Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **1**	Vetter: **Dr. Sanjay Tiwari**
Concepts of Quality, Total Quality and Total Quality Management	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the concept of Quality in day-to-day life and business.
- Differentiate between Quality and Quality Management
- Elaborate the concept of Total Quality Management

1.1 Introduction

Quality is a buzz word in our lives. When the customer is in market, he or she is knowingly or unknowingly very cautious about the quality of product or service. Imagine the last buying of any product or service, e.g., mobile purchased last time. You must have enquired about various features like RAM, Operating System, Processor, Size, Body Colour, Cover, etc. If any of the features is not available, you might have suddenly changed the brand or have decided not to purchase it. Remember, how our mothers buy fruits, vegetables or grocery items. They are buying fresh and look-wise firm fruits, vegetable and groceries. Simultaneously, they are very conscious about the price of the fruits, vegetable and groceries. So, by nature, we are inclined to get various features of products or services or these are supposed to be provided by the manufacturers. If we get the desired standard features in a product or service, we generally say that the quality of the product or service is up to the mark. It means the features of products and services give satisfaction. These features can be termed as quality characteristics. Cost considerations are also taken care of while measuring the quality considerations, but have you ever imagined how the producers or manufactures identify and provide these features of products and services?

1.2 Concept of Quality

The meaning of 'Quality' in Oxford Dictionary is 'the standard of something when it is compared to other things.' ISO defines quality as 'the totality of features and characteristics of a product or service that bears on its ability to meet a stated or implied need.' The meaning of the quality could be understood from two perspectives: (i) Producer's perspective (ii) Consumer's perspective. From Producer's Perspective the quality is to conform to the specifications with cost considerations. Providing maximum quality features while having minimum cost is the focus point for producers or manufacturers. Consumer's perspective is to consider quality characteristics with price considerations. Getting maximum quality features while having price as the focus point is the motto of maximum consumers. Quality is defined in terms of different perspectives as mentioned under:

Producer-based definitions:

- Crosby defines quality as the means to conform to standards, specifications or requirements.
- Parasuraman defines quality as the concerned with meeting or exceeding customer expectations.

Consumer-based definitions:

- Edeward defines quality in terms of the capacity to satisfy needs.
- Gilmore defines quality as the degree to which a specific product satisfies the wants of a specific consumer.

- Juran defines quality as fitness for use.

1.3 Dimensions of Quality

Quality is an attitude of mind. Quality is in the eye of the consumers. It is the total sum of features liked by the consumers while purchasing a product or service. Let's take an example of product. For some consumers, it is the processor of mobile and for some consumers it is the RAM, which matters. For some consumers both RAM and process of mobile matter. In the case of a restaurant, for some consumers taste of meal and parking matters, while for some consumers it is the aesthetics of the restaurant that matters. For some consumers both aesthetics and taste of meal matter. Therefore, quality is the specific feature of the product and service that satisfies the needs of the consumers.

Quality is advanced design and engineering technology. Let's take an example of automobile industry where every company is striving hard to deliver at least two new cars in the market. Have you ever imagined how the companies like Toyota, Ford, Volkswagen, Audi, and Mercedes Benz are capable of giving newer model of cars with innovated and advanced features in-built in a car? They are committed to deliver flawless products consistently. Delivering flawless products is called quality. They have precise manufacturing facilities in their plants. Their processes are standardised. Having standardised processes is called quality. The standardisation of processes gives them advantage to deliver quality products consistently. They have achieved excellence in quality output. They have no room for errors. Here, Quality is having policy of no room for errors. The Indian companies like Tata Motors, Maruti Suzuki are not far behind in delivering quality products and services internationally. They also have zero error policy.

Quality is also called zero error policy. Quality could be called as giving standard products with zero defects. So, we can say that companies live with quality commitment. The management works very hard to deliver error free standardised products consistently. They strive hard to give innovated products to the market. The ultimate satisfaction of consumers leads to upgrade the standard of living of the society.

1.4 Application / Usage of Quality for General Public / Consumers

- It ensures error free products.
- It enhances the development of new or innovated products. (e.g. HUL's Pure it)
- It helps to give warranty or guarantee of products. (e.g. 2 years warranty with Bajaj Fans)
- It enables good customer service.
- It promises timely delivery.
- It helps in getting all the desired features in products and services.
- Quality helps in getting satisfaction after the use of products and services.

1.5 Application of Quality for Producers or Manufacturers

- Quality helps in meeting the changing demands of the consumers.
- It ensures delivery of flawless or zero error products or services.
- It ensures delivery of products or service on time.

- It helps in giving superior products produced with advanced engineering technology.

- Quality helps in meeting or fulfilling the commitment.

1.6 Factors affecting Quality

The following factors affect the quality of any product or services:

- **Management**

The concept of quality management starts from the top management. It is the top management which initiates the quality concept in an organisation. For this purpose the top management creates a culture in the organisation where everybody is responsible for the quality. The commitment for quality is must from top management side.

- **Dedicated Employees**

Every employee is responsible for the quality planning, quality production, quality delivery, quality after-sale service etc.

- **Suppliers**

Suppliers supply machines and raw material to the company. As for example Tata Nano plant receives raw material and other component supplies from more than 600 suppliers. So, we can say that the suppliers play an important role as far as quality of product is concerned.

1.7 Quality Management

Quality management includes all the functions of the organisation to design and provide quality products and services which fulfils the needs of the customers and generate ultimate satisfaction. The core concept of quality management is quality planning, quality controlling and quality improvement. The traditional approach of quality management covers typical inspection aspect and the 'do it right from the first time' concept. The modern quality management covers all the concepts given by thinkers called Quality Gurus like W. Edwards Deming, Philip B. Crosby, Armand V. Feigenbaum, Kaoru Ishikawa, Joseph M. Juran and Genichi Taguchi etc.

Quality Planning

The first and foremost step in quality planning is to plan and know who your customer is, and what are his needs and wants. After optimising the product or service features, the organisation designs and develops the product or service. The next step is to standardise the processes so that the products or services can be standardised. The consistent production of desired quality products and services require high involvement and contribution of employees in planning.

Quality Control

It is a very important step in quality management. It requires extensive, proper and consistent training of employees so that errors can be controlled. Inconsistency in products and services can be avoided by using Statistically Process Control techniques.

1.8 Total Quality Management

Total Quality Management is mainly concerned with continuous improvement in all work. It is a long term planning. It is the consistent improvement in the quality. It is a never ending process. Total Quality Management consists of three words: Total, Quality and Management

Total

Make up of the whole.

Quality

Degree of excellence a product or service provides.

Management

It is a process of planning, organising, directing and controlling.

Therefore, TQM is the art of managing the whole to achieve excellence. TQM covers all the set rules, regulations, guidelines and principles that contribute in improving the organization continuously. It is a continuous process of improvement for individuals, groups of people and the whole organisation. It is the application of quantitative methods and human resources to improve all the processes within an organization to satisfy the needs of customers consistently. TQM integrates all the fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach. It covers the most quality principles and practices proposed by quality gurus.

Total Quality Management (**TQM**) is a management approach for an organization, centered on quality, based on the participation and commitment of all the internal and

external customers and aiming at strategically long-term success through customer satisfaction, and benefits to all members of the organization and to society.

Total Quality Management (**TQM**) is a top-management strategy aimed at embedding awareness of quality in all organizational processes.

Total Quality Management is a total system approach and it is an integral part of the strategic decision making of the top management. It works horizontally across all the functions and departments. It involves all the employees of three levels, i.e., top level, middle level and bottom level. It extends backward and forward and covers supply chain management as well as logistics management also. So, we can say that it is a consistent effort by everyone in the organisation to meet the expectations of the customers leading 100 per cent satisfaction. TQM requires that the company maintain the quality standard in all aspects of its business. This requires ensuring that things are done right the first time and that defects and waste are eliminated from operations.

1.9 Characteristics / Nature of TQM

- **TQM Starts from Top Management**

  The quality concept is initiated by the top management. The whole credit of the initiation of total quality management goes to the top management. Only the top management can create an environment that develops team-oriented environment and creates quality oriented culture that can prevent problems and continually improve.

- **It is a Consistent Process**

To produce quality product and service is not an easy job. Sometimes it takes years to give the desired results. All the employees have to work consistently as a team in one direction to improve all the processes in the organisation.

- **It is a Part of Strategic Planning and Thinking**

TQM policy is a long term planning. The quality policy must be the part of strategic planning to get the desired results.

- **It is Customer Focused / Oriented**

The end result of TQM is complete satisfaction of customers by giving them quality products and services. It is possible only when TQM programme is customer centric.

- **It is a Team Work**

Success in terms of standard quality is possible only when the organizations has a culture of team formation and the employees work in teams and give their maximum. Teams can be formed vertically and horizontally. When top management is involving the lower level employees it is vertically and when the different departmental employees are involved then it is horizontally (employees of marketing, sales, production and finance departments are working for critical and complex projects). Teams are inter-organisational when the employees of other organisations are involved (like employees of banks, suppliers, audit companies, consultants etc.

- **It is Related with Consistent Improvement of Quality**

To deliver quality products and services is not an easy job. All the processes have to be developed and standardised by consistent improvement.

- **Every Employee is Involved in Quality Improvement Aspect**

All the employees internal as well as external are involved in the TQM programme. Internal employees include all the employees included from top to bottom and external employees are suppliers, banks and other institutions which are involved in the TQM process.

- **Every Employee is Responsible for the Success of TQM**

If all the employees are determined and committed for the quality products and services, then only quality could be delivered.

