the supplier with clear and sufficient requirements so that the supplier can know precisely what to produce
- Both the customer and the supplier should enter into a non adversarial contract with respect to quality, quantity, price, delivery method and terms of payments
- The supplier is responsible for providing the quality that will satisfy the customer and submitting necessary data upon the customer's request
- Both the customer and the supplier should decide the methods to evaluate the quality of the product or service to the satisfaction of both parties
- Both the customer and the supplier should establish in the contract the method by which they can reach an amicable settlement of any disputes that may arise
- Both the customer and the supplier should continually exchange information, sometimes using

multifunctional teams, in order to improve the product or service quality

- Both the customer and the supplier should perform business activities such as procurement, production and inventory planning, clerical work and system so that an amicable and satisfactory relationship is maintained
- When dealing with business transactions both the customer and the supplier should always have the best interest of the end user in mind

### **Supplier Partnering**

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

### **Benefits Of Supplier Partnering**

- Improved Quality
- Reduced cost
- Increased Productivity
- Increased efficiency
- Increased market share
- Increased opportunity for innovation

### **Sourcing**

The three types of sourcing are

- Sole sourcing
- Multiple sourcing
- Single sourcing
- Sole sourcing - only one supplier for the entire organization. This may be forced to happen because of patent, technical specification, raw material location, monopolistic supplier
- Multiple sourcing - For a single item having two or more supplier, resulting in better quality, better service at lower cost
- Single sourcing- use of one supplier to one item when several sources are available leading to long-term partnering relationship.

### **Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
- <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
- [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

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LECTURE HANDOUTS

L 16

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:** Supplier Partnership –Partnering ,Sourcing

**Introduction : ( Maximum 5 sentences)**

- Supplier selection is the process by which firms identify, evaluate, and contract with suppliers. The supplier selection process deploys a tremendous amount of a firm's financial resources. In return, firms expect significant benefits from contracting with suppliers offering high value.
- Supplier evaluation is a term used in business and refers to the process of evaluating and approving potential suppliers by quantitative assessment. The purpose of supplier evaluation is to ensure a portfolio of best in class suppliers is available for use
- Sourcing is the process of selecting suppliers that provide goods or services.
- Choosing the right suppliers can make or break the following steps in the supply chain, and it's difficult to backtrack once you're too far in. Sourcing can involve the following: Negotiating contracts.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Basis Of Supplier Selection**

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

**Stage In Supplier Selection & Evaluation**

Survey stage, enquiry stage, negotiation and selection stage, experience stage.

- The supplier should understand and appreciate the management philosophy of the organization
- The supplier should have a stable management system
- The supplier should maintain high technical standards and have the capability of dealing with future technological innovation
- The supplier should provide those raw materials and parts required by the purchaser and those supplied meet the quality specifications
- The supplier should have the capability to produce the amount of production needed
- The supplier should not breach the corporate secrets
- The supplier should be easily accessible in terms of transportation and communication
- The supplier should be sincere in implementing the contract provisions

- The supplier should have an effective quality system and improvement program such as ISO / QS 9000
- The supplier should have a track record of customer satisfaction and organization Credibility

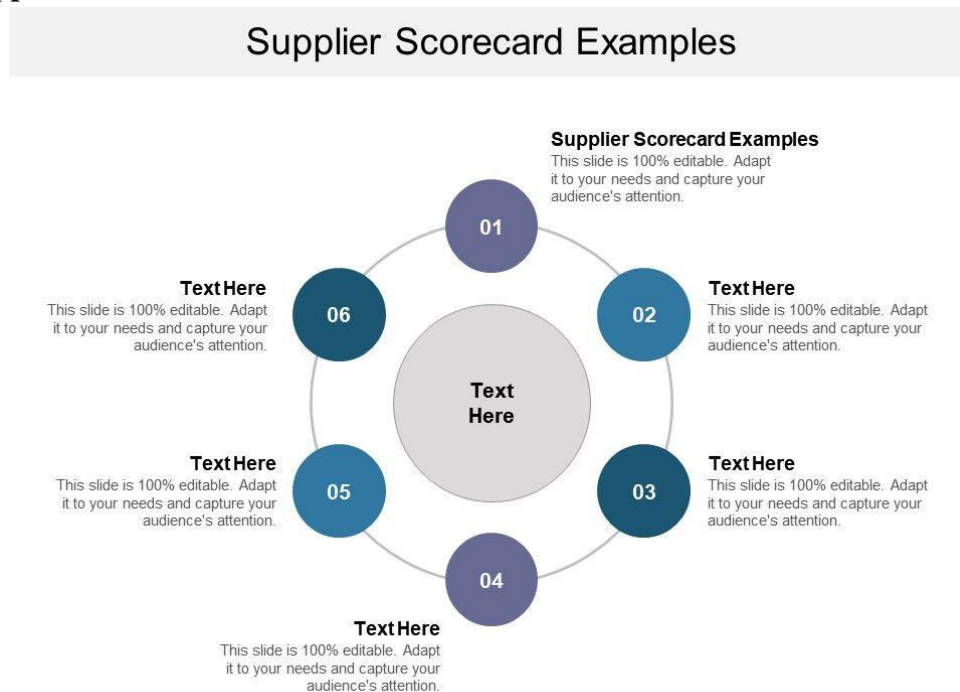
### **Supplier Rating**

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

### **Objectives Of Supplier Rating**

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

### **Example Supplier Scorecard**



### **Three Basic Factors For Successful Supplier Rating System**

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

### **Relationship development :**

For establishment of supplier relationship, the following are necessary.

- Partnering
- Supplier selection
- Principles of customer / supplier relations
- Certification
- Periodic rating

For relationship development, the following are necessary.

- Inspection
  - 100% inspection
  - Sampling
  - Audit
  - Identity check
- Training
- Teams

(d) Recognition and Reward

**Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
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**Important Books/Journals for further learning including the page nos.:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 169-172)

**Course Faculty**



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 17

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

**Topic of Lecture:** Performance Measures – Basic Concepts, Strategy, Performance Measure

**Introduction : ( Maximum 5 sentences)**

- A performance measure is a quantification that provides objective evidence of the degree to which a performance result is occurring over time.” It doesn't matter if you call them KPIs, metrics, performance indicators, performance measures, or whatever other term we might use.
- Performance measurement is a process by which an organization monitors important aspects of its programs, systems, and care processes.
- Data is collected to reflect how its processes are working, and that information is used to drive an organization's decisions over time
- The execution of strategy is often difficult and always critical to a company's success. SPM is an approach that makes an organization's strategic goals more transparent to line executives and provides an ongoing mechanism to monitor progress toward these goals through simple and intuitive performance measures

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**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**

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

#### **Research and Development**

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

#### **Suppliers**

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

#### **Marketing / Sales**

1. Sales expense to revenue.
2. New product sales to total sales.
3. 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 analysed. They are

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

**Video Content / Details of website for further learning (if any):**

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LECTURE HANDOUTS

L 18

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : II-TQM Principles

Date of Lecture:

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**Detailed content of the Lecture:**

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**Course Faculty**



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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L19

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** The seven tools of quality

**Introduction : ( Maximum 5 sentences)**

1. There are many proposed tools and techniques to achieve the TQM promises. Generally, a technique can be considered as a number of activities performed in a certain order to reach the values
2. Quality pros have many names for these seven basic tools of quality, first emphasized by Kaoru Ishikawa, a professor of engineering at Tokyo University and the father of "quality circles." Start your quality journey by mastering these tools, and you'll have a name for them too: indispensable.
3. The seven basic tools of quality is a designation given to a fixed set of graphical techniques identified as being most helpful in troubleshooting issues related to quality.
4. They are called basic because they are suitable for people with little formal training in statistics and because they can be used to solve the vast majority of quality-related issues

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Seven tools of quality are:**

1. Check sheets,
2. Histograms,
3. Cause and effect diagrams,
4. Pareto diagrams,
5. Stratification analysis,
6. Scatter diagrams, and
7. Control charts.

**Check Sheet:** The check sheet is a form (document) used to collect data in real time at the location where the data is generated. The data it captures can be quantitative or qualitative. When the information is quantitative, the check sheet is sometimes called a tally sheet.

Kaoru Ishikawa identified five uses for check sheets in quality control:

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

checklist)

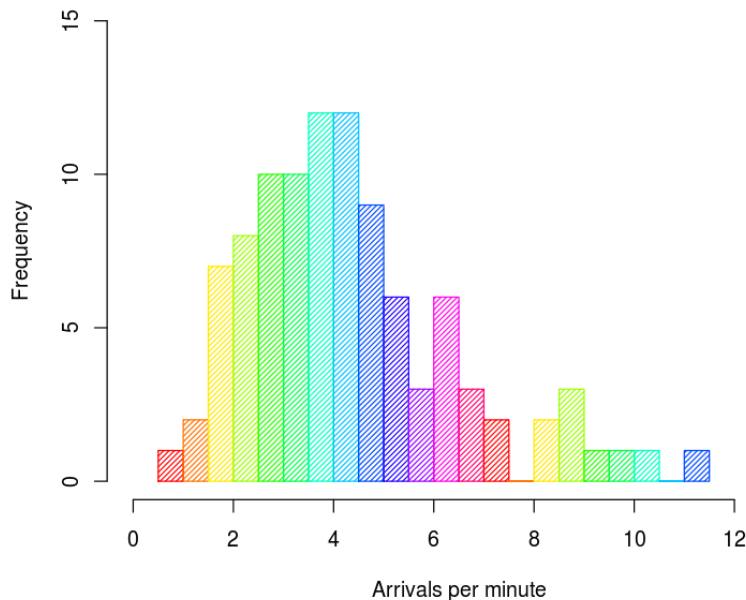
**Motor Assembly Check Sheet**

Name of Data Recorder: Lester B. Rapp  
 Location: Rochester, New York  
 Data Collection Dates: 1/17 - 1/23

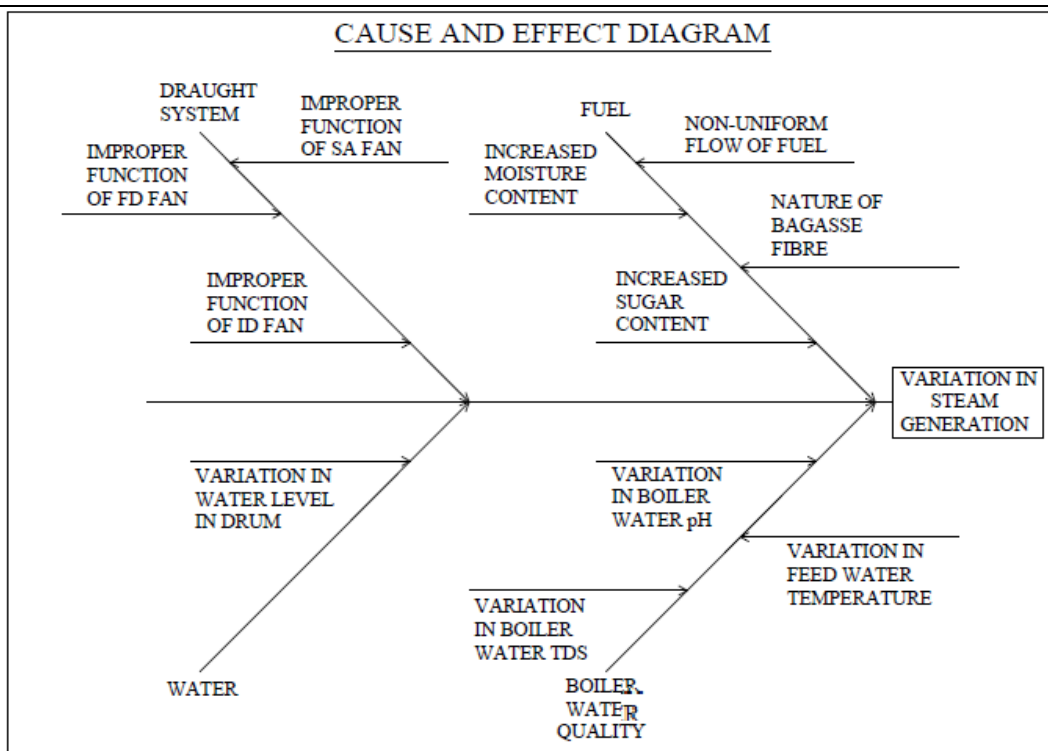
Defect Types/ Event Occurrence	Dates						TOTAL
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	
Supplied parts rusted							20
Misaligned weld							5
Improper test procedure							0
Wrong part issued							3
Film on parts							0
Voids in casting							6
Incorrect dimensions							2
Adhesive failure							0
Masking insufficient							1
Spray failure							5
<b>TOTAL</b>		10	13	10	5	4	

**Histograms:** A histogram is an approximate representation of the distribution of numerical or categorical data. It was first introduced by Karl Pearson. To construct a histogram, the first step is to "bin" (or "bucket") the range of values—that is, divide the entire range of values into a series of intervals—and then count how many values fall into each interval. The bins are usually specified as consecutive, non-overlapping intervals of a variable. The bins (intervals) must be adjacent, and are often (but not required to be) of equal size.

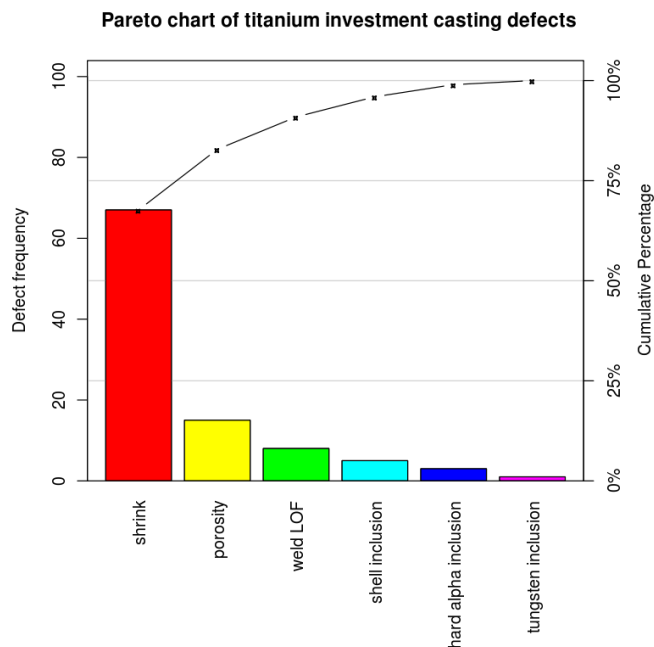
**Histogram of arrivals**



**Cause and Effect Diagram:** Ishikawa diagrams (also called fishbone diagrams, herringbone diagrams, cause-and-effect diagrams, or Fishikawa) are causal diagrams created by Kaoru Ishikawa that show the causes of a specific event. Common uses of the Ishikawa diagram are product design and quality defect prevention to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify and classify these sources of variation.



**Pareto Diagram:** A Pareto chart is a type of chart that contains both bars and a line graph, where individual values are represented in descending order by bars, and the cumulative total is represented by the line. The chart is named for the Pareto principle, which, in turn, derives its name from Vilfredo Pareto, a noted Italian economist.

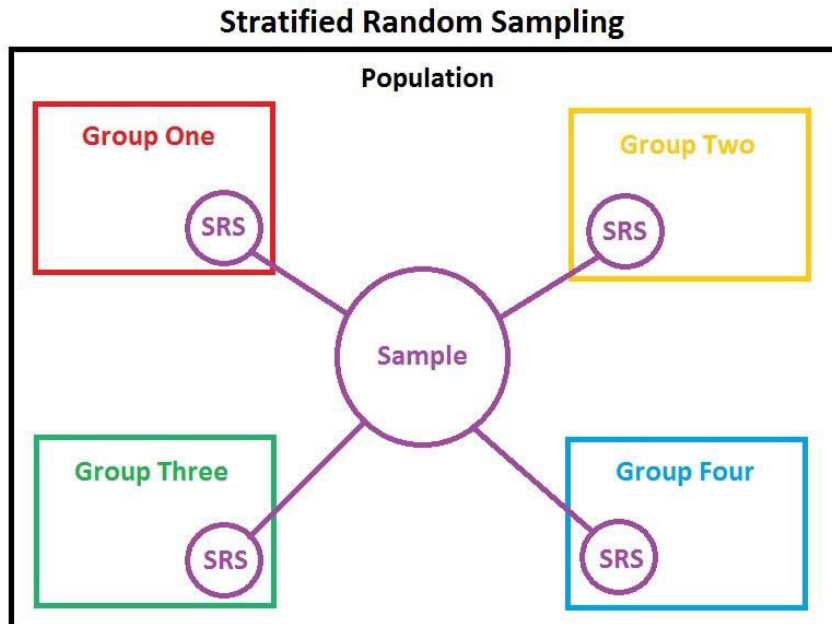


**Stratified sampling:** In statistics, stratified sampling is a method of sampling from a population which can be partitioned into subpopulations.