1.10 The TQM Practices Followed by Multinational Companies

All the MNC's like Sony, Toyota, Xerox, Motorola follow the Total Quality Management practices. The salient features of TQM approach followed by the best companies are as following:

- The companies create a sense of an environment of mutual trust, respect and dignity.
- The management act immediately on new ideas and suggestions.
- The companies are meeting and exceeding customers' requirements and expectations on consistent basis.
- The companies hear and learn from the dissatisfied/unhappy customers and responsible for complete customer satisfaction.

- The companies are committed to their both internal as well as external employees. They know the value of workers' involvement and intensive training.
- The companies develop the teams to have broad decision –making powers and responsibilities.
- They apologize for the complaints.
- The companies know that labour-management relations could do more for quality and productivity.
- The companies empower their employees to make them responsible.
- The companies implement statistical process control and monitor defect rates.

1.11 Summary

Quality is a buzz word in our lives. When the customer is in market, he or she is knowingly or unknowingly very cautious about the quality of product or service. The features of products and services give satisfaction. These features could be called as quality characteristics. Cost considerations are also taken care of while measuring the quality considerations. The producers or manufactures identify and provide these features of products and services. ISO defines quality as 'the totality of features and characteristics of a product or service that bears on its ability to meet a stated or implied need.' The meaning of the quality could be understood from two perspectives: (i) Producer's perspective (ii) Consumer's perspective. Quality management include all the functions of the organisation to design and produce quality products and services which fulfils the needs of the customers and generate ultimate satisfaction.

Total Quality Management is mainly concerned with continuous improvement in all work. It is a long term planning. It is the consistent improvement in the quality. It is a never ending process. Total Quality Management consists of three words: Total, Quality and Management. TQM starts from top management; it is a consistent process; it is a part of strategic planning and thinking; it is customer focused; it is a team work; it is related with consistent improvement of quality; every employee is involved in quality improvement aspect; and every employee is responsible for the success of TQM.

1.12 Keywords

Quality

It is the totality of features and characteristics of a product or service that bears on its ability to meet a stated or implied need.

Total Quality Management

TQM covers all the set rules, regulations, guidelines and principles that contribute in the continuously improving organization.

1.13 Self Assessment Questions

1. What do you understand by quality? Explain various definitions given by different authors.

2. Define quality. Enumerate various features of quality.

3. Elaborate the producers' point of view regarding quality?

4. Examine the customers' point of view regarding quality?

5. Discuss the dimensions of quality of products and services?

6. Define Total Quality Management. Explain the core concepts of TQM.

7. Define and discuss the key components of Total Quality Management

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Subject: **Total Quality Management**	
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Lesson No.: **2**	Vetter: **Dr. Sanjay Tiwari**
Approaches of Total Quality & Cost of Quality	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the different approaches to Total Quality Management
- Know the importance of Framework for Quality and Performance Excellence
- Understand the Principles of Total Quality Management
- Familiar with the concept of Quality Cost
- Know the basics of International Quality Award Programs

1.1 Approaches to Total Quality Management: An Introduction

Total Quality Management is mainly concerned with continuous improvement in all works and functional activities of an organisation. It is a long term planning. It is the consistent improvement in the quality. It is a never ending process. It describes a management approach to long–term success through customer satisfaction. In a TQM effort, all members of an organization are involved in improving processes, products,

services, and create a culture in which they work. The success of the TQM depends on the significant changes in organisation design, work processes, and culture. There are various approaches to TQM. Some organisations give importance to the use of quality programme like statistical process control and some organisations give importance to the tool like quality function deployments. Sometimes, the organisations fail to realize quality improvements because of lack of holistic understanding of the quality tool(s) or concept(s) by the entire organisation.

"Total Quality Management (TQM) is a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback. TQM requirements may be defined separately for a particular organization or may be in adherence to established standards, such as the International Organization for Standardization's ISO 9000 series. TQM can be applied to any type of organization; it originated in the manufacturing sector and has since been adapted for use in almost every type of organization imaginable, including schools, highway maintenance, hotel management, and churches. As a current focus of e-business, TQM is based on quality management from the customer's point of view." (www. searchcio.techtarget.com)[i]

Total Quality Management is a management approach for an organization, centered on quality, based on the participation and commitment of all the internal and external customers and aiming at strategically long-term success through customer satisfaction, and benefits to all members of the organization and to society. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization. So, some organisations adopt a problem-solving focus and

concentrate on production as well as customer service processes. They adopt quality circles and team approaches. Some organisations concentrate on error prevention through continuous process improvement and business process reengineering.

Most of the successful companies have adopted unique approaches of total quality management according to their own requirements because one approach suitable for one organisation may be not suitable for another organisation. The reason is the difference in the culture. Every organisation has different culture. Total Quality Management requires a set of guiding principles and concepts. The all-over world famous quality gurus like Deming, Juran, Crosby, Ishikawa, as well as many others, have made substantial contribution to the theory and practice of quality management. Their philosophies, concepts, principles have helped to shape the framework for quality management. Quality management as a discipline is incomplete without their contribution and approaches to total quality. A discussion of their philosophies which are actually more about management of quality as follows:

1.2 The Deming Management Philosophy

William Edwards Deming (1900-1993) was an American engineer, statistician, professor, author, lecturer, and management consultant. He developed some sampling techniques which are still used by the U.S. Department of the Census and the Bureau of Labor Statistics. He always advocated that there is no substitute for knowledge. He found great inspiration in the work of Walter Shewhart like Statistical Process Control, Operational Definitions, and the PDSA (Plan-Do-Study-Act) Cycle. The Deming called PDSA as 'The Shewhart Cycle'. He taught statistical process controls to the Japanese engineers and managers and the message was very much clear that the improvement in

quality will reduce expenses while increasing productivity and market share. Deming is best known for his 14 Points for quality and his system of thought called the System of Profound Knowledge. He stressed that the system of profound knowledge is very important because it helps the managers to transform within their organizations which improves the outcomes in the form of quality.

1.3 System of Profound Knowledge

The four parts of the System of Profound Knowledge are:

- Appreciation of a System
- Knowledge of Variation
- Theory of Knowledge
- Knowledge of Psychology

1.4 Deming's 14 Points for Management

The Deming's fourteen principles are named as:

i. Constancy of Purpose
ii. Adopt the New Philosophy
iii. End Lowest Tender Contracts
iv. Improve Every Process
v. Institute Training on the Job
vi. Drive Out Fear
vii. Break-down Barriers
viii. Eliminate Exhortations

ix. Eliminate Arbitrary Numerical Targets

x. Permit Pride in Workmanship

xi. Encourage Education

xii. Top Management Commitment to Action

xiii. Cease the Need for Mass Inspection

xiv. Institute Leadership

1.5 The Juran Philosophy

Joseph M. Juran was an industrial engineer. He Joined Western Electric in the 1920s. He authored 'The Quality Control Handbook' which is often referred to as the quality bible and is a classic reference for quality engineers. Juran proposed a simple definition of quality: "fitness for use." This definition of quality suggests that it should be viewed from both external and internal perspectives; that is, quality is related to "(a) product performance that results in customer satisfaction; (b) freedom from product deficiencies, which avoids customer dissatisfaction." He believed that quality improvement should be achieved through projects. He revolutionized the Japanese philosophy on quality management. Dr. Juran was the first to incorporate the human aspect of quality management which is referred to as Total Quality Management. He focused on three major quality processes, called the

1.6 Juran's Quality Trilogy

According to Juran, quality processes are summed up by the Triology. It means that the management of quality consists of three inter-related quality oriented processes namely:

- Quality Planning;
- Quality Control; and
- Quality Improvement.

1.7 Juran's 10 Points for Management

Juran has given 10 Points for Quality Improvement:

i. Build awareness of need and opportunity for improvement to realize that all processes are improvable
ii. Set-goals for improvement
iii. Organize to reach goals
iv. Provide training
v. Carryout projects to solve problems
vi. Report progress
vii. Give recognition
viii. Communicate results
ix. Keep score
x. Maintain momentum by making annual improvement part of the regular systems and processes of the company

1.8 The Crosby Philosophy

Philip Bayard Crosby, (1926 –2001) was a businessman and author who contributed to management theory and quality management practices. He is best known in relation to the concepts of 'Zero Defects' and 'Do it Right First Time'. He authored a number of

books, of which the book entitled 'Quality is Free' is the most popular in which he stated that "Quality is free. It's not a gift, but it is free. What costs money are the unquality things -- all the actions that involve not doing jobs right the first time." His two other books are 'Quality without Tears' and 'The Art of Getting Your Own Sweet Way'.

1.9 Four Absolutes of Quality Management

Crosby's TQM approach is based on his four absolutes of Quality Management:

- **First absolute:** Quality is defined as conformance to requirements
- **Second absolute:** Problems are functional in nature
- **Third absolute:** There is no optimum level of defects
- **Fourth absolute:** Cost of quality is the only useful measurement

1.10 Crosby's 14 Points for Management

Philip Crosby developed 14 steps for an organization to follow in building an effective quality program:

i. Management Commitment
ii. Quality Improvement Team
iii. Quality Measurement
iv. Calculate the Cost of Quality
v. Raise Quality Awareness among Employees
vi. Instigate Corrective action

vii. Monitor Progress of Quality Improvement – establish a 'Zero Defects' Committee

viii. Train Supervisors in Quality Improvement

ix. Zero Defects Day

x. Encouraging Employees to Create Quality Improvement Goals

xi. Error-cause Removal

xii. Recognise Participants' Effort

xiii. Create Quality Councils

xiv. Do it over again

1.11 The Kaoru Ishikawa Philosophy

This approach was given by Kaoru Ishikawa was born in July 13, 1915. He graduated in applied chemistry in 1939. He was a Japanese organizational theorist, Professor at the Faculty of Engineering at The University of Tokyo. He is one of the Japan's quality control pioneers. He is considered a key figure in the development of quality initiatives in Japan, particularly 'the quality circles' in which small group of employees meet regularly to improve quality and productivity. He developed the Ishikawa or cause and effect diagram or fishbone diagram often used in the analysis of industrial processes. He emphasised the development of participation and bottom-up of quality which is now main philosophy of the Japanese approach to quality management. He advocated that the first concern for management is the happiness of the people connected with it. If people are not happy then it does not deserve to survive.

1.12 Framework for Quality and Performance Excellence

The framework of quality and performance excellence cover Just-in-Time philosophy, Business Process Reengineering, Kaizen – A Continuous Improvement Tool, ISO-9000 Standards, Quality Audit tools, etc. The details are as follows:

1.13 Just-in-Time (JIT)

Just-in-time is an approach which means producing only what is needed, when it is needed, not early, not late; not less, not more. The key target is achieving high volume production using minimal inventories. It is an integrated but simplified system. According to this philosophy, anything which is not generating value is called waste. JIT advocates minimising all types of wastes. Top management is responsible for change in the organisation. For that sake, it has to create an environment in the organisation. The management has to develop a culture in the organisation. In order for JIT implementation to be successful, the organisation must frame these policies regarding JIT and must get commitment from the employees to follow the guidelines lead down in the policies by words and means. The implementation of JIT is not just for the sake of change. Most of the organisations implement JIT just for the sake to beat the competitors. In this way they miss the true essence of the philosophy and the results are like half-hearted. The success of JIT philosophy lies in the commitment of the employees. This philosophy covers the whole organisation under one umbrella. All the departments have to work with coordination and follow the guidelines with full spirit. The top executives have to be the leaders involved in JIT and they must be the guiding light for all the employees. Getting everyone involved and committed is the first step to successful implementation of JIT and the first step to an increase in continuous improvement.

1.14 Business Process Reengineering

Business process reengineering (BPR) is redesigning business processes in the organisation. BPR brings radical changes in the processes those generate value to the customers. Business process reengineering is a dramatic change initiative which is processed in four steps: (i) Start from beginning / scratch; (ii) Identification of goals and purposes; (iii) Analysis of current processes; and (iv) Action time. It makes the employees to be more productive for their customers not their bosses. It generates empowered employees who work in process teams rather in functional departments. The controlled employees are empowered employees who are read to perform multidimensional work. BPR helps to understand and measure the existing processes. It helps to develop a vision and sense of belonging among employees. It lowers cost and increases customers' satisfaction. It helps organisation to face competitiveness and generates excellent capability advantages. It helps to improve efficiency. It helps to develop solution and make new processes operational. Sometimes, BPR fails because the organisation is failed to focus on the customers' needs and satisfaction level. The organisation may fail to integrate information technology. Sometimes, the managers get confused and assumed that the change will bring insecurity.

1.15 Kaizen Approach – A Continuous Improvement Tool

Kaizen is a Japanese word and the meaning is continuous improvement. It's made up of two words in Japanese: *kai*, which means 'change,' and 'zen,' which means 'good.' Kaizen is the practice of continuous improvement. *Kaizen* is considered a slow but it is an ongoing process of improvement. 'Kaizen' word was used by Masaaki Imai in his

book entitled ‘The Key to Japan’s Competitive Success’ first time in 1986. It illustrates an organisational culture where everyone from the top to the bottom is involved in the regular evaluation of his or her work and sense the ways to improve it. The concept is that small improvements on a regular basis will head towards the large improvements over time. One of the most notable features of kaizen is that big results come from many small changes accumulated with the passage of time. However, this has been misunderstood to mean that kaizen equals small changes. Today Kaizen is acknowledged worldwide as an important part of an organization’s long-term competitive strategy.

Kaizen means involvement for improvements. It is continuous improvement that is based on certain guiding principles like no process is thought to be perfect and it should be improved continuously. Everything can and should be improved. Further, Kaizen is teamwork and it is everybody’s business. It is possible with the change in the mindset of employees.

1.16 ISO-9000 Standards (International Standards Organisation)

ISO-9000 standards are developed by International Standards Organisation to effectively design and implement efficient quality systems. The ISO-9000 standards were published in 1987. It has undergone revision in 2000 and 2005. It covers definitions, requirements, and continual improvements. These standards provide a framework that can give guidance for the processes to be made auditable. These standards help organisations to work effectively. To follow ISO standards is voluntary for the organisations. It is not legally to purchase standards by the organisations. But, the standards are recognised internationally. ISO-9000 standards are market driven

designed by experts. These standards are reviewed once in five years to decide whether to modify, maintained or withdrawn. ISO-9000 standards indicate the customers that the organisations have adopted quality standards, quality procedures and quality processes. It helps external auditors to show that all the internal processes are in place and well documented. ISO-9000 standards implementation shows that all the processes used for manufacturing products are audited internally and well documented. The ISO quality standards are frequently followed for food safety, data security in computers, agriculture, healthcare industry, education institutions etc. In fact, quality standards developed by ISO impact our lives by giving quality and standard products and raising standard of living.

1.17 Quality Audit

Quality audit is defined as a systematic and independent monitoring to determine whether activities and related results comply with planned manuals and whether these manuals are implemented effectively and are suitable to achieve objectives. A quality audit is a process by which the management reviews and evaluates an element of the business to ensure that it is meeting certain standards. A quality audit can be applied to various aspects of a business, like it can be applied on inventory or service, employees, management, or databases. The objectives of the quality audit are to monitor and drives continuous improvement in quality. It ensures quality of the product and determines the required improvement. It assesses effectiveness of quality assurance system. The management knows problems or potential problems by quality audit. It ensures timely correction of problems. It shows management support of the quality program and establishes high degree of confidence, trust, understanding and communication among

internal employees. There are three types of quality audits, namely, first party (internal), second party (external) and third party (extrinsic) audits. Quality audit ensures that the business is offering a value to the customers through high-quality product or services. It gives information to the customers that the company is committed to quality standards and performs regular audits programmes. It helps to increase consumer confidence in the business. Finally, regular quality audits help protect the business from issues that could arise from selling a poor quality product.

1.18 Principles of Quality Management

Total quality management is an organization-wide philosophy to satisfy customers. It is continuously improving the quality of its product and services as well as the quality of processes. The main focus is to meet and exceed customers' desired expectations. TQM is the task of everyone in the organization (from top to bottom). Teamwork plays a key role in providing quality of products, services and processes. All the stakeholders like the suppliers and the customers are part and parcel of the quality improvement programme. Some of the principles of total quality management are: TQM starts from Top Management, Customer Satisfaction, Create an Ultimate TQM Environment**,** Employee Involvement and Commitment**,** Integrated System Approach**,** Continuous Improvements in Quality. The details are as follows:

- **TQM starts from Top Management**

The quality concept is initiated by the top management. The whole credit of the initiation of total quality management goes to the top management. The top

management is responsible to create a quality oriented culture which can prevent problems and improve processes.

- **Customer Satisfaction**

Total Quality Management's focus is customers' satisfaction. The customer ultimately determines the level of quality. No matter what an organisation does to foster quality improvement, the customer determines whether the efforts are worthwhile or not. The consistent improvements in the processes help to meet customer's expectations and to lower down the customer dissatisfaction level.

- **Create an Ultimate TQM Environment**

Every employee must be mentally prepared to make and accept changes in the TQM processes. Make quality a buzz word and as the nature of all the employees. Without it, all the corporate statements, procedures and standards will prove to be rules that are meant to be broken. Employees and departments should not feel burden and as if they are in competition with one another. The ultimate TQM environment will help the employees to feel pride to be member of cross-functional teams in the organisation. The organisation should increase attention towards the individual's contribution and reward for the self-improvement and cooperative efforts.

- **Employee Involvement and Commitment**

Employee involvement is very important in achieving and sustaining high levels of quality. All the employees should participate in working for achieving common goals. Employees must be encouraged and involved to participate in quality improvement programmes. The employees must be empowered and developed to be totally

committed for the quality improvement. For that regular training and development of employees is essential for achieving and sustaining high levels of quality.

- **Integrated System Approach**

The organisations comprise of different departments for different functions. The focus of all the departments of the organization should be on quality and continuous improvement. Every department in the organisation should have a thorough understanding of the quality policies, standards, objectives, and important processes. It will help to generate commitment for continuous improvement. Involve all the departments in cross-functional quality improvements processes. It is very important to promote a quality work culture in the organisation as it helps to achieve excellence and surpass customer expectations. An integrated system ensures continual improvement and helps organisations to gain competitive advantage.

- **Continuous Improvements in Quality**

Continuous improvement in quality is a never ending process and the top management is completely involved in the quality improvement process rather than simply supportive of it. For this purpose, a strategic plan is very necessary to ensure quality for long period. The strategic planning includes the formulation of strategic plans that integrates quality as a core process with other processes. The management should focus on identifying and eliminating causes of poor quality consistently. Quality should be made the responsibility of everyone in the organisation.

1.19 Seven Principles by Gerald F. Smith

The following seven principles have been suggested by Gerald F. Smith, in his book 'Quality Problem Solving':

(i) Strive for the quality in all things.

(ii) The customer is the criterion of quality.

(iii) Improve the process or system by which products are produced.

(iv) Quality improvement is continuous and never ending activity.

(v) Workers' involvement is essential.

(vi) Ground decisions and actions in knowledge.

(vii) Encourage team work and co-operation.

1.20 International Quality Award Programs

There are several quality awards worldwide such as The Deming Prize in Japan, The Malcolm Baldrige National Quality Award in USA, The European Quality Award, etc. The broad purposes of these awards are to increase awareness about total quality management, its contribution and to encourage companies to share and spread latest information about the quality improvement programmes. These award models provide a framework for the organisations in the area of quality management. These models provide an insight into the practical way of applying Total Quality Management.