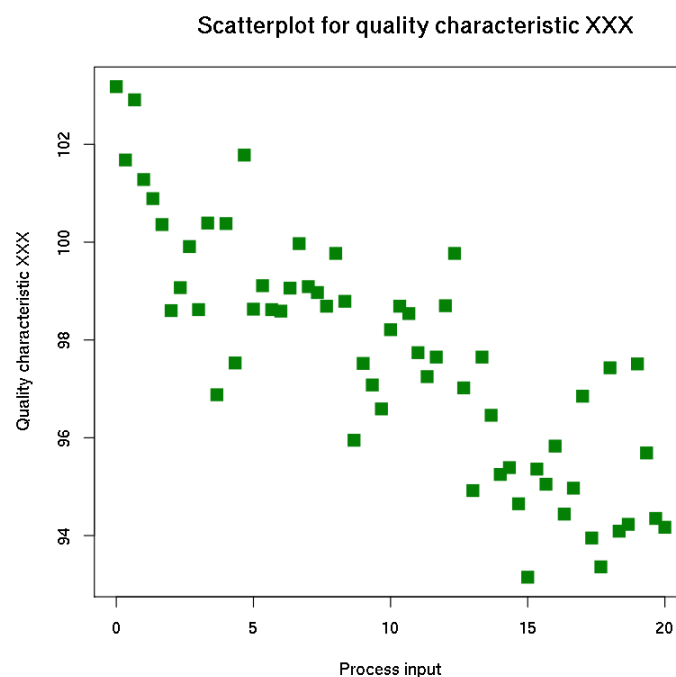
### Stratified sampling example

In statistical surveys, when subpopulations within an overall population vary, it could be advantageous to sample each subpopulation (stratum) independently. Stratification is the process of dividing members of the population into homogeneous subgroups before sampling. The strata should define a partition of the population. That is, it should be collectively exhaustive and mutually exclusive: every element in the population must be assigned to one and only one stratum. Then simple random sampling or systematic sampling is applied within each stratum. The objective is to improve the

precision of the sample by reducing sampling error. It can produce a weighted mean that has less variability than the arithmetic mean of a simple random sample of the population.

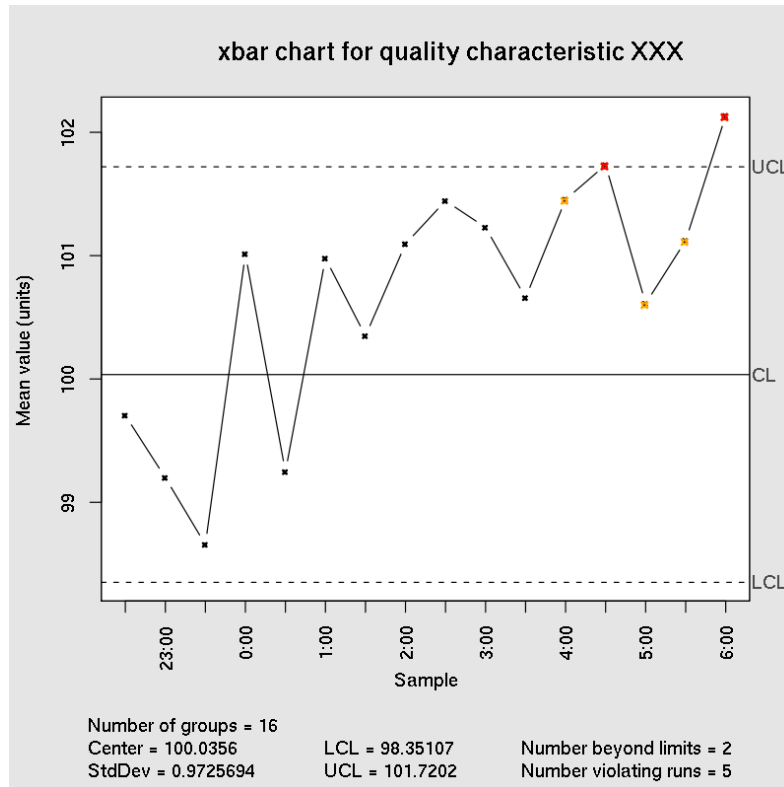


**Scatter Diagram:** A scatter plot (also called a scatterplot, scatter graph, scatter chart, scattergram, or scatter diagram) is a type of plot or mathematical diagram using Cartesian coordinates to display values for typically two variables for a set of data. If the points are coded (color/shape/size), one additional variable can be displayed. The data are displayed as a collection of points, each having the value of one variable determining the position on the horizontal axis and the value of the other variable determining the position on the vertical axis.



**Control charts:** Also known as Shewhart charts (after Walter A. Shewhart) or process-behavior charts, are a statistical process control tool used to determine if a manufacturing or business process is in a state of control. It is more appropriate to say that the control charts are the graphical device for Statistical Process Monitoring (SPM). Traditional control charts are mostly designed to monitor process parameters when underlying form of the process distributions are known. However, more advanced techniques are available in the 21st century where incoming data streaming can be monitored even without any knowledge of the underlying process distributions. Distribution-free control charts

are becoming increasingly popular.



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**Course Faculty**



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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L20

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** The seven tools of quality

**Introduction : ( Maximum 5 sentences)**

1. There are many proposed tools and techniques to achieve the TQM promises. Generally, a technique can be considered as a number of activities performed in a certain order to reach the values
2. Quality pros have many names for these seven basic tools of quality, first emphasized by Kaoru Ishikawa, a professor of engineering at Tokyo University and the father of "quality circles." Start your quality journey by mastering these tools, and you'll have a name for them too: indispensable.
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4. They are called basic because they are suitable for people with little formal training in statistics and because they can be used to solve the vast majority of quality-related issues

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Seven tools of quality are:**

1. Check sheets,
2. Histograms,
3. Cause and effect diagrams,
4. Pareto diagrams,
5. Stratification analysis,
6. Scatter diagrams, and
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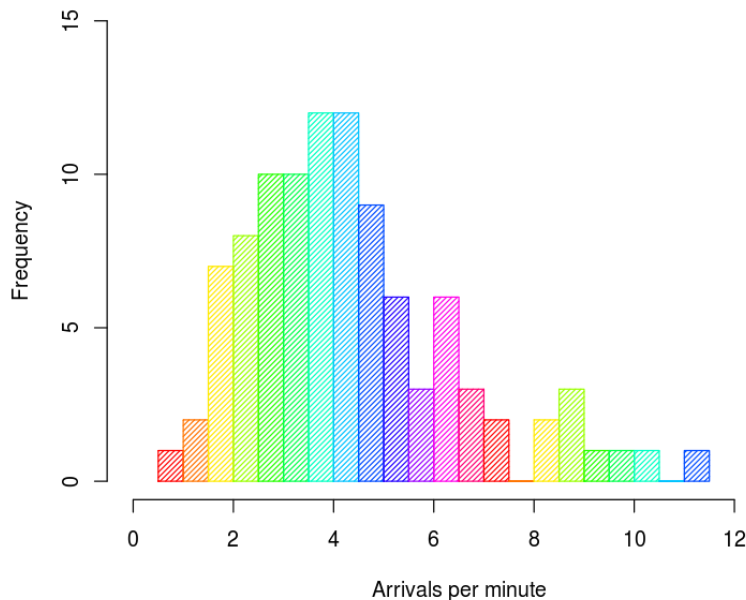
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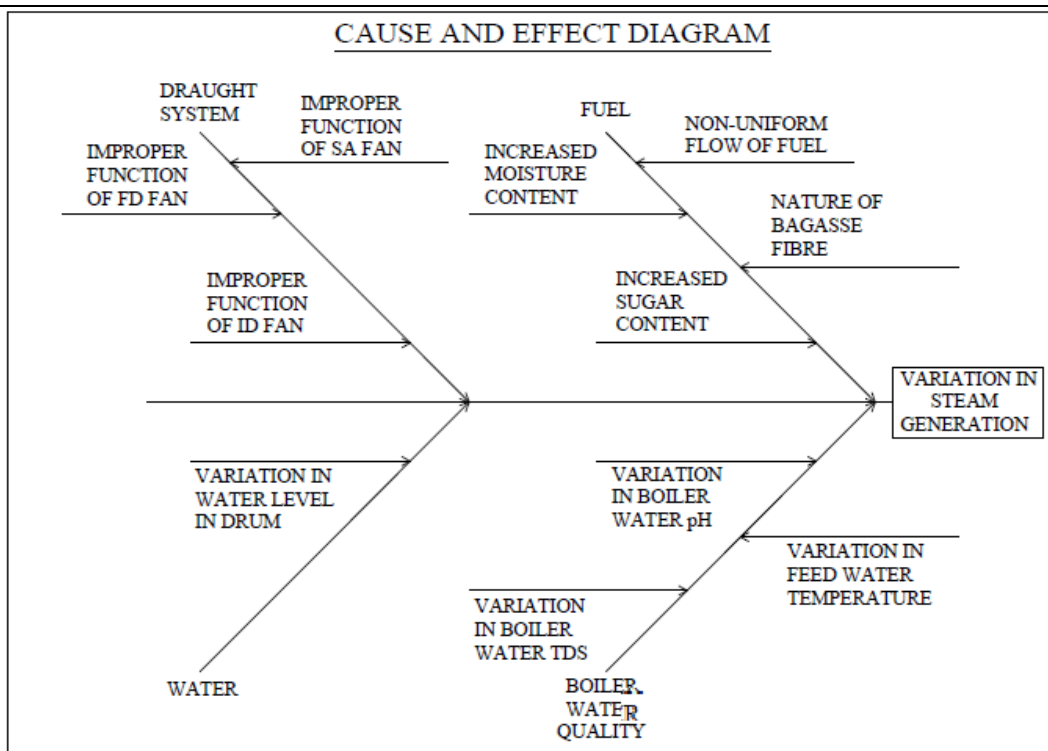
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Wrong part issued								3
Film on parts								0
Voids in casting								6
Incorrect dimensions								2
Adhesive failure								0
Masking insufficient								1
Spray failure								5
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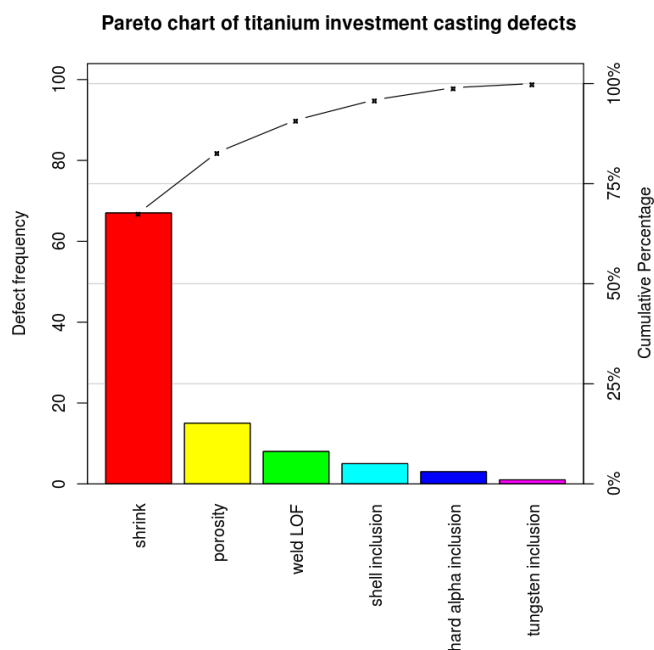
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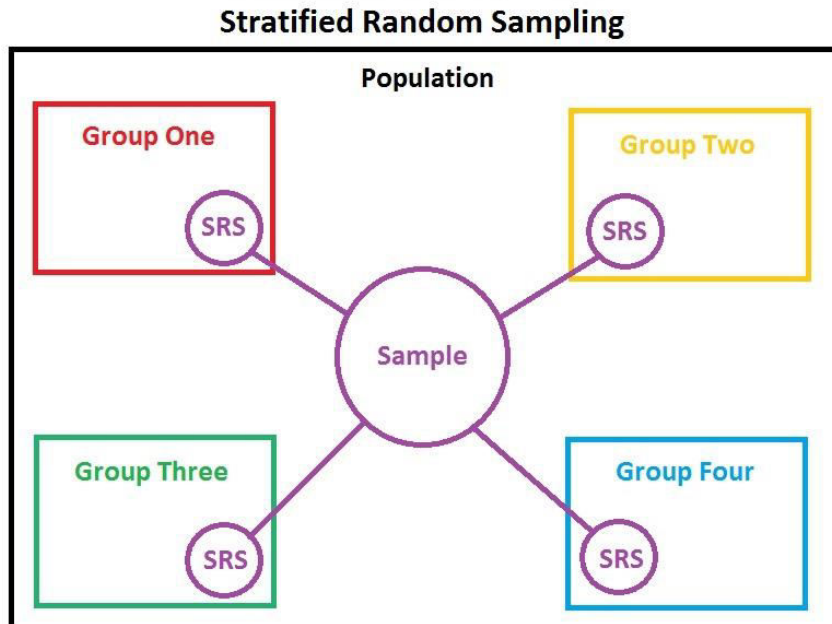


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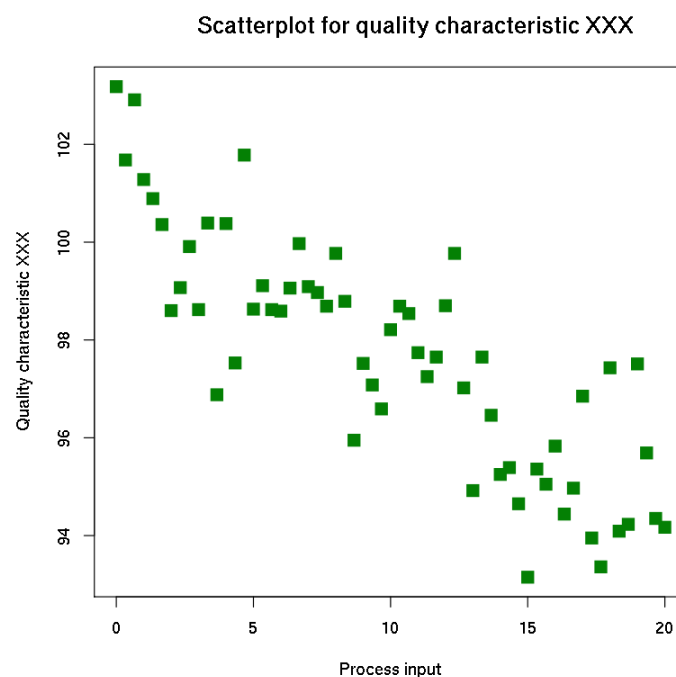
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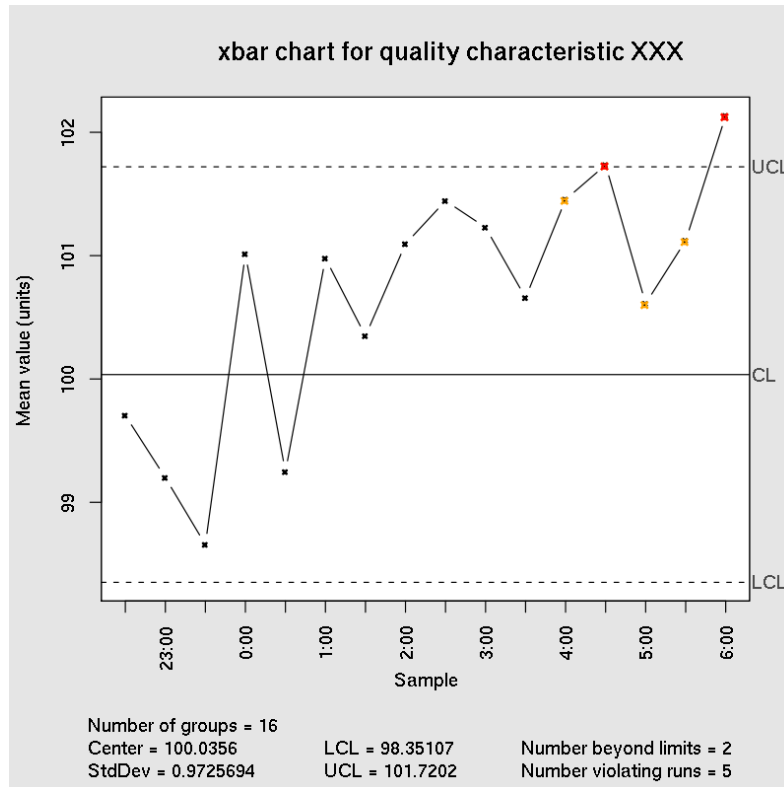


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**Course Faculty**



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LECTURE HANDOUTS

L21

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** Statistical Fundamentals –Measures of central Tendency and Dispersion

**Introduction : ( Maximum 5 sentences)**

1. Two important types of statistics are measures of central tendency and measures of dispersion. A measure of central tendency is a number used to represent the center or middle of a set of data values.
2. The mean, median, and mode are three commonly used measures of central tendency.
3. Statistical process control, or SPC, is a fundamental approach to quality control and improvement that is based on objective data and analysis.
4. The origin of SPC dates back to the 1920s and 1930s at the Western Electric Company and Bell Telephone Laboratories. Walter Shewhart (1891-1967) recognized that variation in a production process can be understood and controlled through the use of statistical methods.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

**Statistical Fundamentals**

Statistics are numerical values used to summarize and compare sets of data. Two important types of statistics are measures of central tendency and measures of dispersion. A measure of central tendency is a number used to represent the center or middle of a set of data values. The mean, median, and mode are three commonly used measures of central tendency.