1.21 The Deming Prize

The Japanese Deming Prize is awarded by the Japanese Union of Scientists and Engineers (JUSE). The Deming Prize is a global quality award that recognizes both individuals for their contributions to the field of Total Quality Management (TQM) and businesses that have successfully implemented TQM. It is the oldest and most widely recognized quality award in the world. It was established in 1951 to honor W. Edwards Deming. The company is eligible and can apply after five years once the company got this award. Deming contributed greatly to Japan's proliferation of statistical quality control after World War II. His teachings helped Japan build its foundation by which the level of Japan's product quality has been recognized as the highest in the world, was originally designed to reward Japanese companies for major advances in quality improvement. Over the years it has grown, the Japanese Union of Scientists and Engineers (JUSE) regulate this prize under its guidance.

The Deming Award consists of two categories:

- The Deming Application Prize; and
- The Deming Prize for Individuals.

The Deming Application Prize is an annual award given to the company that has achieved distinctive performance through the application of total quality management concepts. The non-Japanese companies can apply for the award but its operations should be in Japan. The awards ceremony is broadcasted every year in Japan on national television. More than 160 companies have been awarded the Deming Application Prize. The Deming Prize is acknowledged globally as one of the best symbols of recognition for building business excellence.

1.22 The Malcolm Baldrige National Quality Award

The Malcolm Baldrige National quality Award was established by the US Congress in 1987. This award recognizes U.S. organizations in the business, health care, education, and non-profit sectors to promote better quality management practices. The Baldrige Award is the only formal recognition of the performance excellence of both public and private U.S. organizations given by the President of the United States. In many ways, it is the American prize equivalent to Japan's 'Deming Prize'. It is administered by the Baldrige Performance Excellence Program, which is based at and managed by the National Institute of Standards and Technology, an agency of the U.S. Department of Commerce. The award's 'Criteria for Performance Excellence' establish a framework for integrating total quality principles and practices in any organisation. Up to 18 awards are given annually across six eligibility categories—manufacturing, service, small business, education, health care, and non-profit. As of 2014, 105 awards have been presented to 99 organizations. The main purpose of this award is to help and stimulate American companies to attain excellence in quality and productivity. The criterion for the selection of the said award is difficult. It covers seven categories: (i) Leadership (110 points); (ii) Strategic Planning Area (80 points); (iii) Customer and Market Focus (80 points); (iv) Information and Analysis (80 points); (v) Human Resources Focus (110 points); (vi) Process Management (100 points); and (vii) Business Results (450 points). The companies which apply for awards are evaluated on the basis of 1000 points for seven categories.

1.23 The European Quality Award

The European Quality Award is given by European Foundation for Quality Management (EFQM). It was started in 1991 to recognize the European companies. The main objective of the award is to support, encourage, aware and recognize the development in the area of total quality management among European companies.

1.24 The Rajiv Gandhi National Quality Award

The Rajiv Gandhi National Quality Award is the Indian national quality award given by the Bureau of Indian Standards to Indian organisations that deliver excellence performance. The award aims to promote quality services to the consumers and to give special recognition to organisations that contribute significantly in the development of quality.

1.25 Cost of Quality

Meaning: Cost of Quality is a term that's widely used and widely misunderstood. The 'cost of quality' isn't the price of creating a quality product or service. It's the cost of NOT creating a quality product or service. Every time work is redone, the cost of quality increases. The examples include the reworking of a manufactured item, the retesting of an assembly, the rebuilding of a tool, the correction of a bank statement etc.

The term 'Cost of Quality' is sometimes confusing to some persons. It does not indicate the costs such as costs of producing high quality products or services. The term refers to all of the costs that are incurred to prevent poor quality. Preventing, detecting and dealing with defects cause costs that are called costs of quality. Cost of quality is a method that allows an organization to determine the extent to which its resources are

used for activities that prevent defects or failures. The prior knowledge of the resources used in as the result of internal and external failures allows an organization to determine the potential savings to be gained by implementing process improvements.

The cost of quality is defined as the sum of the costs that would not have been required if everything had done right the first time. It refers to the costs incurred due to the lack of quality. Generally, the most effective way to manage quality costs is to avoid having defects in the first place. It is much less costly to prevent a problem from ever happening than it is to find and correct the problem after it has occurred. There are four types of quality costs namely: (i) Prevention Costs, (ii) Appraisal Costs, (iii) Internal Failure Costs and (iv) External Failure Costs and these four quality costs are divided into two groups. The first two types of quality costs (prevention costs and appraisal costs) are included in one group because these are incurred to prevent poor quality production of products or services. The organisations adopt various quality tools and techniques of total quality management like statistical process control, business process engineering, quality circle, training, etc. to avoid poor or defective quality products and services. The last two types of quality costs ('internal failure costs' and 'external failure costs') are grouped because internal and external failure costs are incurred because defects are produced despite efforts to avoid them therefore these costs are also known as costs of poor quality. Four types of quality costs are briefly explained below:

(i) Prevention Costs

The purpose of this cost is to prevent the number of defects or to avoid quality problems. These costs are associated with the product design, product or service

requirements, quality tools implementation, quality planning, quality assurance, quality training, maintenance of the production systems, etc. These costs follows:

- **Process control Costs**

  It is related with the costs of analysing production processes and implementing standard processes, establishment of specifications for incoming materials, finished products or services etc.

- **Quality Planning Costs**

  It is related with the planning of the quality standards, product design, reliability, operations, production, new equipment design, teams, inspection, etc.

- **Quality Assurance Costs**

  It is related with the prevention of defects or errors in the production and maintenance of the quality system.

- **Training Costs**

  It is related with development, preparation, and training of programs to educate the employees as well as suppliers.

(ii) Appraisal Costs

Appraisal costs are associated with measuring and monitoring activities related to quality. These costs are associated with the efforts to ensure conformance to requirements like test and inspection costs, verification costs, suppliers rating costs,

quality audits etc. Appraisal costs are sometimes called inspection costs because these are incurred to identify defective products before the products are shipped to customers.

(iii) Internal Failure Costs

Internal failure costs are all the raw materials and labour expenses incurred due to waste, scrap or rework. These costs occur when the output of production work fails to reach designed & planned standard quality. Internal failure costs are resulted from identification of defects before they are shipped to customers. These costs include scrap, rejected products, reworking of defective units, and downtime caused by quality problem.

(iv) External Failure Costs

External failure costs include all costs incurred due to defected delivery to the customer. These are incurred to remedy defects discovered by customers. These costs occur when products or services that fail to reach design quality standards are not detected until the products are used by the customers. These include repairs, servicing, recall, legal suit settlements, lost sales, warranty claims, handling complaints, returns, transport costs, etc.

1.26 Examples of 'Cost of Quality'

Prevention Costs	Internal Failure Costs

Systems development Quality engineering Quality training Quality circles Statistical Process Control Supervision of prevention activities Quality data gathering, analysis, and reporting Quality improvement projects Technical support provided to suppliers Audits of the effectiveness of the quality system	Net cost of scrap Net cost of spoilage Rework labor and overhead Re-inspection of reworked products Retesting of reworked products Downtime caused by quality problems Disposal of defective products Analysis of the cause of defects in production Re-entering data because of keying errors Debugging software errors
Appraisal Costs	**External Failure Costs**
Test and inspection of incoming materials Test and inspection of in-process goods Final product testing and inspection Supplies used in testing and inspection Supervision of testing and inspection activities Depreciation of test equipment Maintenance of test equipment Plant utilities in the inspection area Field testing and appraisal at customer site	Cost of field servicing and handling complaints Warranty repairs and replacements Repairs and replacements beyond the warranty period Product recalls Liability arising from defective products Returns and allowances arising from quality problems Lost sales arising from a reputation for poor quality.

Source: www.accountingdetails.com

1.27 Summary

Total Quality Management requires a set of guiding principles and concepts. There are various approaches of TQM. The all-over world famous quality gurus like Deming, Juran, Crosby, Ishikawa, as well as many others, have made substantial contribution to the theory and practice of quality management. Their philosophies, concepts, principles have helped to shape the framework for quality management. Quality management as a discipline is incomplete without their contribution and approaches to total quality.

Some of the principles of total quality management are: TQM starts from Top Management, Customer Satisfaction, Create an Ultimate TQM Environment**,** Employee Involvement and Commitment**,** Integrated System Approach**,** Continuous Improvements in Quality.

There are several quality awards worldwide such as The Deming Prize in Japan, The Malcolm Baldrige National Quality Award in USA, The European Quality Award, etc.

The term 'Cost of Quality' refers to all the costs that are incurred to prevent poor quality. Preventing, detecting and dealing with defects cause costs that are called costs of quality. There are four types of quality costs. Two of these groups are known as 'prevention costs' and 'appraisal costs'. These are incurred to prevent poor quality production of products or services. The other two groups of costs are known as 'internal failure costs' and 'external failure costs'. Internal and external failure costs are incurred because defects are produced despite efforts to avoid them therefore these costs are also known as costs of poor quality.

1.28 Keywords

Total Quality Management (TQM)

Total Quality Management (TQM) is a comprehensive and structured approach to organizational management that seeks to improve the quality of products and services through ongoing refinements in response to continuous feedback.

Business Process Reengineering (BPR)

Business process reengineering (BPR) is redesigning business processes in the organisation to bring radical changes in the processes to generate value to the customers.

Cost of Quality

Cost of quality is a method that allows an organization to determine the extent to which its resources are used for activities that prevent defects or failures.