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 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

**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.

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

where S = sample standard deviation

$X_i$  = observed value

$n$  = number of observations

**Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 480-483)



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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 22

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** Population and Sample, Normal Curve

**Introduction : ( Maximum 5 sentences)**

1. Many times it isn't possible or practical to analyze an entire population, therefore, samples are obtained from a portion of the population. There are various techniques for gathering samples
2. There are several methods of sampling. It is important to choose the best plan to provide the best output of information about the entire population.
3. The main difference between a population and sample has to do with how observations are assigned to the data set. A population includes all of the elements from a set of data. A sample consists one or more observations drawn from the population.
4. A normal curve is the probability distribution curve of a normal random variable. It is a graphical representation of a normal distribution.
5. The probability that an observation under the normal curve lies within 1 standard deviation of the mean is approximately 0.68.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

(Max. Four important topics)

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

- A population is a group of phenomena that have something in common. The term often refers to a group of people.
- The main difference between a population and sample has to do with how observations are assigned to the data set.
- A population includes all of the elements from a set of data.
- A sample consists one or more observations drawn from the population.
- Depending on the sampling method, a sample can have fewer observations than the population, the same number of observations, or more observations. More than one sample can be derived from the same population.
- Other differences have to do with nomenclature, notation, and computations. For example, a measurable characteristic of a population, such as a mean or standard deviation, is called a parameter; but a measurable characteristic of a sample is called a statistic.

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, and 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.

$\bar{X}$  is for sample average or sample mean.

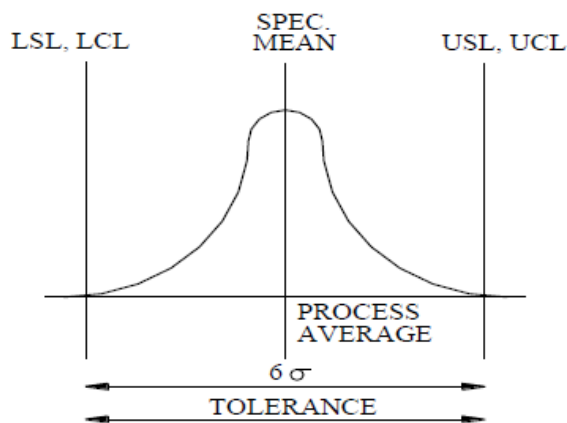
$\mu$  is for population mean.

S is for sample standard deviation.

$\sigma$  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.
- Normal distribution, also known as the Gaussian distribution, is a probability distribution that is symmetric about the mean, showing that data near the mean are more frequent in occurrence than data far from the mean. In graph form, normal distribution will appear as a bell curve



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- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
- <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
- [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

#### Important Books/Journals for further learning including the page nos:

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 487-490)





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LECTURE HANDOUTS

L 23

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : I - Introduction

Date of Lecture::

**Topic of Lecture:** Control Charts for Variables

**Introduction : ( Maximum 5 sentences)**

1. Variables control charts are used to evaluate variation in a process where the measurement is a variable--i.e. the variable can be measured on a continuous scale (e.g. height, weight, length, concentration).
2. The objective of the control chart is to find any "special" causes of variation as well as to reflect the process improvements that have been made. Again, to effectively use control charts, you must understand the information in variation.
3. It improves process control to give less variation in the output, lower the unit cost and increase the process capacity. Provide a common language for all staff to discuss and improve processes. Control charts are not a substitute for action.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

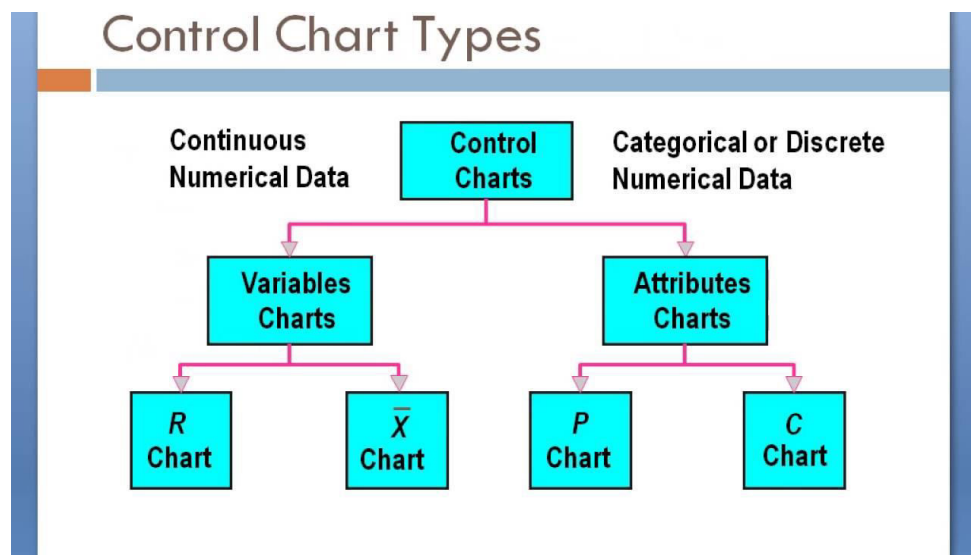
1. The most widely used control chart for attributes is the fraction (proportion) defective chart, that is, the p-chart. The p-chart may be applied to quality characteristics, which cannot be measured or impracticable and uneconomical to measure it. These items/units are classified as defective or non-defective on the basis of certain criteria (defects).
2. Variation is a law of nature because no two natural items in any category are the same. Variations are due to the following reasons.
  - Chance causes or Natural causes.
  - Assignable causes.
3. 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.
4. Hence, when only chance causes are present in a process, the process is said to be in Statistical Control.
5. 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.
6. Hence, when only chance causes are present in a process, the process is said to be in Statistical Control.

7. 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.
8. All control charts have three basic components.
  - A centre line, usually the mathematical average of all the samples plotted.
  - Upper and Lower Control Limits that define the constraints of common cause variations.
  - Performance data plotted over time.
9. 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).

**Different types of control charts:**

- X bar control chart.
- Range “R” control chart.
- Standard Deviation “S” control chart.
- “p” and “np” control charts.
- Pre-control Charts.

Control charts fall into two categories: Variable and Attribute Control Charts. Variable data are data that can be measured on a continuous scale such as a thermometer, a weighing scale, or a tape rule.



**1. Mean chart - X chart & Range Chart - R Chart**

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

Where, N = Total number of observations.

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

n = Sample size (for finding out the value of A<sub>2</sub> and D<sub>4</sub> and D<sub>3</sub> from the table)

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

**$\bar{X}$  - CHART****R - CHART**

$$\text{CL} = \bar{X}$$

$$\text{CL} = R$$

$$\text{UCL}_{\bar{X}} = \bar{X} + A_2 \cdot R$$

$$\text{UCL}_R = D_4 \cdot R$$

$$\text{LCL}_{\bar{X}} = \bar{X} - A_2 \cdot R$$

$$\text{LCL}_R = D_3 \cdot R$$

**2. Mean chart -  $\bar{X}$  chart & Standard Deviation chart - S Chart**

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

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.

 **$\bar{X}$  - CHART****S - CHART**

$$\text{CL} = \bar{X}$$

$$\text{CL} = S$$

$$\text{UCL}_{\bar{X}} = \bar{X} + A_3 \cdot S$$

$$\text{UCL}_S = B_4 \cdot S$$

$$\text{LCL}_{\bar{X}} = \bar{X} - A_3 \cdot S$$

$$\text{LCL}_S = B_3 \cdot S$$

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## LECTURE HANDOUTS

L 24

EEE

III/V

**Course Name : 19EEE09 & Total Quality Management**

**Faculty Name : Mrs.M.Selvakumari**

**Unit : III-Statistical Process Control (SPC)**

**Date of Lecture:**

**Topic of Lecture:** Control Charts for Attributes , Process capability

### **Introduction : ( Maximum 5 sentences)**

1. Variables control charts are used to evaluate variation in a process where the measurement is a variable--i.e. the variable can be measured on a continuous scale (e.g. height, weight, length, concentration).
2. The objective of the control chart is to find any "special" causes of variation as well as to reflect the process improvements that have been made. Again, to effectively use control charts, you must understand the information in variation.
3. It improves process control to give less variation in the output, lower the unit cost and increase the process capacity. Provide a common language for all staff to discuss and improve processes. Control charts are not a substitute for action.
4. Process Capability (Cp) is a statistical measurement of a process's ability to produce parts within specified limits on a consistent basis.
5. Process capability indices Cp and Cpk evaluate the output of a process in comparison to the specification limits determined by the target value and the tolerance range

### **Prerequisite knowledge for Complete understanding and learning of Topic: (Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

### **Detailed content of the Lecture:**

1. Attribute Charts are a set of control charts specifically designed for Attributes data (i.e. counts data). Attribute charts monitor the process location and variation over time in a single chart.

### **Control Chart for Attributes**

- The cost of collecting data for attributes is less than that for the variables
- There are various types of control charts for attributes:
  - The p chart for the fraction rejected
  - The np chart for the total number rejected
  - The c chart for the number of defects
  - The u chart for the number of defects per unit
- X-bar and R charts are used to monitor the mean and variation of a process based on samples

taken from the process at given times (hours, shifts, days, weeks, months, etc.).

- When a point is outside these established control limits it indicates that the mean (or variation) of the process is out-of-control

### **np Chart**

The  $np$  chart construction steps are similar to those of the  $p$  chart. The trial centerline and control limits are as follows:

$$\text{Centerline } \bar{np} = \frac{\sum np}{m}$$

where,  $m$  = number of subgroups

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

$$LCL_{np} = \bar{np} - 3\sqrt{\bar{np}(1-\bar{p})}$$

### **C Chart**

Step 3: Calculate the centerline and the control limits (trial)

$$\text{Centerline } \bar{c} = \frac{\sum c}{m}$$

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

$$LCL_c = \bar{c} - 3\sqrt{\bar{c}}$$

Where,  $m$  = number of samples

### **u Chart**

Step 3: Calculate the centerline and the control limits (trial)

$$\text{Centerline } \bar{u} = \frac{\sum c}{\sum n}$$

$$UCL_u = \bar{u} + 3\frac{\sqrt{\bar{u}}}{\sqrt{n}}$$

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Process Capability Index ( $CP$ ,  $CPK$ )

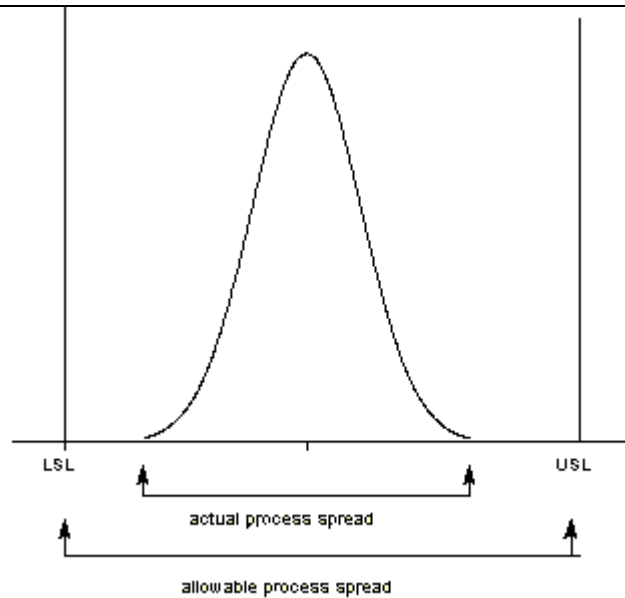
In **process** improvement efforts, the **process capability** index or **process capability** ratio is a statistical measure of **process capability**: the ability of a **process** to produce output within specification limits. The concept of **process capability** only holds meaning for **processes** that are in a state of statistical control.

### **Process Capability Indices**

We are often required to compare the output of a stable process with the process specifications and make a statement about how well the process meets specification. To do this we compare the natural variability of a stable process with the process specification limits.

A process where almost all the measurements fall inside the specification limits is a capable process.

This can be represented pictorially by the plot below:



There are several statistics that can be used to measure the capability of a process:  $C_p$ ,  $C_{pk}$ , and  $C_{pm}$ .

Most capability indices estimates are valid only if the sample size used is "large enough". Large enough is generally thought to be about 50 independent data values.

The  $C_p$ ,  $C_{pk}$ , and  $C_{pm}$  statistics assume that the population of data values is normally distributed. Assuming a two-sided specification, if  $\mu$  and  $\sigma$  are the mean and standard deviation, respectively, of the normal data and USL, LSL, and  $T$  are the upper and lower specification limits and the target value, respectively, then the population capability indices are defined as follows.

$$C_p = \frac{USL - LSL}{6\sigma}$$

$$C_{pk} = \min \left[ \frac{USL - \mu}{3\sigma}, \frac{\mu - LSL}{3\sigma} \right]$$

$$C_{pm} = \frac{USL - LSL}{6\sqrt{\sigma^2 + (\mu - T)^2}}$$

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**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 508-510)



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LECTURE HANDOUTS

L 25

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** Control Charts for Attributes , Process capability

**Introduction : ( Maximum 5 sentences)**

1. Variables control charts are used to evaluate variation in a process where the measurement is a variable--i.e. the variable can be measured on a continuous scale (e.g. height, weight, length, concentration).
2. The objective of the control chart is to find any "special" causes of variation as well as to reflect the process improvements that have been made. Again, to effectively use control charts, you must understand the information in variation.
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4. Process Capability ( $C_p$ ) is a statistical measurement of a process's ability to produce parts within specified limits on a consistent basis.
5. Process capability indices  $C_p$  and  $C_{pk}$  evaluate the output of a process in comparison to the specification limits determined by the target value and the tolerance range

**Prerequisite knowledge for Complete understanding and learning of Topic:**

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## Control Chart Techniques

Procedure for establishing a pair of control charts for the average  $\bar{X}$  and the range  $R$ :

1. Select the quality characteristic
2. Choose the rational subgroup
3. Collect the data
4. Determine the trial center line and control limits
5. Establish the revised central line and control limits
6. Achieve the objective

## Control Charts for $\bar{X}$ and $R$

### Notation for variables control charts

- $n$  - size of the sample (sometimes called a subgroup) chosen at a point in time
- $m$  - number of samples selected
- $\bar{x}_i$  = average of the observations in the  $i$ th sample (where  $i = 1, 2, \dots, m$ )
- $\bar{\bar{x}}$  = grand average or "average of the averages" (this value is used as the center line of the control chart)

## Control Charts for $\bar{X}$ and $R$

### Notation and values

- $R_i$  = range of the values in the  $i$ th sample

$$R_i = X_{\max} - X_{\min}$$

- $\bar{R}$  = average range for all  $m$  samples
- $\mu$  is the true process mean
- $\sigma$  is the true process standard deviation

### np Chart

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Process Capability Index ( $CP$ ,  $CPK$ )

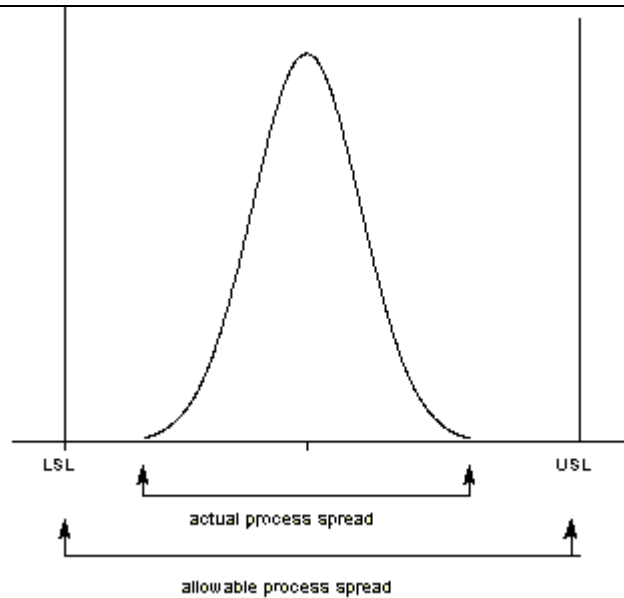
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A process where almost all the measurements fall inside the specification limits is a capable process.

This can be represented pictorially by the plot below:



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Most capability indices estimates are valid only if the sample size used is "large enough". Large enough is generally thought to be about 50 independent data values.

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LECTURE HANDOUTS

L 26

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** Concept of six sigma

**Introduction : ( Maximum 5 sentences)**

1. Six Sigma is a quality management methodology used to help businesses improve current processes, products or services by discovering and eliminating defects.
2. The goal is to streamline quality control in manufacturing or business processes so there is little to no variance throughout.
3. A Six Sigma team consists of members from the executive leadership committee of a company, a champion, Six Sigma Master Black Belts, Six Sigma Black Belts and Six Sigma Green Belts.
4. Green Belt training is necessary to participate in a Six Sigma project on the most basic level.
5. The objective of six sigma principle is to achieve zero defects products/process. It allows 3.4 defects per million opportunities.

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

**Detailed content of the Lecture:**

1. **Leadership Commitment:** Top management not only initiates Six Sigma deployment, it also plays an active role in the whole deployment cycle. Six Sigma starts by providing senior leadership with training in the principles and tools it needs to direct the development of a management infrastructure to support Six Sigma. This involves reducing the levels of organizational hierarchy and removing procedural barriers to experimentation and change.
2. **Customer Focus:** Systems are developed for establishing close communications with “external customers” (direct customers, end-users, suppliers, regulatory bodies, etc), and with internal customers (employees). From upstream suppliers to ultimate end-users, Six Sigma eliminates the opportunities for defects.
3. **Strategic Deployment:** Six Sigma targets a small number of high-financial leveraged items. It focuses the company’s resources: right support, right people, right project, and right tools, on identifying and improving performance metrics that relate to bottom-line success.
4. **Integrated Infrastructure:** The Leadership Team defines and reviews project progress. The Champion acts as a political leader and removes the barriers for the project team. The Master

Black Belt acts as a technical coach and provides in-depth knowledge of quality tools. The Black Belt controls the project while the Green Belt supports the Black Belt - together they form the Six Sigma Project Teams. In addition, the incentive and recognition systems motivate the project teams to achieve the business goals.

5. **Disciplined Framework:** Six Sigma projects are implemented using the Measure, Analyze, Improve and Control disciplined road map. This MAIC discipline sets up a clear protocol to facilitate internal communication. In addition, from a business perspective, Six Sigma is also a framework for continuous business improvement.
6. **Education and Training:** Six Sigma believes that true commitment is driven by true understanding. As a fact-based methodology, it intensively utilizes quality and statistical tools to transform a practical problem to a practical solution. Thus, a top-to-bottom training is conducted in Six Sigma philosophy and system improvement techniques for all levels.

In conclusion, Six Sigma's approach and deployment makes it distinguishable from other quality initiatives. The Six Sigma approach involves the use of statistical tools within a structured methodology for gaining the knowledge needed to achieve better, faster and less expensive products and services than the competition. The repeated, disciplined application of the master strategy on project after project, where the projects are selected based on key business objectives, is what drives dollars to the bottom line, resulting in impressive profits. Moreover, fueled by the bottom line improvement, top management will continuously be committed to this approach, the work culture will be constantly nurtured, customers will definitely be satisfied, and Total Quality will ultimately be achieved.

**Principles of six sigma:**

Recognize, Define, Measure, Analyze, Improve, Control, Standardize, and Integrate.

**Six sigma tools:** Six Sigma tools are defined as the problem-solving tools used to support Six Sigma and other process improvement efforts. It is an integral part of a Six Sigma initiative, but can also be implemented as a standalone quality improvement procedure or as part of other process improvement initiatives such as lean.

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**Course Faculty**



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LECTURE HANDOUTS

L 27

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : III-Statistical Process Control (SPC)

Date of Lecture:

**Topic of Lecture:** New Seven Management Tools

**Introduction : ( Maximum 5 sentences)**

1. New management planning tools are defined as the method(s) for achieving expected outcomes that previously have not been used.
2. In 1976, the Union of Japanese Scientists and Engineers (JUSE) saw the need for tools to promote innovation, communicate information, and successfully plan major projects. A team researched and developed these seven new quality control tools, often called the seven management and planning tools, or simply the seven management tools.
3. The main purpose of these tools was to guide the managers in planning, analysis and decision making. These tools were invented separately by different people for various purposes, but were organized and clubbed together during the course of time to achieve efficient planning and management of operations.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Statistical Approach for Quality Control

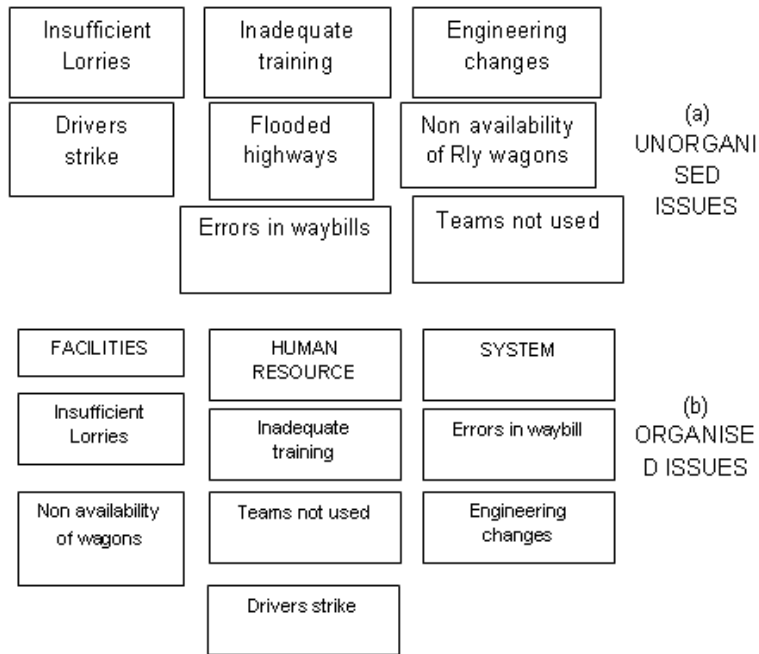
**Detailed content of the Lecture:**

**The New Seven Management Tools**

- Affinity Diagram (KJ Method)
- Interrelationship Diagram (ID)
- Tree Diagram.
- Prioritization Matrix.
- Matrix Diagram.
- Process Decision Program Chart (PDPC)
- Activity Network Diagram

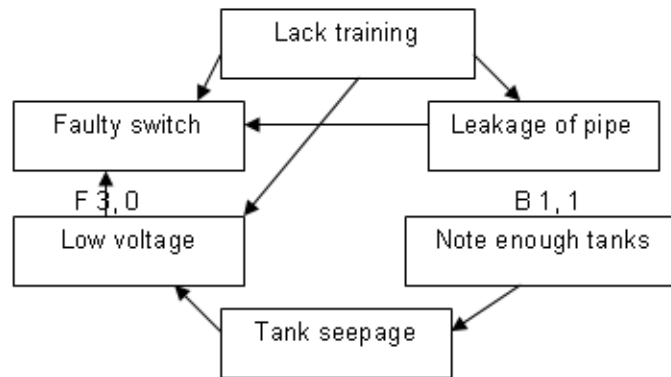
**Affinity diagram:** Organizes a large number of ideas into their natural relationships.

What are the issues in delay in delivery fertilizers?

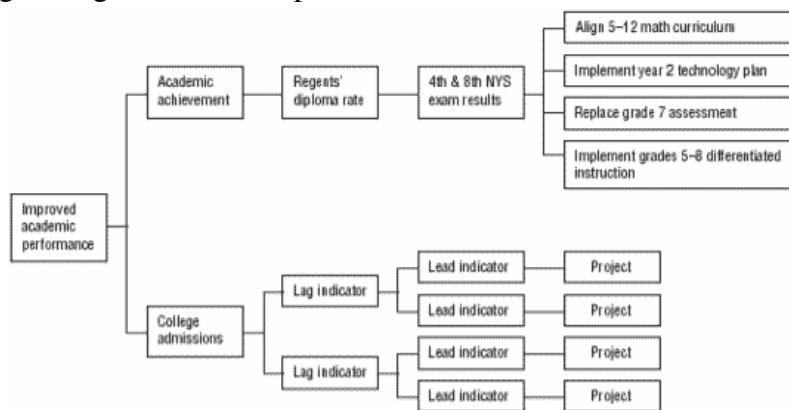


**Interrelationship diagram:** Shows cause-and-effect relationships and helps analyze the natural links between different aspects of a complex situation.

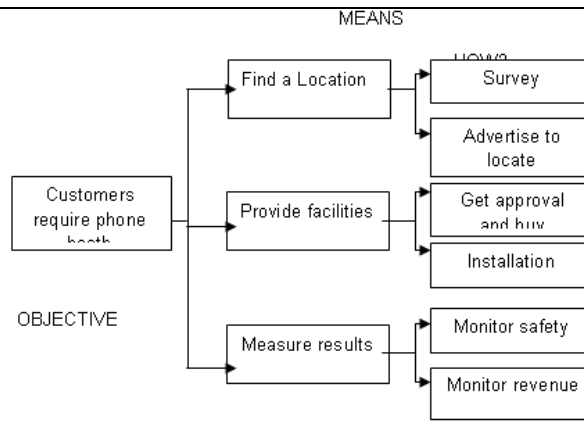
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**Tree diagram:** Breaks down broad categories into finer and finer levels of detail, helping to move step-by-step thinking from generalities to specifics.

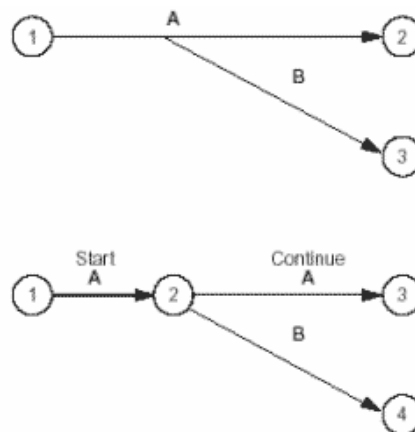


**Matrix diagram:** Shows the relationship between two, three, or four groups of information and can give information about the relationship, such as its strength, the roles played by various individuals, or measurements.

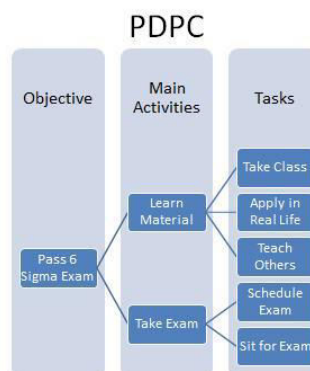


**Matrix data analysis:** A complex mathematical technique for analyzing matrices, often replaced by the similar prioritization matrix. A prioritization matrix is an L-shaped matrix that uses pairwise comparisons of a list of options to a set of criteria in order to choose the best option(s).

**Arrow diagram:** Shows the required order of tasks in a project or process, the best schedule for the entire project, and potential scheduling and resource problems and their solutions.



**Process decision program chart:** Systematically identifies what might go wrong in a plan under development.



**Video Content / Details of website for further learning (if any):**

- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <https://asq.org/quality-resources/new-management-planning-tools>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 455-461)





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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L28

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:**Benchmarking–Reasons to Benchmark

### Introduction : ( Maximum 5 sentences)

1. Benchmarking is the practice of comparing business processes and performance metrics to industry bests and best practices from other companies. Dimensions typically measured are quality, time and cost.
2. Benchmarking is used to measure performance using a specific indicator (cost per unit of measure, productivity per unit of measure, cycle time of x per unit of measure or defects per unit of measure) resulting in a metric of performance that is then compared to others.
3. In project management benchmarking can also support the selection, planning and delivery of projects
4. In regards to methods used for analyzing benchmarking data, there are several approaches, like: matrix technology, comparison tables, graphs (Pie chart, Bar chart / Histogram), SWOT analysis, life cycle analysis, market growth and attractiveness and spider web diagram

### Prerequisite knowledge for Complete understanding and learning of Topic: (Max. Four important topics)

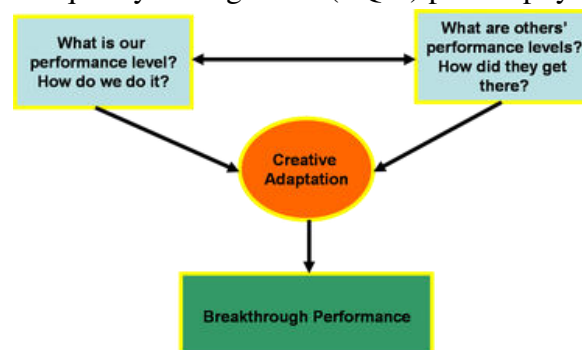
- Communicative in English
- Statistical Approach for Quality Control

### Detailed content of the Lecture:

1. Benchmarking is a way to go backstage and watch another company's performance from the wings, where all stage tricks and hurried realignments are visible.

### What is that organizations do that gets result so much better than ours?

The answer to this question opens door to benchmarking, an approach that is accelerating among many firms that have adopted the total quality management (TQM) philosophy.



### The Essence of Benchmarking

The essence of benchmarking is the continuous process of comparing a company's strategy, products,

processes with those of the world leaders and best-in-class organizations.

The purpose is to learn how the achieved excellence, and then setting out to match and even surpass it. The justification lies partly in the question: “Why reinvent the wheel if I can learn from someone who has already done it?” However, Benchmarking is not a panacea that can replace all other quality efforts or management processes.

### **The Evolution of Benchmarking**

The method may have evolved in the early 1950s, when W. Edward Deming taught the Japanese the idea of quality control. Other American management innovations followed.

The best example is Toyota Motor Corporation’s following the footsteps of Ford Motor Corporation albeit with the adaptation of the Ford’s Just-in-case system into Toyota’s Just-in-time system. The term “benchmarking,” however, was not coined by that time.

The term “benchmarking” emerged when the idea took ground in US during 1980s when Xerox, Ford and Motorola became the pioneers of benchmarking in USA. Robert Camp, the logistics engineer who initiated Xerox’s benchmarking program and who is generally regarded as the guru of the benchmarking movement, defines it: “Benchmarking is the search for industry best practices that lead to superior performance”.

### **The Xerox Case**

The company invented the photocopier in 1959 and maintained a virtual monopoly for many years thereafter. “Xerox” became a generic name for all photocopiers. By 1981, however, the companies market shrunk to 35% as IBM and Kodak developed high-end machines and Canon, Ricoh and Savin dominated the low-end segment of market.

The company instituted the quality improvement plan, which resulted in tremendous progress and survival of the organization. This quality improvement plan was later known to the world as Benchmarking Program. Xerox’s approach focused on key processes, rather than simply on finished products, and highlighted distinctive elements of those processes that accounted for product superiority.

Xerox’s benchmarking strategy recognized that many processes are not unique to a single industry and that comparisons need not be confined strictly to one’s competitors. Xerox and other benchmarkers now believe that breakthrough advances are more likely to occur by adapting lessons learned from leaders operating in entirely different industries.

Xerox benchmarked companies both, in and outside the industry. The particular example is L.L.Bean, catalog seller of outside equipment for improving distribution system based on the same. The benchmarking process resulted in: Quality problems cut by two-thirds, manufacturing costs cut in half, development task cut by two-thirds, direct labor cut by 50% and corporate staff cut by 35% while increase in volume.

It should be noted that all these improvements were not direct result of benchmarking rather it became the cause climate for change and continuous improvement followed as a natural result.

### **Levels of Benchmarking**

There are three levels of benchmarking:

1. Internal benchmarking (within the company)
2. Competitive or strategic benchmarking (Industry and competitors)
3. Benchmarking outside the industry.

### **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

**Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No219-221)

**Course Faculty**



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LECTURE HANDOUTS

L29

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:**Benchmarking Process

**Introduction : ( Maximum 5 sentences)**

1. If a company is to be successful, it needs to evaluate its performance in a consistent manner.
2. In order to do so, businesses need to set standards for themselves and measure their processes and performance against recognized industry leaders or against best practices from other industries, which operate in a similar environment.
3. This is commonly referred to as benchmarking in management parlance.
4. The benchmarking process is relatively uncomplicated. Some knowledge and a practical dent is all that is needed to make such a process a success.
5. Therefore, for the benefit of corporate executives, students and the interested general populace, the key steps in the benchmarking process are highlighted below.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

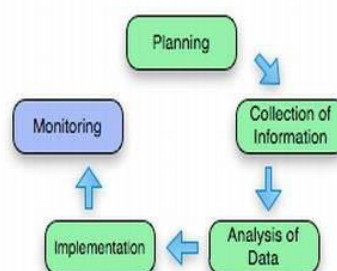
- Communicative in English
- TQM Basics
- Management Principles

**Detailed content of the Lecture:**

1. Benchmarking is a process of measuring the performance of a company's products, services, or processes against those of another business considered to be the best in the industry, aka "best in class." The point of benchmarking is to identify internal opportunities for improvement.

**A Step-by-Step Approach to Benchmarking**

**Following are the steps involved in benchmarking process:**



**(1) Planning**

- Prior to engaging in benchmarking, it is imperative that corporate stakeholders identify the

activities that need to be benchmarked.