1.29 Self Assessment Questions

1. Give brief introduction of the approaches to total quality management.
2. Write short note on the followings: (i) The Deming Management Philosophy (ii) System of Profound Knowledge (iii) Deming's 14 Points for Management of Quality.
3. What is Juran's quality philosophy? Outline the Juran's Quality Trilogy.
4. Enumerate the Juran's 10 points for management of quality.
5. What is Crosby quality philosophy? Outline four Absolutes of Quality Management given by Crosby.

6. Enumerate the Crosby's 14 Points for quality management.
7. What is Kaoru Ishikawa quality philosophy?
8. Give details about the framework for quality and performance excellence.
9. Write brief notes on the following: (i) Just-in-Time (JIT) (ii) Business Process Reengineering (iii) Kaizen – A Continuous Improvement Tool (iv) ISO-9000 Standards (v) Quality Audit
10. Enumerate the famous principles of Quality Management.
11. What are the seven principles of quality management by Gerald F. Smith?
12. Give details about the International Quality Award Programs.
13. Write notes on the following: (i) The Deming Prize (ii) The Malcolm Baldrige National Quality Award (iii) The European Quality Award
14. Define Cost of Quality and give details about its types.
15. Give examples of four types of Cost of Quality.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **3**	Vetter: **Dr. Sanjay Tiwari**
Designing Organisation for Quality and Quality Policy	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the rational for designing organisation for quality and quality policy.
- Know the elements of quality management system.
- Understand the concept of quality objectives, quality manual and quality documentation.
- Get familiar with the implementation and benefits of quality management system.

1.1 Total Quality Management (TQM) and Senior Management

Total Quality Management (TQM) is introduced and led by top management. It is a management approach which is focused on quality. Its long term success is based on the quality culture of the organisation, the participation & commitment of the employees and the consistent delivery of quality products and services. The management take the help of TQM for customer satisfaction and benefits of all the stakeholders of the organisation. In other words, with the help of TQM philosophy, the management

manages an organisation in such a way that enables to meet stakeholder needs and expectations consistently in terms of quality. The total in TQM applies to the whole organisation as it is applied to every activity in the organisation. The management covers the soft issues such as ethics, attitude and culture through TQM. Generally, the management apply Quality Management System (QMS) to achieve the success of the total quality programme.

Simple statistics and random sampling were used to get the results from the production line in early days of Quality Management Systems (QMS). By the 20th century, the importance was shifted to team cooperation and dynamics due to the labour inputs as the most costly inputs. In the 21st century, the quality issues and customer satisfaction were become as important part of the QMS and considered as the primary task of it because of the sustainability and transparency initiatives. In this regime, the 'ISO 9000 family of standards' as well as 'quality audit' are used extensively worldwide for quality up-gradation. Besides this, it is assumed that other quality problems can be reduced as result of the systematic as well as analytical thinking, transparency in the processes, standard documentation and problem solving environment in the organisation.

1.2 Quality Management System

According to the American Society for Quality (ASQ), Quality Management System (QMS) is "the organisational structure, processes, procedures and resources needed to implement, maintain and continually improve the management of quality. It is also considered as a set of co-ordinated activities to direct and control an organisation in order to consistently improve the effectiveness and efficiency of its performance."

An effective quality management system (QMS) helps the organisation in terms of implementation of total quality management as it covers quality policy, quality objectives, goals, documentation of information, business processes focused on consistently meeting customer requirements and enhancing their satisfaction. Its success is dependent upon its alignment with company's strategic planning. It is expressed as the total sum of organizational quality policies, standards/processes, objectives and goals, documented information, quality tools and resources needed to implement and maintain it.

1.3 Elements of Quality Management System

The quality management system consists of the following elements as under:

- Quality Policy
- Quality Objectives
- Quality Manual
- Organizational Structure and Responsibilities
- Understanding customers and fulfilling their satisfaction
- Continuous improvement of processes
- Facilitate employees' education and quality training
- Using quality tools, techniques and parameters
- Data/Record management through standard documentation
- Quality control

1.4 Quality Policy

“Quality Policy is a mirror, which shows the structure of QMS, which drives implementation. It monitors effectiveness, it guides working, it allows perceptions, it thinks future, overall quality policy is management's commitment towards QMS.” (www.qualitygurus.com)

“Quality policy is the top management's expression of its intentions, direction, and aims regarding quality of its products and processes.” (www.businessdictionary.com)

Quality Policy is a written statement coined by the top management of an organisation with regard to manufacture or supply of quality product/service that meet the customer's expectations. The written quality policy is very much helpful to demonstrate that its internal quality controls are effective and to assure the stakeholders regarding the management of quality. The written quality policy assures all the stakeholders that the organisation can product and deliver the desired quality product or services with standard specifications on time and within budget.

In quality management system, a quality policy is a document designed by top management, senior managers and quality experts to express the quality statement of the organization. It clearly depicts the acceptable level of quality and the duties of specific departments to ensure consistency of quality production and delivery. Quality policy management is a long term strategic issue. The quality policy is thus a commitment from the top management to ensure compliance with the Quality Management System, and to ensure regularity in customer satisfaction.

Section 4.1.1 of ISO 9001 requires the organisation to define and document the Quality Policy and Quality Objectives for quality and commitment to quality. These must be relevant to the organizational goals and customer expectations. It is a brief statement or

document that defines the quality goals and objectives, a commitment to meeting them as well as continuous improvement. It should provide an outline for creating, stating, and measuring your performance of the quality objectives. The ISO standard requires a written, well defined quality policy that is communicated and understood within an organization. Section 5.3 also sets out some of the requirements for quality policies. The management should ensure that all employees are not only aware of, but fully understand the objectives stated through the Quality Policy.

1.5 Elements of Quality Management Policy Statement

The major elements described in quality policy are aimed at the following:

- To describe managements' commitment to maintaining standards of the company's product or service.
- To identify the ownership and involvement within the organisation of all staff and specifically those with key roles in maintaining the quality of the company's product or service.
- To state how the company's product or service is monitored to ensure that it continues to meet customer and market place needs.
- To state how the importance of meeting the customers' needs it communicated within the organisation.
- To state how the company ensures customer satisfaction is achieved.

- To detail how the company provides adequate resources to enable the above to happen.

- To state that the company systems or processes will be reviewed periodically to ensure that they remain effective in delivering customer satisfaction.

1.6 Examples of the Quality Policy

Most companies today have a written quality policy or mission statement. It is the established policy regarding the standards to be followed and the intention of the company to provide its customers regular quality products or services which conform to customer requirements and are delivered on time within the budget. This will be ensured through a defined quality program as detailed in the company quality manual.

Goodyear's quality policy is *"our mission is constant improvement in products and services to meet our customers' needs. This is the only means to business success for Goodyear and prosperity for its investors and employees."*

Motorola's quality policy is *"Doing the right thing. Every day. No excuses."*

Nestle's Quality Policy is *"To sustainably create value and to effectively and efficiently build customer and consumer trust, Quality at Nestlé is to: (i) Guarantee food safety and full compliance by respecting our policies, principles and standards with full transparency, (ii) Ensure preference and consistency to delight consumers and customers by valuing what they value and by offering products, systems and services that always meet or exceed their expectations, (iii) Strive for zero defects and no waste by constantly looking for opportunities to apply our continuous improvement approach*

to deliver competitive advantage, and (iv) Engage everybody's commitment across our complete value chain and at all levels of our organization to build the Nestlé quality culture."

1.7 Quality Objectives

Quality objectives are measurable steps towards achieving the organisational quality policy. Quality objectives state the answer of what to do to meet the goals fixed in the quality policy? These can be the best way to spotlight the key elements of the quality policy. The quality objectives can be to improve on-time deliveries, reduction in internal scrap, lower down the defects in production, cost reduction through elimination of wastes by 90-95 percent within one year, etc. The objectives must be controlled by considering them as the part of a procedure and making them part of the quality manual. The quality policy is created with the customer requirements/needs in mind, then quality objectives are linked back to the customer requirements/needs through the quality policy. These quality objectives would then be communicated to each level of the organization. The quality objectives should be designed to be specific, measurable, achievable, realistic and time-based.

1.8 Quality Manual

Quality manual is an official document produced by a business that details how its quality management system operates. A typical quality manual will include the company's quality policy and goals, as well as a detailed description of its quality control system that might include staff roles and relationships, procedures, systems and

any other resources that relate to producing high quality goods or services. The purposes of the quality manual are as under:

- The quality manual identifies the scope of the Quality Management System. In fact, it identifies the limits of the QMS. This is the explanation of what the business is? Is it a fast food chain? Or Is it a retail store? Or Is it an automotive industry?

- The quality manual consists of flowcharts which explains the connectivity of the all the different processes. This in-depth flowchart may help the employees to better understand the interactions between processes in the organization.

- It includes a top-level management structure so that people can better understand how the organisation is controlled.

The quality manual should be smaller, more graphic, more informative and easier to read and understand. The mission and vision statements of the company, quality policy and quality objectives can be a part of the quality manual. A good quality manual gives a clear picture about the success of the Quality Management System.

1.9 Quality Documentation

Quality documentation means the process of documenting the information. The information is related with each and every process, procedure, quality objective, checklist, drawing, flowchart, forms, diagram, etc. These quality documents describe the functioning of the quality management system. It is also mandatory as per the provisions of ISO 9000 certification as some information/documents are required to get the quality certificate.