- For instance, the processes that merit such consideration would generally be core activities that have the potential to give the business in question a competitive edge.
- Such processes would generally command a high cost, volume or value. For the optimal results of benchmarking to be reaped, the inputs and outputs need to be redefined; the activities chosen should be measurable and thereby easily comparable, and thus the benchmarking metrics needs to be arrived at.
- Prior to engaging in the benchmarking process, the total process flow needs to be given due consideration. For instance, improving one core competency at the detriment to another proves to be of little use.
- Therefore, many choose to document such processes in detail (a process flow chart is deemed to be ideal for this purpose), so that omissions and errors are minimized; thus enabling the company to obtain a clearer idea of its strategic goals, its primary business processes, customer expectations and critical success factors.
- An honest appraisal of the company's strengths, weaknesses and problem areas would prove to be of immense use when fine-tuning such a process.
- The next step in the planning process would be for the company to choose an appropriate benchmark against which their performance can be measured.
- The benchmark can be a single entity or a collective group of companies, which operate at optimal efficiency.
- As stated before, if such a company operates in a similar environment or if it adopts a comparable strategic approach to reach their goals, its relevance would, indeed, be greater.
- Measures and practices used in such companies should be identified, so that business process alternatives can be examined.
- Also, it is always prudent for a company to ascertain its objectives, prior to commencement of the benchmarking process.
- The methodology adopted and the way in which output is documented should be given due consideration too. On such instances, a capable team should be found in order to carry out the benchmarking process, with a leader or leaders being duly appointed, so as to ensure the smooth, timely implementation of the project.

## **(2) Collection of Information**

- Information can be broadly classified under the sub texts of primary data and secondary data.
- To clarify further, here, primary data refers to collection of data directly from the benchmarked company/companies itself, while secondary data refers to information garnered from the press, publications or websites.
- Exploratory research, market research, quantitative research, informal conversations, interviews and questionnaires, are still, some of the most popular methods of collecting information.
- When engaging in primary research, the company that is due to undertake the benchmarking process needs to redefine its data collection methodology.
- Drafting a questionnaire or a standardized interview format, carrying out primary research via the telephone, e-mail or in face-to-face interviews, making on-site observations, and documenting such data in a systematic manner is vital, if the benchmarking process is to be a success.

## **(3) Analysis of Data**

- Once sufficient data is collected, the proper analysis of such information is of foremost importance.
- Data analysis, data presentation (preferably in graphical format, for easy reference), results projection, classifying the performance gaps in processes, and identifying the root cause that

leads to the creation of such gaps (commonly referred to as enablers), need to be then carried out.

#### **(4) Implementation**

- This is the stage in the benchmarking process where it becomes mandatory to walk the talk. This generally means that far-reaching changes need to be made, so that the performance gap between the ideal and the actual is narrowed and eliminated wherever possible.
- A formal action plan that promotes change should ideally be formulated keeping the organization's culture in mind, so that the resistance that usually accompanies change is minimized.
- Ensuring that the management and staff are fully committed to the process and that sufficient resources are in place to meet facilitate the necessary improvements would be critical in making the benchmarking process, a success.

#### **(5) Monitoring**

- As with most projects, in order to reap the maximum benefits of the benchmarking process, a systematic evaluation should be carried out on a regular basis.
- Assimilating the required information, evaluating the progress made, re-iterating the impact of the changes and making any necessary adjustments, are all part of the monitoring process.

#### **Conclusion**

- As is clearly apparent, benchmarking can add value to the organization's workflow and structure by identifying areas for improvement and rectification.
- It is indeed invaluable in an organization's quest for continuous improvement.

#### **Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
- <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
- [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

#### **Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 221-225)



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LECTURE HANDOUTS

L30

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:**Quality Function Deployment (QFD)–House of Quality

**Introduction : ( Maximum 5 sentences)**

- Quality function deployment (QFD) provides a systematic process for integrating TQM into new product development activities.
- QFD combines various design engineering and managerial tools to create a customer-oriented approach to developing new products
- House of Quality refers to a well-known process for product development that is inspired by customer desires for product or process development and anchored by the capabilities and resources of the organization seeking to meet those desires
- HOQ is considered the primary tool used during quality function deployment to help facilitate group decision making.

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- TQM Basics
- Management Principles

**Detailed content of the Lecture:**

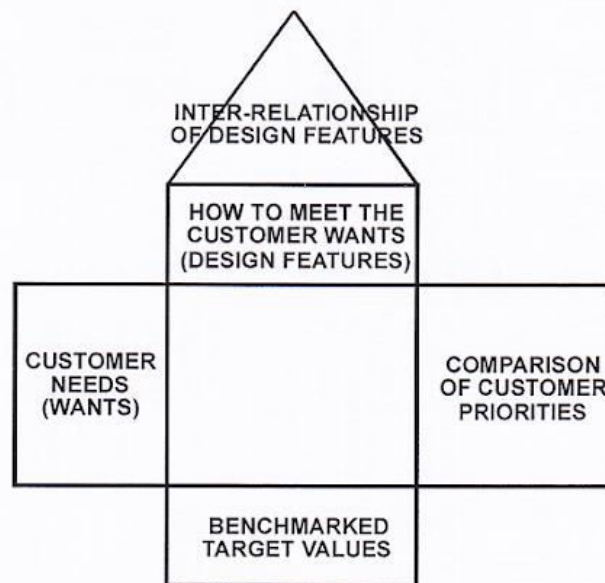
- Quality Function Deployment (QFD) is a process and set of tools used to effectively define customer requirements and convert them into detailed engineering specifications and plans to produce the products that fulfill those requirements. QFD is used to translate customer requirements (or VOC) into measurable design targets and drive them from the assembly level down through the sub-assembly, component and production process levels. QFD methodology provides a defined set of matrices utilized to facilitate this progression.
- QFD was first developed in Japan by YojiAkao in the late 1960s while working for Mitsubishi's shipyard. It was later adopted by other companies including Toyota and its supply chain. In the early 1980s, QFD was introduced in the United States mainly by the big three automotive companies and a few electronics manufacturers. Acceptance and growth of the use of QFD in the US was initially rather slow but has since gained popularity and is currently being used in manufacturing, healthcare and service organizations.
- Effective communication is one of the most important and impactful aspects of any organization's success. QFD methodology effectively communicates customer needs to multiple business operations throughout the organization including design, quality, and

manufacturing, production, marketing and sales. This effective communication of the Voice of the Customer allows the entire organization to work together and produce products with high levels of customer perceived value.

**There are several additional benefits to using Quality Function Deployment:**

- Customer Focused: QFD methodology places the emphasis on the wants and needs of the customer, not on what the company may believe the customer wants. The Voice of the Customer is translated into technical design specifications. During the QFD process, design specifications are driven down from machine level to system, sub-system and component level requirements. Finally, the design specifications are controlled throughout the production and assembly processes to assure the customer needs are met.
- VOC Competitor Analysis: The QFD “House of Quality” tool allows for direct comparison of how your design or product stacks up to the competition in meeting the VOC. This quick analysis can be beneficial in making design decisions that could place you ahead of the pack.
- Shorter Development Time and Lower Cost: QFD reduces the likelihood of late design changes by focusing on product features and improvements based on customer requirements. Effective QFD methodology prevents valuable project time and resources from being wasted on development of non-value added features or functions.
- Structure and Documentation: QFD provides a structured method and tools for recording decisions made and lessons learned during the product development process. This knowledge base can serve as a historical record that can be utilized to aid future projects.
- Companies must bring new and improved products to market that meet the customer’s actual wants and needs while reducing development time. QFD methodology is for organizations committed to listening to the Voice of the Customer and meeting their needs.

**House of Quality**



Basic House of Quality Description

**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



**Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
- <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
- [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No327-334)

**Course Faculty**



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LECTURE HANDOUTS

L31

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:** QFD Process, and Benefits

**Introduction : ( Maximum 5 sentences)**

- Quality Function Deployment provides documentation for the decision-making process.
- QFD helps: Translate customer requirements into specific offering specifications.
- Prioritize possible offering specifications and make trade-off decisions based on weighted customer requirements and ranked competitive assessment.
- Quality function development is a systematic and organized approach of taking customer needs and demands into consideration while designing new products and services or while improving the existing products and services.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- TQM Basics
- Management Principles

**Detailed content of the Lecture:**

**Level 1 QFD**

- The House of Quality is an effective tool used to translate the customer wants and needs into product or service design characteristics utilizing a relationship matrix. It is usually the first matrix used in the QFD process. The House of Quality demonstrates the relationship between the customer wants or “Whats” and the design parameters or “Hows”. The matrix is data intensive and allows the team to capture a large amount of information in one place. The matrix earned the name “House of Quality” due to its structure resembling that of a house. A cross-functional team possessing thorough knowledge of the product, the Voice of the Customer and the company’s capabilities, should complete the matrix. The different sections of the matrix and a brief description of each are listed below:
- “Whats”: This is usually the first section to be completed. This column is where the VOC, or the wants and needs, of the customer are listed.
- Importance Factor: The team should rate each of the functions based on their level of importance to the customer. In many cases, a scale of 1 to 5 is used with 5 representing the highest level of importance.
- “Hows” or Ceiling: Contains the design features and technical requirements the product will need to align with the VOC.
- Body or Main Room: Within the main body or room of the house of quality the “Hows” are

ranked according to their correlation or effectiveness of fulfilling each of the “Whats”. The ranking system used is a set of symbols indicating either a strong, moderate or a weak correlation. A blank box would represent no correlation or influence on meeting the “What”, or customer requirement. Each of the symbols represents a numerical value of 0, 1, 3 or 9.

- **Roof:** This matrix is used to indicate how the design requirements interact with each other. The interrelationships are ratings that range from a strong positive interaction (++) to a strong negative interaction (–) with a blank box indicating no interrelationship.
- **Competitor Comparison:** This section visualizes a comparison of the competitor’s product in regards to fulfilling the “Whats”. In many cases, a scale of 1 to 5 is used for the ranking, with 5 representing the highest level of customer satisfaction. This section should be completed using direct feedback from customer surveys or other means of data collection.
- **Relative Importance:** This section contains the results of calculating the total of the sums of each column when multiplied by the importance factor. The numerical values are represented as discrete numbers or percentages of the total. The data is useful for ranking each of the “Hows” and determining where to allocate the most resources.
- **Lower Level / Foundation:** This section lists more specific target values for technical specifications relating to the “Hows” used to satisfy VOC.
- Upon completion of the House of Quality, the technical requirements derived from the VOC can then be deployed to the appropriate teams within the organization and populated into the Level 2 QFDs for more detailed analysis. This is the first step in driving the VOC throughout the product or process design process.

### **Level 2 QFD**

- The Level 2 QFD matrix is used during the Design Development Phase. Using the Level 2 QFD, the team can discover which of the assemblies, systems, sub-systems and components have the most impact on meeting the product design requirements and identify key design characteristics. The information produced from performing a Level 2 QFD is often used as a direct input to the Design Failure Mode and Effects Analysis (DFMEA) process. Level 2 QFDs may be developed at the following levels:

**System Level:** The technical specifications and functional requirements or “Hows” identified and prioritized within The House of Quality become the “Whats” for the system level QFD. They are then evaluated according to which of the systems or assemblies they impact. Any systems deemed critical would then progress to a sub-system QFD.

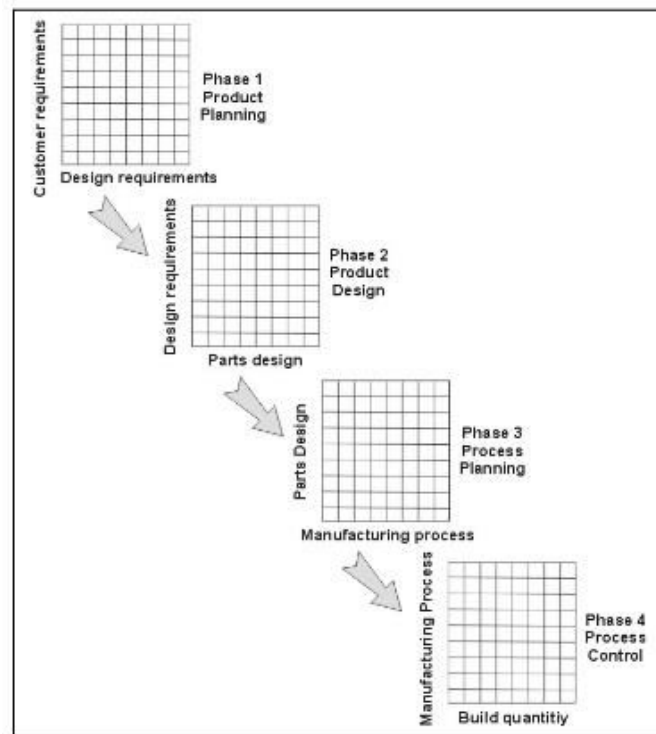
**Sub-system Level:** The requirements cascaded down from the system level are re-defined to align with how the sub-system contributes to the system meeting its functional requirements. This information then becomes the “Whats” for the QFD and the components and other possible “Hows” are listed and ranked to determine the critical components. The components deemed critical would then require progression to a component level QFD.

**Component Level:** The component level QFD is extremely helpful in identifying the key and critical characteristics or features that can be detailed on the drawings. The key or critical characteristics then flow down into the Level 3 QFD activities for use in designing the process. For purchased components, this information is valuable for communicating key and critical characteristics to suppliers during sourcing negotiations and as an input to the Production Part Approval Process (PPAP) submission.

### **Level 3 QFD**

- The Level 3 QFD is used during the Process Development Phase where we examine which of the processes or process steps have any correlation to meeting the component or part specifications. In the Level 3 QFD matrix, the “Whats” are the component part technical specifications and the “Hows” are the manufacturing processes or process steps involved in producing the part. The matrix highlights which of the processes or process steps have the most impact on meeting the part specifications. This information allows the production and quality

teams to focus on the Critical to Quality (CTQ) processes, which flow down into the Level 4 QFD for further examination.



#### Level 4 QFD

- The Level 4 QFD is not utilized as often as the previous three. Within the Level 4 QFD matrix, the team should list all the critical processes or process characteristics in the “Whats” column on the left and then determine the “Hows” for assuring quality parts are produced and list them across the top of the matrix. Through ranking of the interactions of the “Whats” and the “Hows”, the team can determine which controls could be most useful and develop quality targets for each. This information may also be used for creating Work Instructions, Inspection Sheets or as an input to Control Plans.
- The purpose of Quality Function Deployment is not to replace an organization’s existing design process but rather support and improve an organization’s design process. QFD methodology is a systemic, proven means of embedding the Voice of the Customer into both the design and production process. QFD is a method of ensuring customer requirements are accurately translated into relevant technical specifications from product definition to product design, process development and implementation. The fact is that every business, organization and industry has customers. Meeting the customer’s needs is critical to success. Implementing QFD methodology can enable you to drive the voice of your customers throughout your processes to increase your ability to satisfy or even excite your customers.

#### 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)

**Video Content / Details of website for further learning (if any):**

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- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>
- <http://www.iannauniversity.com/2012/06/ge2022-total-quality-management-lecture.html>
- <http://www.nprcet.org/e%20content/Misc/e-Learning/ECE/IV%20year-VIII%20semester/MG1301%20TOTAL%20QUALITY%20MANAGEMENT.pdf>
- [www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc](http://www.wsu.edu/~chenbi/mgtop340/lecture/Quality.doc)

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 335-354)

**Course Faculty**



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L32

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:** Taguchi Quality Loss Function

**Introduction : ( Maximum 5 sentences)**

- The quality loss function as defined by Taguchi is the loss imparted to the society by the product from the time the product is designed to the time it is shipped to the customer.
- In fact, he defined quality as the conformity around a target value with a lower standard deviation in the outputs.
- Taguchi's methods are statistical methods developed largely by Genichi Taguchi to improve the quality of manufactured goods. Taguchi methods are controversial among many convention western statisticians.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
(Max. Four important topics)

- Basics of Mathematics Concepts
- Management Principles
- TQM basics

**Detailed content of the Lecture:**

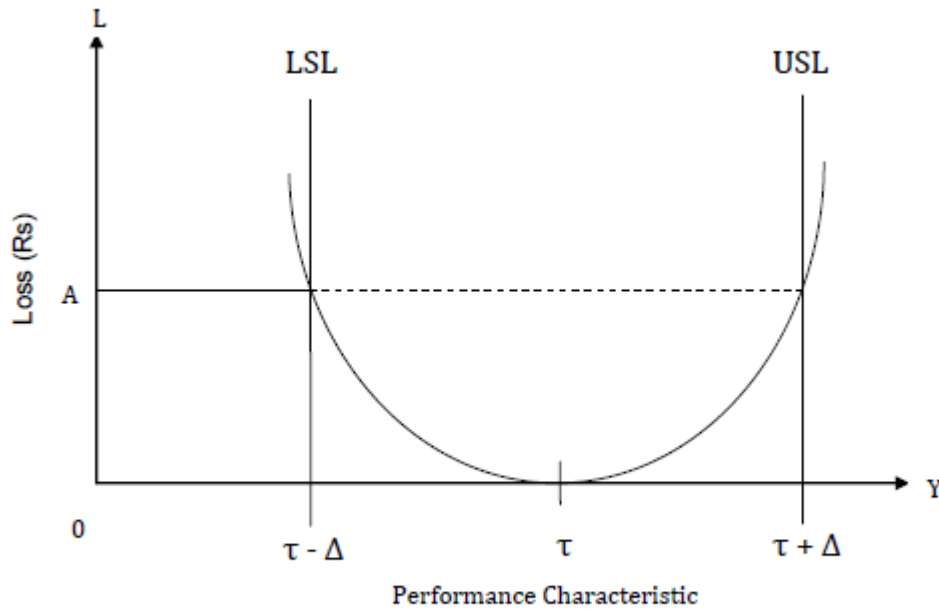
1. The concept of Taguchi's quality loss function was in contrast with the American concept of quality, popularly known as goal post philosophy, the concept given by American quality guru Phil Crosby. Goal post philosophy emphasizes that if a product feature doesn't meet the designed specifications it is termed as a product of poor quality (rejected), irrespective of amount of deviation from the target value (mean value of tolerance zone).
2. This concept has similarity with the concept of scoring a 'goal' in the game of football or hockey, because a goal is counted 'one' irrespective of the location of strike of the ball in the 'goal post', whether it is in the center or towards the corner. This means that if the product dimension goes out of the tolerance limit the quality of the product drops suddenly.
3. Through his concept of the quality loss function, Taguchi explained that from the customer's point of view this drop of quality is not sudden. The customer experiences a loss of quality the moment product specification deviates from the 'target value'.
4. This 'loss' is depicted by a quality loss function and it follows a parabolic curve mathematically given by  $L = k(y-m)^2$ , where  $m$  is the theoretical 'target value' or 'mean value' and  $y$  is the actual size of the product,  $k$  is a constant and  $L$  is the loss. This means that if the difference between 'actual size' and 'target value' i.e.  $(y-m)$  is large, loss would be more, irrespective of tolerance specifications. In Taguchi's view tolerance specifications are given by engineers and not by customers; what the customer experiences is 'loss'.