1.10 Pillars of Quality Management System

Each organization is unique in terms of the culture, management practices, and the processes used to create and deliver its products and services. The quality management strategy will then vary from organization to organization; however, a set of primary elements should be present in some format. ISO 9000 (which contains eight quality management principles) and quality audit are the two important pillars upon which the efficient, effective and adaptable quality management system is to base. The eight quality management principles are applicable throughout industry, commerce and the service sectors:

1.11 ISO-9000 (International Standards Organisation)

The ISO-9000 standard was published in 1987. It had undergone revision in 2000 and 2005. It covers definitions, requirements, and continual improvements. ISO-9000 standards are developed to effectively design and implement efficient quality systems. These provide a framework that can provide guidance for the processes to be made auditable. These standards help organisations to work effectively. ISO-9000 standards are market driven designed by experts. These standards are reviewed once in five years to decide whether to modify, maintained or withdrawn. ISO-9000 is helpful to show the customers that the organisation have adopted quality procedures, quality processes and quality standards. It helps external auditors to show that all the internal processes are in place and well documented. ISO-9000 standards implementation shows that all the processes used for manufacturing products are audited internally and well documented. The ISO quality standards are frequently followed for food safety, data security in

computers, agriculture, healthcare industry, education institutions etc. In fact, Quality Standards developed by ISO impact our lives by giving quality and standard products and raising standard of living. The standards are recognised internationally.

1.12 Eight Principles of Quality Management

ISO standards are based on eight principles of quality management that can be applied by senior managers to improve their organisation:

i) Customer Focus

Customers are the backbone of the organisation. The organisations must have clear understanding of the customers' needs and do their best to meet the needs. Through regular survey the customers' dissatisfaction can be known.

ii) Leadership

Leaders should be ready to take the front positions at the time of problems. Only best leaders can guide their employees the right vision.

iii) Involvement

At the time of requirement or problem, the employees can be involved and their talent as well as skills be utilised.

iv) Process Approach

Companies activates are managed in the form of processes. The input, transformation and output are managed as a process.

v) System approach to management

At this step, all the processes of the organisation are examined thoroughly.

vi) Continuous Improvements

At this step, the management should try to find the long-term and consistent solutions of the problems.

vii) Right approach of decision making

The decision making must be based on the relevant data and information subsequently.

viii) Long term relationships with Suppliers

Long term relationships with the suppliers create value.

1.13 Quality Audit

A good quality management system (QMS) will not function or improve without adequate audits and reviews. Quality audit is defined as a systematic and independent monitoring to determine whether activities and related results comply with planned manuals and whether these manuals are implemented effectively and are suitable to achieve objectives. A quality audit is a process by which the management reviews and evaluates an element of the business to ensure that the process is meeting certain standards. A quality audit can be applied to various aspects of a business, such as inventory, service, employees, management, or databases. The objectives of the quality audit are to monitor and drives continuous improvement in quality. It ensures quality of

the product and determines the required improvement. It assesses effectiveness of quality assurance system. The management knows problems or potential problems by quality audit. It ensures timely correction of problems. It shows management support of the quality program and establishes high degree of confidence, trust, understanding and communication among internal employees. There are three types of quality audits, namely, first party (internal), second party (external) and third party (extrinsic) audits. Quality audit ensures that the business is offering a value to the customers through high-quality product or services. It gives information to the customers that the company is committed to quality standards and performs regular audits programmes. It helps to increase consumer confidence in the business. Finally, regular quality audits help protect the business from issues that could arise from selling a poor quality product.

1.14 Generic Model for Implementing Quality Management Systems

The American Society for Quality (ASQ) has given a generic model for implementing quality management systems which is given below:

- 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 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. (www.asq.org)

1.15 Benefits of implementing a Quality Management System

The benefits of implementing a quality management system are as under:

- QMS ensures that all the quality processes are operating efficiently and effectively.
- QMS ensures consistent quality output in terms of products or services. Hence, the customer loyalty is generated when he/she is getting consistent good quality products/services.

- An effective QMS is helpful in generating value for both the organisation and its customers.
- QMS ensures that all the processes are aligned together which is helpful in getting good desired results.
- The QMS ensures good operational results such as increase in revenue and increase in market share.
- The organisation is ready to response to market opportunities if QMS is operational.
- It reduces costs through the effective and efficient use of resources.
- QMS ensures improved organisational capabilities which is helpful for the companies to get competitive advantage.
- QMS is helpful in the communication of quality motives of the top management to all the stakeholders. It helps in proper understanding of the corporate philosophy regarding quality and its culture.
- QMS is helpful in motivating employees towards achieving the company's quality objectives.
- QMS is helpful in the continuous improvement of the processes.
- QMS increases confidence of interested parties in the effectiveness and efficiency of the business and reputation.

1.16 Summary

The top management apply Quality Management System (QMS) to achieve the success of the total quality programme. Quality Management System (QMS) is the organisational structure, processes, procedures and resources needed to implement, maintain and continually improve the management of quality. It is also considered as a set of co-ordinated activities to direct and control an organisation in order to consistently improve the effectiveness and efficiency of its performance. The quality management system consists of the following elements as under: Quality Policy, Quality Objectives, Quality Manual, Organizational Structure and Responsibilities, Understanding customers and fulfilling their satisfaction, Continuous improvement of processes, Facilitate employees' education and quality training, Using quality tools, techniques and parameters, Data/Record management through standard documentation and Quality control. Quality Policy is a mirror, which shows the structure of QMS, which drives implementation. It monitors effectiveness, it guides working, it allows perceptions, it thinks future, overall quality policy is management's commitment towards QMS. Quality objectives are measurable steps towards achieving the organisational quality policy. Quality objectives state the answer of what to do to meet the goals fixed in the quality policy? Quality manual is an official document produced by a business that details how its quality management system operates. A typical quality manual will include the company's quality policy and goals, as well as a detailed description of its quality control system that might include staff roles and relationships, procedures, systems and any other resources that relate to producing high quality goods or services. Quality documentation means the process of documenting the information. The information is related with each and every process, procedure, quality objective,

checklist, drawing, flowchart, forms, diagram, etc. These quality documents describe the functioning of the quality management system.

1.17 Keywords

Quality Management System

Quality Management System (QMS) is the organisational structure, processes, procedures and resources needed to implement, maintain and continually improve the management of quality. It is also considered as a set of co-ordinated activities to direct and control an organisation in order to consistently improve the effectiveness and efficiency of its performance.

Quality Policy

Quality Policy is a mirror, which shows the structure of QMS, which drives implementation. It monitors effectiveness, it guides working, it allows perceptions, it thinks future, overall quality policy is management's commitment towards QMS.

Quality Objectives

Quality objectives are measurable steps towards achieving the organisational quality policy.

Quality Manual

Quality manual is an official document produced by a business that details how its quality management system operates. A typical quality manual will include the company's quality policy and goals, as well as a detailed description of its quality

control system that might include staff roles and relationships, procedures, systems and any other resources that relate to producing high quality goods or services.

1.18 Self Assessment Questions

1. What is the role of senior management in Total Quality Management (TQM)?
2. Define the concept of Quality Management System.
3. Enumerate the elements of Quality Management System.
4. Define the concept of Quality Policy.
5. Elaborate the elements of Quality Management Policy Statement.
6. Discuss the examples of the Quality Policy.
7. Define Quality Objectives.
8. Define Quality Manual.
9. What is the use of Quality Documentation in the organisation?
10. Enumerate and discuss the pillars of Quality Management System.
11. Discus the role of ISO-9000 in the organisation.
12. Enumerate the eight principles of Quality Management.
13. Define the concept of Quality Audit.

14. Give details about the generic model for implementing Quality Management Systems.

15. What the benefits of implementing a Quality Management System?

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **4**	Vetter: **Dr. Sanjay Tiwari**
Contribution of TQM by W.E. Deming, Joseph M. Juran & Philip Crosby and Kaoru Ishikawa	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic contribution given by quality gurus namely W. E. Deming, Joseph M. Juran, Philip B. Crosby and Kaoru Ishikawa.
- Know the concepts of Deming's System of Profound Knowledge and Seven Deadly Diseases.
- Understand Juran's Quality Trilogy and Crosby's Zero Defect Programme
- Elaborate the concept of Cause and Effect Diagram

Introduction

Total Quality Management requires a set of guiding principles and concepts. The all-over world famous quality gurus like Deming, Juran, Crosby, Ishikawa, as well as many others, have made substantial contribution to the theory and practice of quality management. Their philosophies, concepts, principles have helped to shape the framework for quality management. Quality management as a discipline is incomplete without their contribution and approaches to total quality. A discussion of their philosophies which are actually more about management of quality as follows:

1.1 Contribution of W. E. Deming

William Edwards Deming was an American engineer, statistician, professor, author, lecturer, and management consultant. He was born in October 14, 1900 Sioux City, Lowa, United States and died in December 20, 1993). He was an electrical engineer initially and later specializing in mathematical physics. Deming was a professor of statistics at New York University's Graduate School of Business Administration. He taught at Columbia University's Graduate School of Business also. He helped in the development of the sampling techniques which are still used by the U.S. Department of the Census and the Bureau of Labor Statistics. He always advocated that there is no substitute for knowledge.

He found great inspiration in the work of Walter Shewhart like Statistical Process Control, Operational Definitions, and the PDSA (Plan-Do-Study-Act) Cycle. The Deming called PDSA as 'The Shewhart Cycle'. This was in response to the growing popularity of PDSA, which Deming viewed as tampering with the meaning of Shewhart's original work.

Deming is best known for his work in Japan after World War-II, particularly his work with the leaders of Japanese industry. That work began in August 1950 at the Hakone Convention Center in Tokyo when Deming delivered a seminal speech on what he called Statistical Product Quality Administration. He taught statistical process controls to the Japanese engineers and managers and the message was very much clear that the improvement in quality will reduce expenses while increasing productivity and market share. Many in Japan credit Deming as the inspiration for what has become known as the Japanese post-war economic miracle of 1950 to 1960, when Japan rose from the

ashes of war to start Japan on the road to becoming the second largest economy in the world. He is credited with enabling Japan to become a world business power by the 1980's due to image of quality. He worked for Ford Motor Co. during the period of 1979-1982 and he is credited for making Ford the most profitable US Auto manufacturer by 1986. Deming is best known for his 14 Points for quality and his system of thought called the System of Profound Knowledge.