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  $\tau$ .

At  $\tau$ , 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

$\tau$  = target

$k$  = Quality loss coefficient.

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

Thus,

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

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LECTURE HANDOUTS

L33

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:** Taguchi Quality Loss Function

**Introduction : ( Maximum 5 sentences)**

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**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Basics of Mathematics Concepts
- Management Principles
- TQM basics

**Detailed content of the Lecture:**

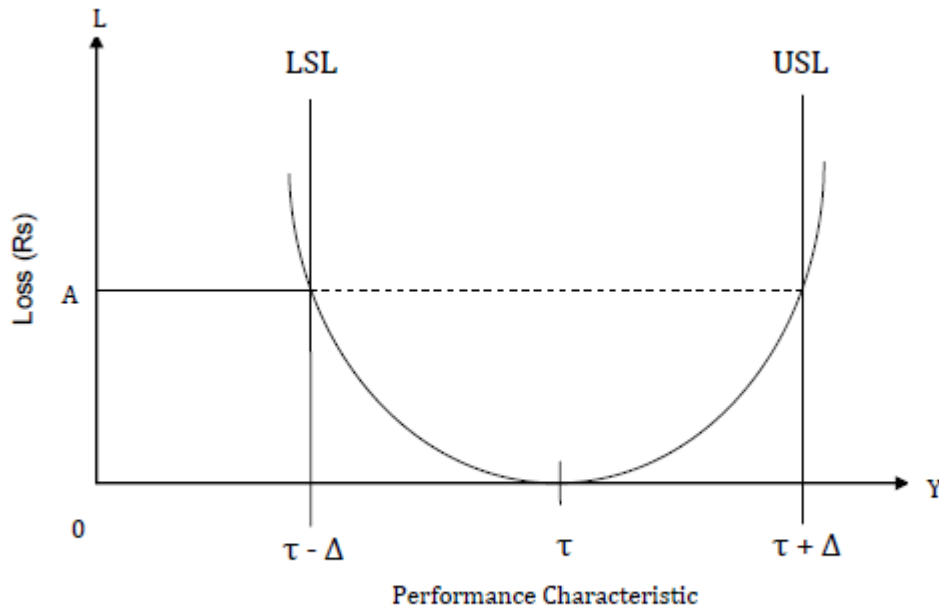
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Where,

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$y$  = Performance characteristic

$\tau$  = target

$k$  = Quality loss coefficient.

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

Thus,

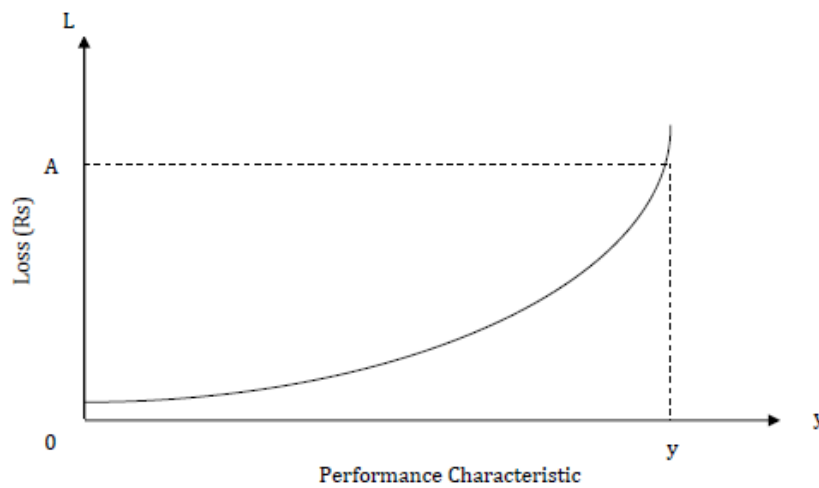
$$K = A / (y - U)^2 = A / \Delta^2 .$$

### SMALLER – THE – BETTER

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

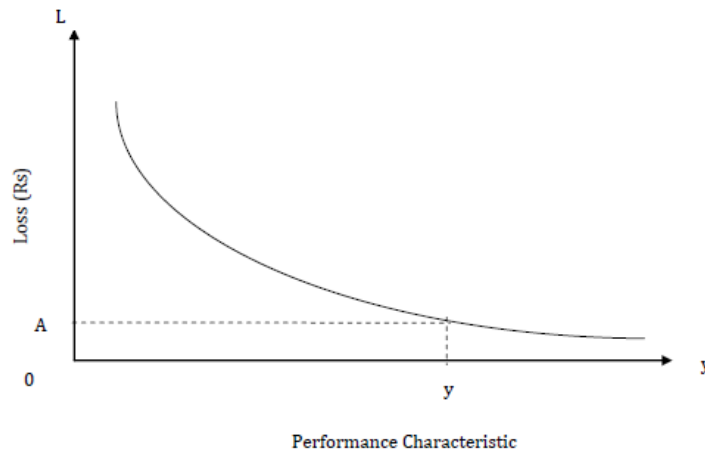
The target value for **smaller – the – better** is 0. There are no negative values for the performance characteristic.

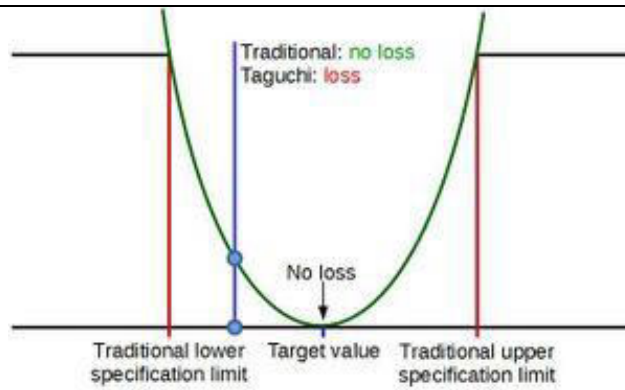
The radiation leakage from a microwave appliance, the response time for a computer, pollution from an automobile, out of round for a hole etc. are the performance characteristics for this concept.



### LARGER – THE – BETTER :

In the Larger – the – better concept, the target value is  $\infty$  (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.





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**Course Faculty**



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LECTURE HANDOUTS

L34

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:** Total Productive Maintenance (TPM)

**Introduction : ( Maximum 5 sentences)**

- Total Productive Maintenance (TPM) is a system of maintaining and improving the integrity of production, safety and quality systems through the machines, equipment, processes, and employees that add business value to an organization.
- TPM focuses on keeping all equipment in top working condition to avoid breakdowns and delays in manufacturing process.
- Total Productive Maintenance (TPM) was developed by Seiichi Nakajima based on the experience of the practical application of maintenance best practices in Japan between 1950 and 1970.
- The classic TPM process he developed consisting of 5 principles was later enhanced by the JIPM to incorporate many of the lessons of Lean Manufacturing and is referred to as Company-Wide TPM which consists of 8 principles/pillars

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Basics of Mathematics Concepts
- Management Principles
- TQM basics

**Detailed content of the Lecture:**

1. The goal of TPM is the continuous improvement of equipment effectiveness through engaging those that impact on it in small group improvement activities. Total quality management (TQM) and total productive maintenance (TPM) are considered as the key operational activities of the quality management system. In order for TPM to be effective, the full support of the total workforce is required.
2. This should result in accomplishing the goal of TPM: "Enhance the volume of the production, employee morals, and job satisfaction."
3. The main objective of TPM is to increase the Overall Equipment Effectiveness (OEE) of plant equipment. TPM addresses the causes for accelerated deterioration while creating the correct environment between operators and equipment to create ownership.
4. OEE has three factors which are multiplied to give one measure called OEE Performance  $\times$  Availability  $\times$  Quality = OEE

Each factor has two associated losses making 6 in total, these 6 losses are as follows:

- Performance = (1) running at reduced speed – (2) Minor Stops
- Availability = (3) Breakdowns – (4) Product changeover
- Quality = (5) Startup rejects – (6) Running rejects

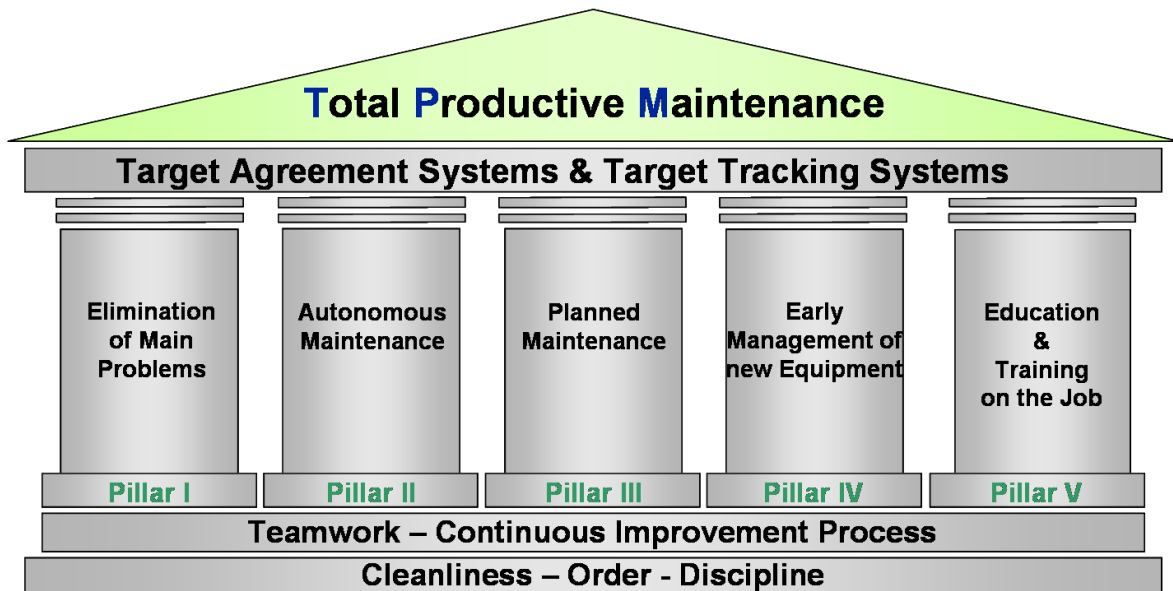
The objective finally is to identify then prioritize and eliminate the causes of the losses. This is done by self-managing teams that solve problem. Employing consultants to create this culture is a common practice.

## Principles

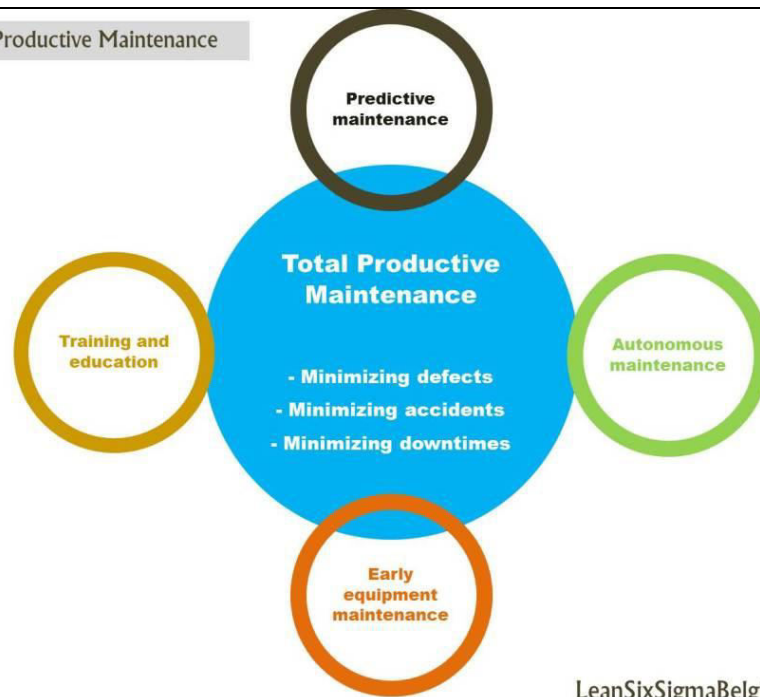
The eight pillars of TPM are mostly focused on proactive and preventive techniques for improving equipment reliability:

- Autonomous Maintenance
- Focused Improvement
- Planned Maintenance
- Quality management
- Early/equipment management
- Education and Training
- Administrative & office TPM
- Safety Health Environmental conditions
- With the help of these pillars, we can increase productivity, Manufacturing support

### The 5 Pillars of TPM-Concept



## Total Productive Maintenance



LeanSixSigmaBelgium.com

### Need of TPM

The overall goal of a TPM program is to improve the integrity of production and the quality of products through regular equipment **maintenance**. Just think of TPM as preventative medicine for your machines and equipment – one that helps your business increase production processes.

### Video Content / Details of website for further learning (if any):

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

### Important Books/Journals for further learning including the page nos:

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 443-450)

Course Faculty



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LECTURE HANDOUTS

L35

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture:

**Topic of Lecture:** FMEA

**Introduction : ( Maximum 5 sentences)**

- Failure Mode and Effects Analysis (FMEA) is a structured approach to discovering potential failures that may exist within the design of a product or process. Failure modes are the ways in which a process can fail. Effects are the ways that these failures can lead to waste, defects or harmful outcomes for the customer.
- An FMEA can be a qualitative analysis, but may be put on a quantitative basis when mathematical failure rate models are combined with a statistical failure mode ratio database. It was one of the first highly structured, systematic techniques for failure analysis.
- It was developed by reliability engineers in the late 1950s to study problems that might arise from malfunctions of military systems. An FMEA is often the first step of a system reliability study.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Basics of Mathematics Concepts
- Management Principles
- TQM basics

**Detailed content of the Lecture:**

- Also called: potential failure modes and effects analysis; failure modes, effects and criticality analysis (FMECA)
- Begun in the 1940s by the U.S. military, failure modes and effects analysis (FMEA) is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service. It is a common process analysis tool.
- "Failure modes" means the ways, or modes, in which something might fail. Failures are any errors or defects, especially ones that affect the customer, and can be potential or actual.
- "Effects analysis" refers to studying the consequences of those failures.
- Failures are prioritized according to how serious their consequences are, how frequently they occur, and how easily they can be detected. The purpose of the FMEA is to take actions to eliminate or reduce failures, starting with the highest-priority ones.
- Failure modes and effects analysis also documents current knowledge and actions about the risks of failures, for use in continuous improvement. FMEA is used during design to prevent failures. Later it's used for control, before and during ongoing operation of the process. Ideally, FMEA begins during the earliest conceptual stages of design and continues throughout the life



of the product or service.

FMEA includes review of the following:

- Steps in the process
- Failure modes (What could go wrong?)
- Failure causes (Why would the failure happen?)
- Failure effects (What would be the consequences of each failure?)

Teams use FMEA to evaluate processes for possible failures and to prevent them by correcting the processes proactively rather than reacting to adverse events after failures have occurred. This emphasis on prevention may reduce risk of harm to both patients and staff. FMEA is particularly useful in evaluating a new process prior to implementation and in assessing the impact of a proposed change to an existing process.

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

### When to use FMEA?

- When a process, product, or service is being designed or redesigned, after quality function deployment (QFD)
- When an existing process, product, or service is being applied in a new way
- Before developing control plans for a new or modified process
- When improvement goals are planned for an existing process, product, or service
- When analyzing failures of an existing process, product, or service
- Periodically throughout the life of the process, product, or service

May be a product, assembly, subassembly, or part

Initial development of the FMEA									Improvement activities		Post-improvement activities				
Process step/ input	Potential failure mode	Potential failure effects	SEV	Potential causes	OCC	Current controls	DET	RPN	Actions recommended	Resp.	Actions taken	SEV	OCC	DET	RPN
1	2	3	4	5	6	7	8	9	10	11	12	13			

DET = detection  
FMEA = failure mode and effects analysis  
OCC = occurrence

Resp = responsible  
RPN = risk priority number  
SEV = severity

### FMEA Example:

A bank performed a process FMEA on their ATM system. Figure 1 shows part of it: the function "dispense cash" and a few of the failure modes for that function. The optional "Classification" column was not used. Only the headings are shown for the rightmost (action) columns.

Notice that RPN and criticality prioritize causes differently. According to the RPN, "machine jams" and "heavy computer network traffic" are the first and second highest risks.

One high value for severity or occurrence times a detection rating of 10 generates a high RPN. Criticality does not include the detection rating, so it rates highest the only cause with medium to high

values for both severity and occurrence: "out of cash." The team should use their experience and judgment to determine appropriate priorities for action.

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1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 389-396)

**Course Faculty**



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LECTURE HANDOUTS

L36

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : IV- TQM Tools

Date of Lecture :

**Topic of Lecture:** FMEA

**Introduction : ( Maximum 5 sentences)**

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- It was developed by reliability engineers in the late 1950s to study problems that might arise from malfunctions of military systems. An FMEA is often the first step of a system reliability study.

**Prerequisite knowledge for Complete understanding and learning of Topic:**  
(Max. Four important topics)

- Basics of Mathematics Concepts
- Management Principles
- TQM basics

**Detailed content of the Lecture:**

Design FMEA (DFMEA) explores the possibility of product malfunctions, reduced product life, and safety and regulatory concerns derived from:

- Material Properties
- Geometry
- Tolerances
- Interfaces with other components and/or systems
- Engineering Noise: environments, user profile, degradation, systems interactions

**Process FMEA**

Process FMEA (PFMEA) discovers failure that impacts product quality, reduced reliability of the process, customer dissatisfaction, and safety or environmental hazards derived from:

Human Factors

Methods followed while processing

Materials used

Machines utilized

Measurement systems impact on acceptance

Environment Factors on process performance

### **Stages of FMEA**

- Specifying Possibilities
- Quantifying Risk
- Correcting High Risk Causes
- Re-evaluation of Risk

#### **Specifying Possibilities**

- Functions
- Possible Failure Modes
- Root Causes
- Effects
- Detection/Prevention

#### **Quantifying Risk**

- Probability of Cause
- Severity of Effect
- Effectiveness of Control to Prevent Cause
- Risk Priority Number

#### **Correcting High Risk Causes**

- Prioritizing Work
- Detailing Action
- Assigning Action Responsibility
- Check Points on Completion

#### **Re-evaluation of Risk**

- Recalculation of Risk Priority Number
- $RPN = (S) * (O) * (D)$
- S = SEVERITY
- O= OCCURRENCE
- D = DETECTION RAKING

#### **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 misjudgments, errors etc.
- Reduce development time and cost of manufacturing.

#### **Limitations:**

- FMEA document's do not fix the identified problem
- Def. of the action to fix the problem
- Will not replace the basic problem-solving process.

#### **Case Study:**

Case-Study: For example the case of household lamp

Component name: Wiring

Failure mode: broken, frayed, from lamp to plug

Cause of failure: fatigue, heat

Effect of failure on system: will not conduct current; may generate heat, blow breakers; or cause shock.

Correction of problem: Use of wire suitable for long life in extreme environment anticipated.

Comments: Dangerous; warning on instructions

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LECTURE HANDOUTS

L 37

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:**Need for ISO 9000 and Other Quality Systems

**Introduction : ( Maximum 5 sentences)**

1. A quality management system (QMS) is a collection of business processes focused on consistently meeting customer requirements and enhancing their satisfaction.
2. It is expressed as the organizational goals and aspirations, policies, processes, documented information and resources needed to implement and maintain it.
3. Quality Management Systems are usually comprised of descriptions for the company structure, responsibilities assigned to personnel, processes to follow so that work flows from one organization to another, step-by-step procedures used to conduct business in a consistent manner and resources to draw upon to do the best
4. ISO 9000 is a quality management standard that presents guidelines intended to increase business efficiency and customer satisfaction.
5. The goal of ISO 9000 is to embed a quality management system within an organization, increasing productivity, reducing unnecessary costs, and ensuring quality of processes and products.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

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

**ISO 9000 series Quality Management Principles**

- QMP 1 – Customer focus.
- QMP 2 – Leadership.
- QMP 3 – Engagement of people.
- QMP 4 – Process approach.
- QMP 5 – Improvement.
- QMP 6 – Evidence-based decision making.
- QMP 7 – Relationship management.

**Principle 1 – Customer focus**

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

### **Principle 2 – Leadership**

Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

### **Principle 3 – Engagement of people**

People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

### **Principle 4 – Process approach**

A desired result is achieved more efficiently when activities and related resources are managed as a process.

### **Principle 5 – Improvement**

Improvement of the organization's overall performance should be a permanent objective of the organization.

### **Principle 6 – Evidence-based decision making**

Effective decisions are based on the analysis of data and information.

### **Principle 7 – Relationship management**

An organization and its external providers (suppliers, contractors, and service providers) are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

<b>Top 10 countries for ISO 9001 certificates (2014)</b>		
<b>Rank</b>	<b>Country</b>	<b>No. of certificates</b>
1	China	342,801
2	Italy	168,960
3	Germany	55,363
4	Japan	45,785
5	India	41,016
6	United Kingdom	40,200
7	Spain	36,005
8	United States	33,008
9	France	29,122
10	Australia	19,731

### **Importance of ISO 9000**

- The importance of ISO 9000 is the importance of quality. Many companies offer products and services, but it is those companies who put out the best products and services efficiently that succeed.
- With ISO 9000, an organization can identify the root of the problem, and therefore find a solution. By improving efficiency, profit can be maximized.
- As a broad range of companies implement the ISO 9000 standards, a supply chain with integrity is created. Each company that participates in the process of developing, manufacturing, and marketing a product knows that it is part of an internationally known, reliable system.
- Not only do businesses recognize the importance of the ISO 9000, but also the customer

realizes the importance of quality. And because the consumer is most important to a company, ISO 9000 makes the customer its focus.

- One important aspect of ISO 9000 is its process-oriented approach. Instead of looking at a company's departments and individual processes, ISO 9000 requires that a company look at "the big picture."

**Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No265-267)

**Course Faculty**





# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

L 38

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:**Quality Systems – ISO 9000-2000

**Introduction : ( Maximum 5 sentences)**

1. ISO 9000:2000 is a standard developed and published by the International Organization for Standardization (ISO), titled "Quality Management Systems-Fundamentals and Vocabulary". This standard is not used for certification purposes but is used as an aid to help organizations better understands ISO terms and principles.
2. ISO 9000 is a quality management standard that presents guidelines intended to increase business efficiency and customer satisfaction.
3. The goal of ISO 9000 is to embed a quality management system within an organization, increasing productivity, reducing unnecessary costs, and ensuring quality of processes and products.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

**Quality standards** are defined as documents that provide **requirements**, specifications, guidelines, or characteristics that can be used consistently to ensure that materials, products, processes, and services are fit for their purpose.





### **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.

#### **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 Representative to be identified
  - Review the Quality System performance and customer complaints periodically
- Quality System
- Contract review
- Design Control
- Documents Control
- Purchasing
- Purchaser – Supplied Product
- 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

#### **Video Content / Details of website for further learning (if any):**

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- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

#### **Important Books/Journals for further learning including the page nos:**

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LECTURE HANDOUTS

L 39

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:**Quality System – Elements, Implementation of Quality System

**Introduction : ( Maximum 5 sentences)**

1. ISO 9000:2000 is a standard developed and published by the International Organization for Standardization (ISO), titled "Quality Management Systems-Fundamentals and Vocabulary". This standard is not used for certification purposes but is used as an aid to help organizations better understands ISO terms and principles.
2. ISO 9000 is a quality management standard that presents guidelines intended to increase business efficiency and customer satisfaction.
3. The goal of ISO 9000 is to embed a quality management system within an organization, increasing productivity, reducing unnecessary costs, and ensuring quality of processes and products.

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

- In quality management, it's a popular saying that if something is not written, it didn't happen. Businesses which follow a management system need a well-conceived and systematized Quality Management System (QMS). Many organizations failed to manage a QMS while others managed it well.

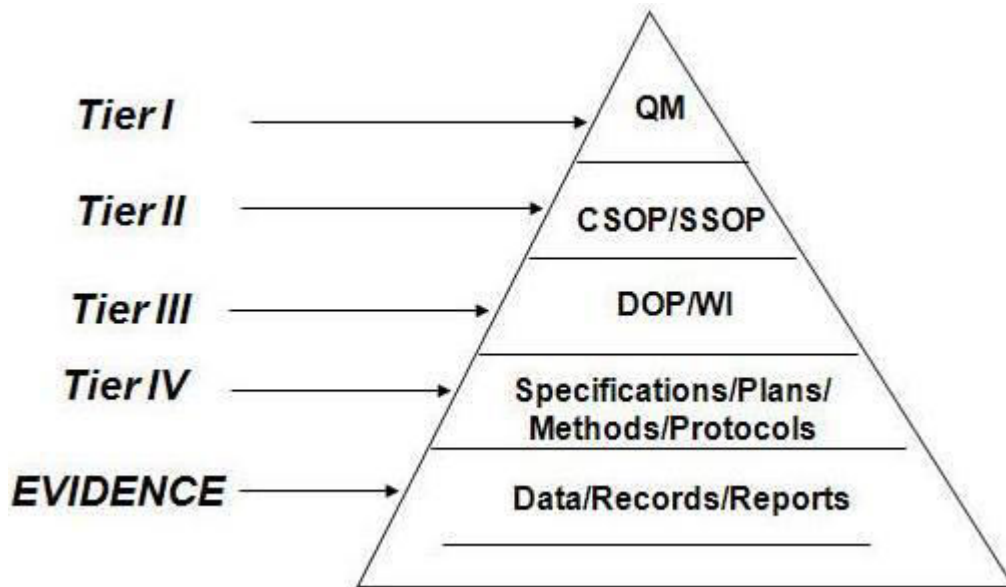
Implementation of quality management system should result in many long-term financial gains. Here is the list of few benefits of effective implementation of a QMS:

- Achieve organizational goals.
- Reduce costly errors.
- Improve customer satisfaction.
- Market your business more effectively.
- Manage growth more effectively.
- Improve documentation availability.
- Correct issues to improve products and services.
- Grow market share in new territories and market sectors.
  
- Creates a culture of quality.
- Embed vision for all projects.
- Better internal communications.

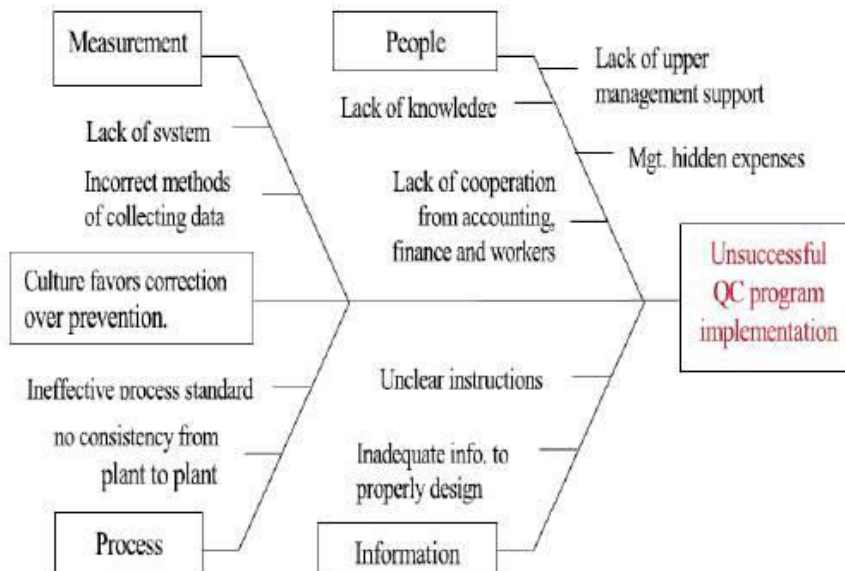
- Consistent products.
- Measure performance of individuals and teams.
- Improve compliance.

**A quality management system requires many important elements. Here are few of them:**

- Documented quality policy and quality objectives.
- A quality manual which will document scope, exclusions with justification. QMS includes documented procedures, guidelines, and checklists. This will allow observed quality and continuous improvement.
- Document procedures mandated by the compliance standard.
- Documents required by the company for effective planning, operation, monitor, and control.



**Tools to be used in QMS**



**Pitfalls of successful implementation :**

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

### **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

### **Video Content / Details of website for further learning (if any):**

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- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

### **Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No282)

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LECTURE HANDOUTS

L 40

EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:** Documentation, Quality Auditing

**Introduction : ( Maximum 5 sentences)**

1. Audit documentation refers to the records or documentation of procedures that auditors performed the audit evidence that they obtained and the conclusion that makes by them based on the evidence obtained.
2. Audit documentation is sometimes called audit working paper or working paper.
3. Internal control documents that auditor prepare in MS words, Ms excel or other application is the example of audit documentation.
4. Another best example that describes audit documentation would be the working paper that auditor prepares to document and test depreciation expenses.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

**The following is the key information that should have in the audit documentation:**

- The nature of information or data that being prepare or documents
- Timing including the audit period that covers, and the date prepare
- Name of the auditor who prepares audit working papers
- The extent of the audit procedures performed to comply with the ISAs and applicable legal and regulatory requirements.
- The evidence that auditor obtains the procedures that they use for testing and the result of testing should properly and clearly document in the audit working papers. This is to ensure that the reviewer could easily perform the quality review and to prove that the relevant standards are implementing.
- During an audit, the auditor might found the significant mater related to financial statements, their ethics, as well as their process. The auditor should clearly document these things.
- Some testing or sampling require auditor use their professional judgment and its importance to documents those judgments.

**The objective of audit documentation:**

1. Before the auditor could make a conclusion on financial statements whether those financial

statements are free from material misstatement or they contain the misstatement, the auditor needs to make sure that they have enough evidence to support their conclusion.

2. Enough evidence here is sometimes called sufficient and appropriate evidence. Therefore, audit documentation is important for the success of audit works.

**Here the summary of audit documentation:**

- It provides evidence of the auditor's basis for a conclusion about the achievement of the overall objective.
- It provides evidence that the audit was planned and performed in accordance with ISAs and other legal and regulatory requirements.
- It assists the engagement team to plan and perform the audit.
- It assists team members responsible for supervision to direct, supervise and review audit work.
- It enables the team to be accountable for its work.
- It allows a record of matters of continuing significance to be retained.
- It enables the conduct of quality control reviews and inspections (both internal and external).

**Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 285)

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LECTURE HANDOUTS

L 41

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:** Quality Auditing

**Introduction : ( Maximum 5 sentences)**

1. It is a Periodic, independent, and documented examination and verification of activities, records, processes, and other elements of a quality system to determine their conformity with the requirements of a quality standard such as ISO 9000 Audit documentation is sometimes called audit working paper or working paper.
2. Internal control documents that auditor prepare in MS words, Ms excel or other application is the example of audit documentation.
3. Another best example that describes audit documentation would be the working paper that auditor prepares to document and test depreciation expenses.

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

- Quality audit is the process of systematic examination of a quality system carried out by an internal or external quality auditor or an audit team. It is an important part of an organization's quality management system and is a key element in the ISO quality system standard, ISO 9001.
- Quality audits are typically performed at predefined time intervals and ensure that the institution has clearly defined internal system monitoring procedures linked to effective action. This can help determine if the organization complies with the defined quality system processes and can involve procedural or results-based assessment criteria.
- With the upgrade of the ISO9000 series of standards from the 1994 to 2008 series, the focus of the audits has shifted from purely procedural adherence towards measurement of the actual effectiveness of the Quality Management System (QMS) and the results that have been achieved through the implementation of a QMS.
- Audits are an essential management tool to be used for verifying objective evidence of processes, to assess how successfully processes have been implemented, for judging the effectiveness of achieving any defined target levels, to provide evidence concerning reduction and elimination of problem areas. For the benefit of the organization, quality auditing should not only report non-conformances and corrective actions, but also highlight areas of good practice. In this way other departments may share information and amend their working practices as a result, also contributing to continual improvement.