1.2 Deming's System of Profound Knowledge

The Profound Knowledge System consists of four parts. Deming advocated that all managers need to understand the System of Profound Knowledge. He stressed that the system of profound knowledge is very important because it helps the managers to transform within their organizations which improves the outcomes in the form of quality. The four parts are as follows:

- **Appreciation of a System**: The systems consist of all the processes involving suppliers, producers, and customers of goods and services. The managers must understand the system thoroughly that they are looking to manage. The understanding of the system will help them in fixing the problems.

- **Knowledge of Variation**: It covers the range and causes of variation in quality and the use of statistical quality control. Deming suggested two basic types of causes for variation: (i) Common Causes – This type of variations are resulted from within the system and can be predicted with probabilities. (ii) Special Causes – This type of variations are generated with special causes are variations that occurs unexpectedly. The variation from a special cause can come after a change in the system (with or

without realization that a change has occurred), and special cause variation cannot be predicted. The knowledge of these two types of variations is must for managers. If they know the cause of variation, then they can handle the problem efficiently or at least be ready to face it.

- **Theory of Knowledge**: It covers the concepts explaining knowledge and the limits of what can be known. Knowledge depends on theory and experience teaches nothing without theory.

- **Knowledge of Psychology**: It consists of the concepts of human nature. Leaders must understand the human behaviour to motivate, coordinate, manage employees and lead teams to optimize the system.

The clear understanding and applying the four parts of Deming's theory will create a better leadership culture. The four parts of Deming's theory tie into his fourteen points.

1.3 Deming's 14 Key Points for Quality

W. Edwards Deming offered 14 key principles for management to follow for significantly improving the effectiveness of a business or organization. He created 14 principles which provide a framework to develop the knowledge in the organisation and can be used to guide long term business plans and aims at workplace. Many of the principles are philosophical. Others are more programmatic. However, all the principles are transformative in nature. The 14 principles were first published in his book 'Out of the Crisis'. These principles are widely discussed and interpreted by many thinkers of quality and other management disciplines. The fourteen principles are named as (i) Constancy of Purpose (ii) Adopt the New Philosophy (iii) End Lowest Tender Contracts

(iv) Improve Every Process (v) Institute Training on the Job (vi) Drive Out Fear (vii) Break-down Barriers (viii) Eliminate Exhortations (ix) Eliminate Arbitrary Numerical Targets (x) Permit Pride in Workmanship (xi) Encourage Education (xii) Top Management Commitment to Action (xiii) Cease the Need for Mass Inspection (xiv) Institute Leadership. The details are as follows:

(i) Constancy of Purpose

Constancy of purpose means that the management should commit resources for quality programmes for long-term period. Deming advocated that there is no short-cut for quality programmes and the quality improvement programmes can only be effective in long time. The principle states that quality is the continuous improvement of products and service and allocating resources for long term rather than short term. The vision of the management must be long term profitability rather short term profitability. The improvement of product and service must be with the aim to become competitive and to stay in business in long run. It is the development of the organizations goals and philosophy from long term view.

(ii) Adopt the New Philosophy

According to this principle, the management must awaken to the challenges, take their responsibilities and bring radical changes in the system. Today, no business can live longer with poor quality of goods and services, commonly accepted levels of delays, mistakes, defective materials, customer complaints and grievances. A high level of transformation in terms of new philosophy is required to halt the continued problems of the businesses because the customer satisfaction is the most important task. Business

can live long life with happy customers only. So, the new philosophy is to identify and remove barriers to achieving quality and involve everybody consistently.

(iii) End Lowest Tender Contracts

According to this principle, the practice of awarding tender on the basis of 'lowest price tag /quotation' must be ended. The organisations must try to depend on a single supplier in spite of many suppliers for one item. Working with single supplier will help in the development of goods relationships and will bring loyalty and trust. It will minimise the overall cost. The shifting from multiple suppliers to single supplier is a good strategy and the demand of the time.

(iv) Improve Every Process

According to this principle, every organisation must try to improve the production system constantly and forever to improve quality consistently. It will help to minimize the overall cost gradually. The system must try to reduce waste gradually and improve quality continually. Deming advocated the use of quality tools like Statistical Quality Control Charts, Flow Charts, etc to manage the quality of goods and services.

(v) Institute Training on the Job

In the organisations, the employees require training regularly for consistent improvement. Modern methods of training are required to make better use of every employee because new skills are required to keep up-date the employees with changes in raw materials/parts, methods/processes, product/service design, technology, machinery, techniques, etc.

(vi) Drive out Fear

Deming advocated driving out fear so that everyone may work effectively for the company as the fear can be the main source of stress and emotional problems. Encourage effective and open two-way communication process and other means to drive out fear throughout the organization so that everybody can contribute maximum and can work effectively with more productivity. Rewarding teamwork and promoting creativity can reduce the fear also.

(vii) Break-down Barriers

Top management should build teamwork between departments and not competition. It should break down barriers between departments and optimize the efforts of teams, groups and staff. As for example, managers in research, design, sales, and production must work together as a team to foresee the problems of production as well as customers facing from products and services.

(viii) Eliminate Exhortations

The top management should eliminate slogans, exhortations, and targets for the work force to encourage productivity. The targets for zero defects and new levels of productivity generate adverse effects. The bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the work force. The top management should support regular training to help employees to achieve stated standard of quality.

(ix) Eliminate Arbitrary Numerical Targets

Get rid of or eliminate Management by Objective (MBO), numbers or numerical goals as the numbers and quotas focus on quantity rather than quality. Instead, learn how the processes can be improved. Try to replace Management by Objective (MBO) with never-ending and long lasting improvements. Top management should stress to eliminate numerical quotas in order to take account of quality and processes rather than just number game.

(x) Permit Pride in Workmanship

Remove barriers to pride of workmanship. Employees must be treated as the valuable asset of the organisation. Avoid monotonous tasks, inferior machines and working extra hours. Deming believed that one of the highest barriers to pride in workmanship is performance appraisal. Performance appraisal destroys team work by promoting competition for limited resources. So, eliminate performance organisation.

(xi) Encourage Education

The top management should have a policy regarding education and training for their employees. It must stress on a vigorous program of both training and development for the workforce. The employees should be educated to make them ready to face the challenges in the current jobs. Today, the organizations need not only just good & skilled people but also it needs people that are consistently upgrading with education.

(xii) Top Management Commitment to Action

Top management must take action to accomplish the transformation for quality improvements. Management and workforce must work together for the same. Include all the stakeholders of the organisation to work to accomplish the transformation. The

transformation is everybody's job and it is possible only with the commitment of the top management.

(xiii) Cease the Dependence on Mass Inspection to achieve Quality

Eliminate the need for mass inspection for quality control and depend on process control through statistical techniques.

(xiv) Institute Leadership and Modern Methods of Supervision

Leadership is a learned skill, so the organisations must institute leadership. Supervision must be done with the practical knowledge of statistical methods. The aim of leadership should be not only being to tell the people about what to do but also to guide and work with them to do a better job.

1.4 Seven Deadly Diseases

The dreadful diseases are management practices that are harmful, but, Deming advocated that these are easier to cure. However, it requires a complete change of management style. The 7 deadly diseases are as follows:

- Lack of constancy of purpose;
- Emphasis on short term profits or performance, quarterly dividends etc.;
- Evaluation by performance merit rating or annual reviews;
- Management mobility;
- Running the company on visible figures alone.
- Excessive medical costs
- Excessive costs of liability.

1.5 Contribution of Joseph M. Juran

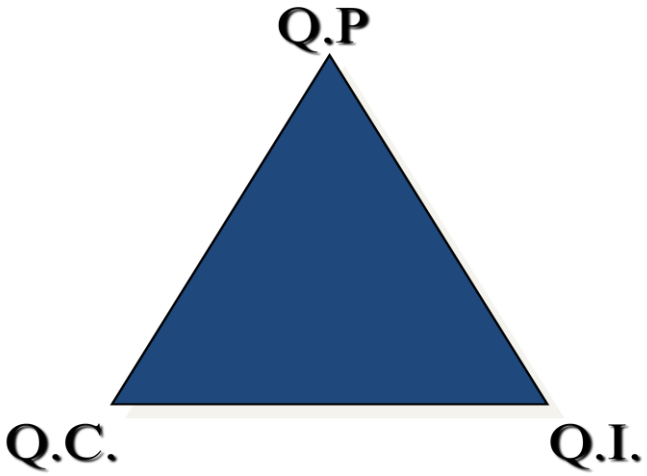
Joseph M. Juran was an industrial engineer. He Joined Western Electric in the 1920s. He authored 'The Quality Control Handbook' which is often referred to as the quality bible and is a classic reference for quality engineers. He made many contributions to the field of quality management in his more than seventy active working years. Juran proposed a simple definition of quality: "fitness for use." This definition of quality suggests that it should be viewed from both external and internal perspectives; that is, quality is related to "(a) product performance that results in customer satisfaction; (b) freedom from product deficiencies, which avoids customer dissatisfaction."

He believed that quality improvement should be achieved through projects. He revolutionized the Japanese philosophy on quality management. Dr. Juran was the first to incorporate the human aspect of quality management which is referred to as Total Quality Management. The process of developing ideas was a gradual one for Dr. Juran. Top management involvement, the Pareto principle, the need for widespread training in quality, the definition of quality as fitness for use, the project-by-project approach to quality improvement--these are the ideas for which Juran is best known, and all emerged gradually. He focused on three major quality processes, called the Quality Trilogy.