- Quality audits can be an integral part of compliance or regulatory requirements. One example is the US Food and Drug Administration, which requires quality auditing to be performed as part of its Quality System Regulation (QSR) for medical devices (Title 21 of the US Code of Federal Regulations part 820)

### **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.

Four Phases of an audit preparation – Audit preparation consists of everything that is done in advance by interested parties, such as the auditor, the lead auditor, the client, and the audit program manager, to ensure that the audit complies with the client’s objective. The preparation stage of an audit begins with the decision to conduct the audit. Preparation ends when the audit itself begins.

**1. Audit performance** – The performance phase of an audit is often called the fieldwork. It is the data-gathering portion of the audit and covers the time period from arrival at the audit location up to the exit meeting. It consists of activities including on-site audit management, meeting with the auditee, understanding the process and system controls and verifying that these controls work, communicating among team members, and communicating with the auditee.

**2. Audit reporting** – The purpose of the audit report is to communicate the results of the investigation. The report should provide correct and clear data that will be effective as a management aid in addressing important organizational issues. The audit process may end when the report is issued by the lead auditor or after follow-up actions are completed.

**3. Audit follow-up and closure** – According to ISO 19011, clause 6.6, “The audit is completed when all the planned audit activities have been carried out, or otherwise agreed with the audit client.” Clause 6.7 of ISO 19011 continues by stating that verification of follow-up actions may be part of a subsequent audit.

- The final quality audit (FQA) process, in the electronic hardware manufacturing world, is the last process flow before shipping a product. This process is established to ensure the unit has gone through and passed all the manufacturing or test process and is in good quality.
- This process not only includes visual checking of the unit (i.e. labels has been placed properly, no scratches, no dents, all LED/lights are functional) but also checks that the correct firmware

and version plus configuration has been loaded properly. It must power up according to specs as well.

- There are cases where a separate out of the box audit (OBA) process is defined, but most of the time this can be combined as well. OBA is just a visual check making sure that the unit has, again, the correct labels plus all the manuals or other parts that needs to ship with it is also inside the box. Labels from the unit should also match the ones outside the box.

#### **ISO 9001-2008**

“ISO 9001 Certified” means an organization has met the requirements in ISO9001. It defines an ISO 9000 Quality Management System (QMS). ISO 9001:2008 is focused on meeting customer expectations and delivering customer satisfaction so you must pay attention to the customer.

#### **ISO 9004-2009**

ISO 9004:2009 provides guidance to organizations to support the achievement of sustained success by a quality management approach. It is applicable to any organization, regardless of size, type and activity.

ISO 9004:2009 is not intended for certification, regulatory or contractual use.

#### **Video Content / Details of website for further learning (if any):**

- <http://www.vidyarthiplus.com/vp/Thread-GE2022-Total-Quality-Management-Lecture-Notes-Lonely-Edition>
- <http://freshupdates.in/lecture-notes/anna-university-total-quality-management-lecture-notes/>

#### **Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 293-301)

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LECTURE HANDOUTS

L 42

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:** TS 16949

**Introduction : ( Maximum 5 sentences)**

1. ISO/TS 16949 is an ISO technical specification aimed at the development of a quality management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the automotive industry supply chain and production. It is based on the ISO 9001 standard and the first edition was published in June 1999 as ISO/TS 16949:1999
2. ISO/TS 16949 applies to the design/development, production and, when relevant, installation and servicing of automotive-related products.
3. The requirements are intended to be applied throughout the supply chain. For the first time vehicle assembly plants will be encouraged to seek ISO/TS 16949 certification.
4. About 30 percent of the more than 100 existing automobile manufacturers affiliate the requirements of the norm but especially the large Asian manufacturers have differentiated, own requirements for the quality management systems of their corporate group and their suppliers

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

1. TS 16949 was an internationally recognized Quality Management System specification for the automotive industry. IATF 16949:2016 is the current version, updated from TS 16949:2009. If you are interested in becoming certified you should learn more about the current version- IATF 16949, one of the automotive industry's most widely used international standards.
2. TS 16949 is the last internationally recognized Quality Management System specification for the automotive industry. TS 16949: 2009 was developed for the Automotive Industry. It contained all of the requirements of ISO 9001:2008 plus several additional requirements specifically for the Automotive Industry.
3. Registration to TS 16949 was a requirement for any company wanting to supply its products to the Automotive Industry. Companies registered to this Technical Specification were required to develop their suppliers' Quality Management Systems with the goal of the supplier conforming to TS 16949. The first step in this development was often for the supplier to achieve third party registration to ISO 9001:2000.

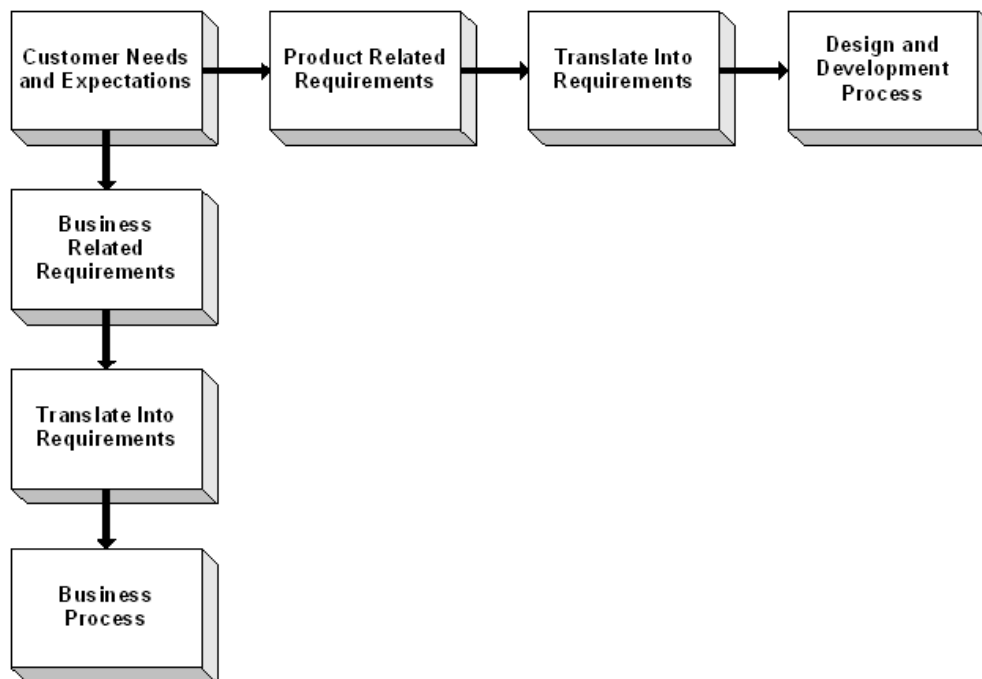
## World Wide OEM Acceptance of *ISO/TS 16949*

- BMW – Compliance
- Daimler Chrysler – Required
- Fiat – New Certification/Renewal
- Ford – Required
- Nissan – Optional/Compliance
- PSA – Required
- Renault – Required
- Volkswagen – Optional
- Honda – Compliance
- GM – Required
- Hyundai is Certified to ISO/TS16949

### Goals of ISO/TS16949

- Development of a Quality Management System (QMS) that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the supply chain
  - ISO/TS16949 Technical Specification document, coupled with customer-specific & industry specific requirements that apply, defines the fundamental QMS requirements
  - Avoids multiple certification audits and provide a common approach to the QMS

### TS 16949 Focus



- Typically, customer needs and expectations gathered will affect both business and product related processes
- Business expectations will be along the lines of cost, delivery, technology, ethical, psychological, timing, and many other expectations
- Product expectations will be in terms of product characteristics, tolerances, reliability, and functionality

### Required Documentation

Quality Manual describing QMS

Process map describing sequence and interaction of key processes

Process Objectives

Level 1

Level 2

Processes

Management  
Processes

Realization  
Processes

Support  
Processes

Procedures

Instructions

Level 3

Activities

Forms &  
Checklists

Level 4

Records

**Video Content / Details of website for further learning (if any):**

- <https://16949store.com/iatf-16949-standards/what-is-ts-16949/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 305)

Course Faculty



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LECTURE HANDOUTS

L 43

EEE

III/IV

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:** ISO14000

**Introduction : ( Maximum 5 sentences)**

1. ISO 14000 is a set of rules and standards created to help companies address their environmental impact. ISO 14000 certification is optional, not required.
2. ISO 14000 certification can be used as a marketing tool for engaging environmentally conscious consumers.
3. It is important for adhering to the standard may result in better conformance to environmental regulations, greater marketability, better use of resources, higher quality goods and services, increased levels of safety, improved image and increased profits.

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

1. ISO 14000 is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes, etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements; and (c) continually improve in the above.
2. ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process of how a product is produced, rather than to the product itself. As with ISO 9001, certification is performed by third-party organizations rather than being awarded by ISO directly. The ISO 19011 and ISO 17021 audit standards apply when audits are being performed.
3. The requirements of ISO 14001 are an integral part of the European Union's Eco-Management and Audit Scheme (EMAS). EMAS's structure and material are more demanding, mainly concerning performance improvement, legal compliance, and reporting duties. The current version of ISO 14001 is ISO 14001:2015, which was published in September 2015

**Development of the ISO 14000 series**

- The ISO 14000 family includes most notably the ISO 14001 standard, which represents the core

set of standards used by organizations for designing and implementing an effective environmental management system (EMS). Other standards in this series include ISO 14004, which gives additional guidelines for a good EMS, and more specialized standards dealing with specific aspects of environmental management. The major objective of the ISO 14000 series of norms is to provide "practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities."

- The ISO 14000 series is based on a voluntary approach to environmental regulation.
- The series includes the ISO 14001 standard, which provides guidelines for the establishment or improvement of an EMS. The standard shares many common traits with its predecessor, ISO 9000, the international standard of quality management, which served as a model for its internal structure, and both can be implemented side by side. As with ISO 9000, ISO 14000 acts both as an internal management tool and as a way of demonstrating a company's environmental commitment to its customers and clients

**Environmental Management System (EMS) :**

EMS has two Evaluation Standards. They are

1. Organization Evaluation Standards
2. Product Evaluation Standards

**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 Benefits**

- 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

**Video Content / Details of website for further learning (if any):**

- <https://16949store.com/iatf-16949-standards/what-is-ts-16949/>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 305-320)





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LECTURE HANDOUTS

L 44

EEE

III/V

**Course Name : 19EEE09 & Total Quality Management**

**Faculty Name : Mrs.M.Selvakumari**

**Unit : V- Quality Systems**

**Date of Lecture:**

**Topic of Lecture:** AS9100

**Introduction : ( Maximum 5 sentences)**

1. AS9100 is an aerospace standard based on the ISO 9001 quality system requirements. AS9100 takes the ISO 9001 requirements and supplements them with additional quality system requirements, which are established by the aerospace industry in order to satisfy DOD, NASA and FAA quality requirements.
2. AS9100 is a company level certification based on a standard published by the Society of Automotive Engineers (SAE) titled "Quality Systems-Aerospace-Model for Quality Assurance in Design, Development, Production, Installation and Servicing".
3. Prior to development of AS9100 standards for Quality Management Systems, the U.S. military applied two specifications to supplier quality and inspection programs, respectively, MIL-Q-9858A, Quality Program Requirements, and MIL-I-45208A, Military Specification: Inspection System Requirements.
4. For years these specifications had represented the basic tenets of the aerospace industry. However, when the U.S. government adopted ISO 9001, it withdrew those two quality standards. Large aerospace companies then began requiring their suppliers to develop quality programs based on ISO 9001

**Prerequisite knowledge for Complete understanding and learning of Topic:**

**(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

- AS9100 is a widely adopted and standardized quality management system for the aerospace industry. It was released in October, 1999, by the Society of Automotive Engineers and the European Association of Aerospace Industries.
- AS9100 replaces the earlier AS9000 and fully incorporates the entirety of the current version of ISO 9001, while adding requirements relating to quality and safety. Major aerospace manufacturers and suppliers worldwide require compliance and/or registration to AS9100 as a condition of doing business with them.
- As aerospace suppliers soon found that ISO 9001 (1994) did not address the specific requirements of their customers, including the DoD, NASA, FAA and commercial, aerospace

companies including Boeing, Lockheed Martin, Northrop Grumman, GE Aircraft Engines and Pratt & Whitney, they developed AS9000, based on ISO 9001, to provide a specific quality management standard for the aerospace industry.

- Prior to the adoption of an aerospace specific quality standard, various corporations typically used ISO 9001 and their own complementary quality documentation/requirements, such as Boeing's D1-9000 or the automotive Q standard.
- This created a patchwork of competing requirements that were difficult to enforce and/or comply with. The major American aerospace manufacturers combined their efforts to create a single, unified quality standard, based on ISO 9001:1994, resulting in AS9000. Upon the release of AS9000, companies such as Boeing discontinued use of their previous quality supplements in preference to compliance with AS900.

**Some things to understand about AS9100:**

There are three ASD Standards, typically mutually exclusive:

- **AS9100 – Design, Develop or Manufacture**
- **AS9110 – Aircraft Maintenance Organizations**
- **AS9120 – ASD Distributors of components like electronics and hardware**
- AS9100 mentions several other guidance standards that you should understand. These additional standards don't require certification, they provide guidance.
- It does NOT matter what size your organization is: 1 person or 1 million people
- It is NOT a product standard that defines product quality. AS9100 asks you to control your processes, so your end product meets customer requirements.
- It is NOT a personal Standard – a person cannot get certified to AS9100. They can attend AS9100 Certified Lead Auditor course, and then apply to become a 3rd party auditor.
- Registrar issues an AS9100 Certificate demonstrating that your organization is Registered to AS9100 (and ISO 9001) for a three year period. (See Who is able to grant certification)

Benefits of AS9100 include market acceptance, and AS 9100 has been endorsed by all major Aerospace regulators, including:

- Federal Aviation Administration (FAA)
- U.S. Department of Defense (DoD)
- National Aeronautics and Space Administration (NASA).

**Video Content / Details of website for further learning (if any):**

- <https://en.wikipedia.org/wiki/AS9100>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 305-320)



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



LECTURE HANDOUTS

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EEE

III/V

Course Name : 19EEE09 & Total Quality Management

Faculty Name : Mrs.M.Selvakumari

Unit : V- Quality Systems

Date of Lecture:

**Topic of Lecture:** ISO 14000–Concept, Requirements and Benefits (ISO 14001)

**Introduction : ( Maximum 5 sentences)**

1. ISO 14001 defines criteria for an EMS. It does not state requirements for environmental performance but rather maps out a framework that a company or organization can follow to set up an effective EMS.
2. It can be used by any organization that wants to improve resource efficiency, reduce waste, and reduce costs.
3. ISO 14001 is an internationally agreed standard that sets out the requirements for an environmental management system.
4. It helps organizations improve their environmental performance through more efficient use of resources and reduction of waste, gaining a competitive advantage and the trust of stakeholder

**Prerequisite knowledge for Complete understanding and learning of Topic:  
(Max. Four important topics)**

- Communicative in English
- Quality Concepts
- Management Principles

**Detailed content of the Lecture:**

1. For companies and organizations of any type that require practical tools to manage their environmental responsibilities, there's the ISO 14000 family.
2. ISO 14001 sets out the criteria for an environmental management system and can be certified to. It maps out a framework that a company or organization can follow to set up an effective environmental management system.
3. Designed for any type of organization, regardless of its activity or sector, it can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.

**A company must fulfill the following three requirements to comply with ISO 14000:**

1. It must create an environmental management system (EMS).
2. It must demonstrate its compliance with the environmental statutes and regulations of countries in which it does business.
3. It must demonstrate its commitment to continuous improvement in environmental protection and pollution prevention.

The ISO 14000 series addresses the following aspects of environmental management:

- Environmental Management Systems (EMS)
- Environmental Auditing & Related Investigations (EA&RI)
- Environmental Labels and Declarations (EL)
- Environmental Performance Evaluation (EPE)
- Life Cycle Assessment (LCA)
- Terms and Definitions (T&D)

**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.
- Managements 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

Within the standard there are numerous elements of ISO 14001 that are required to be met by organisations seeking formal recognition for their EMS.

**General requirements include:**

- Development of an environmental policy that reflects an organization's commitments;
- The appointment of a person(s) responsible for the EMS's coordination;
- Identification of how the organisation interacts with the environment;
- Identification of actual and potential environmental impacts;
- Identification of environmental compliance requirements;
- Establishment of environmental objectives, targets and programs;
- Monitoring and measurement of the progress to achieve its objectives;
- Reviewing the system and environmental performance; and
- Continuous improvement of the organization's environmental performance.

The standard can be easily integrated into existing safety (AS/NZS 4801 or OHSAS 18001) and quality (AS/NZS ISO 9001) management systems

**Video Content / Details of website for further learning (if any):**

- <https://www.iso.org/iso-14001-environmental-management.html>

**Important Books/Journals for further learning including the page nos:**

1. Dale H.Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6 (P.No 305-322)

**Course Faculty**