1.6 Juran's Quality Trilogy

According to Juran, quality processes are summed up by the Triology. It means that the management of quality consists of three inter-related quality oriented processes namely quality planning, quality control and quality improvement. The Trilogy provides a

framework of how an organisation can improve the quality by better understanding the relationships that plan, control and improve quality. The details of trilogy are as follows:



- **Quality Planning**

  It is all that begins with quality planning. It is preparing and developing a process to meet quality goals. The purpose of quality planning is to determine the customers and identifying their needs and expectations. In fact, quality planning provides the operating forces with the means of producing products that can meet the customer's needs.

- **Quality Control**

  Once planning is completed, the plan is turned over to the operating forces. Quality control evaluates the actual quality performance and compares it to the quality goals. Quality control is meeting quality goals during operations by addressing the variation problems.

- **Quality Improvement**

  It is the achieving of standard levels of performance. It is to make sure that no process is deficient, no wastage and avoiding quality deficiencies.

Juran, like Deming, was invited to Japan in 1954 by the Union of Japanese Scientists and Engineers (JUSE). His lectures introduced the management dimensions of planning, organizing, and controlling and focused on the responsibility of management to achieve quality and the need for setting goals. Juran defines quality as fitness for use in terms of design, conformance, availability, safety, and field use. Juran tends to take a more strategic and planning approach to improvement than does Deming.Thus, his concept more closely incorporates the viewpoint of customer. He is prepared to measure everything and relies on systems and problem-solving techniques. Unlike Deming, he focuses on top-down management and technical methods rather than worker pride and satisfaction. Juran promotes the view that organizational quality problems are largely the result of insufficient and ineffective planning for quality. The means proposed by Juran establish specific goals to be reached and plans for reaching those goals.

1.7 Juran's 10 Points for Quality Improvement

Actions taken in the 10 points mentioned below involve the people and sustaining their involvement in the improvement activities is must. Juran's 10 points to quality improvement are:

- Build awareness of need and opportunity for improvement to realize that all processes are improvable;

- Set-goals for improvement;
- Organize to reach goals;
- Provide training;
- Carryout projects to solve problems;
- Report progress;
- Give recognition;
- Communicate results;
- Keep score and;
- Maintain momentum by making annual improvement part of the regular systems and processes of the company.

Juran is the founder of Juran Institute in Wilton, Connecticut. Juran contribution may, over the longer term, greater than Deming's because Juran has broader concept, while Deming's focus on statistical process control is more technical oriented.

1.8 Contribution of Philip B. Crosby

Philip Bayard Crosby, (June 18, 1926 – August 18, 2001) was a businessman and author who contributed to management theory and quality management practices. He worked as corporate vice-president for quality at International Telephone also. He is best known in relation to the concepts of 'Zero Defects' and 'Do it Right First Time'. He authored a number of books, of which the book entitled 'Quality is Free' is the most popular in which he stated that "Quality is free. It's not a gift, but it is free. What costs money are the unquality things -- all the actions that involve not doing jobs right the first time." His two other books are 'Quality without Tears' and 'The Art of Getting Your Own Sweet Way'.

1.9 Four Absolutes of Quality Management

Crosby's TQM approach is based on his four absolutes of Quality Management:

- **First absolute: Quality is defined as conformance to requirements**

  Quality is defined as conformance to requirements and not as 'goodness' or 'elegance'. Requirements must be clearly stated so they can't be misunderstood.

- **Second absolute: Problems are functional in nature**

  It means that the problems are to be identified and the system for causing quality must be corrected and prevented.

- **Third absolute: there is no optimum level of defects**

  It means error-free products and services are possible and perfect quality has to be the aim. Doing the job right the first time is always cheaper. Crosby asserts that it is reasonable to expect a level of zero defects. Management determination is required for the success of 'Zero Defects' a reality.

- **Fourth absolute: cost of quality is the only useful measurement**

  It means the measure of quality is the prices of non-conformance and not indices. Crosby advocated in costing quality as a key motivation for management. It means quality cost data are useful. Crosby estimated that most companies spend 15 to 20 percent of their sales on quality costs.

1.10 Philip B. Crosby's Zero Defect Programme

Crosby advocated that 80 % of problems are caused by management and only the balance by workers. He therefore advocated the need for training the management including executives and managers. Like Frederick Taylor, Philip Crosby's ideas came from his experience on an assembly line. He focused on zero defects. Crosby was quick to point out that zero defects are not something that originates on the assembly line. To create a manufacturing process that has zero defects management must set the tone and atmosphere for employees to follow. The employees cannot be blamed if management has not set any policy for zero defects. The benefit of zero defects policy are many like dramatic decrease in waste of valuable resources and time spent in producing goods or services that consumer's do not want. He believed that 'zero defects' is a realistic goal. He defined the cost of quality as the expense of nonconformance. Crosby initiated the Zero Defects program at the Martin Company. As the quality control manager of the Pershing missile program, Crosby was credited with a 25 percent reduction in the overall rejection rate and a 30 percent reduction in scrap costs.

Crosby identified many other principles and concepts for quality improvement other than 'zero defects' principle like management participation, management responsibility for quality, employee recognition, education, reduction of the cost of quality, doing things right for the first time etc. Crosby has given the valuable contribution of 'Quality Management Grid' which can be used by the organisations to evaluate their quality management maturity. The five stages of this grid are uncertainty, awakening, enlightenment, wisdom and certainty. It is a quality tool for managers to evaluate their quality status.

1.11 Crosby's Fourteen Steps for Quality Improvement

Philip Crosby has developed 14 steps for an organization to follow an effective quality program namely: Management Commitment, Quality Improvement Team, Quality Measurement, Calculate the Cost of Quality, Raise Quality Awareness among Employees, Instigate Corrective action, Monitor Progress of Quality Improvement – establish a 'Zero Defects' Committee, Train Supervisors in Quality Improvement, Zero Defects Day, Encouraging Employees to Create Quality Improvement Goals, Error-cause Removal, Recognise Participants' Effort, Create Quality Councils and Do it over again. The details are as follows:

- **Management Commitment**

The management should clearly state its commitment by a quality policy and implement it. The need for quality policy must be recognised and adopted by management. The top management should clarify its stand on quality as it is necessary to consistently produce conforming products and services at the optimum price.

- **Quality Improvement Team**

Crosby advocated that there is a requirement to create quality improvement teams with representatives from all workgroups and functions. These teams run the quality improvement program and their representatives should have sufficient authority to commit the area they represent to action. Since every function of an operation contributes to defect levels so every function must participate in the quality improvement effort.

- **Quality Measurement**

Establish quality measures for each activity throughout the organisation. To avoid confusion, everyone needs a clear method of measurement of quality. If the quality measures for each area of activity are recorded then the improvement in the process is possible.

- **Calculate the Cost of Quality**

The cost of quality should be clearly defined and measured. The cost of quality if not handled properly, can be a cause of more trouble. The best way to reduce the cost of quality is through prevention. The components of the overall cost of quality are wastes, scrap, rework, service apart from regular maintenance, inspection etc.

- **Raise Quality Awareness among Employees**

Quality awareness means making employees aware about the quality issues, cost of quality, knowledge about defects, conformance of the product or service to the quality, types and expense of the quality problems etc. The awareness of the employees regarding quality improvements can be enhanced through proper training.

- **Instigate Corrective action**

Establish a systematic method of permanently resolving the quality problems that are identified through previous action steps. Try to document the problems and then resolve formally. There must be a regular discussion about the quality problems which are arising frequently so that permanent solution can be obtained and implemented. People need to see that problems are being discussed and resolved on a regular basis. Corrective action should then become a habit.

- **Monitor Progress of Quality Improvement – establish a 'Zero Defects' Committee**

Zero Defects is not a motivation programme. Its purpose is to communicate the clear message that everyone should do things right first time. The quality improvement task team should list all the individual action plans of the 'Zero Defects Programme'. This programme will provide a clean energy flow into an organization for a wide 'Zero Defects' commitment.

- **Train Supervisors in Quality Improvement**

Undertake all supervisors to undergo formal training on the 14 steps before they are implemented. This supervisor training must be a part of quality improvement program. A supervisor should understand each of the 14 steps well enough to be able to explain them to his or her people. Therefore, the supervisor must be given primary consideration when laying out the program.

- **Zero Defects Day**

Hold zero defects day to establish the new attitude and give an impression about the quality issues. It is important that the commitment to Zero Defects as the performance standard of the company should give an impact. Create this event in such a positive way that each employee realize that the management want a change. Zero Defects should be like a revolution in the organisation where everybody is involved to lead a new way of commitments and understanding. Therefore, it is necessary that all members of the company participate in an experience that will make them aware of this change.

- **Encouraging Employees to Create Quality Improvement Goals**

Each supervisor gets his or her people to establish specific, measurable goals on 30, 60, and 90 day basis. These goals should be specific and measurable. These goals guide the employees in the areas of performance measurement and evaluation. The issue is to deal quality issues at the forefront of organisational priorities.

- **Error-cause Removal**

One of the most difficult problems employees face is their inability to communicate problems to management. Error-cause removal is the identification of quality problems that prevent error free work. Employees are encouraged to detail such quality issues/troubles that prevent them from carrying out error-free work. Problems should be acknowledged and addressed permanently. It will boost the morale of the employees if the problems are addressed and dealt with on time.

- **Recognise Participants' Effort**

Establish recognition for those who meet goals or perform outstanding acts. The act of recognition is important. Appreciate those who participate. Recognize their contribution publicly as it will motivate them.

- **Create Quality Councils**

The quality councils should comprise of quality professionals and team-leaders. There should be held regular meetings of quality councils to discuss the quality improvements issues. There should be a planned communication on a regular basis for the regular up gradation of the quality programme via quality councils.

- **Do it over again**

The management should emphasize that the quality improvement program never ends. It should be remembered that march towards quality is never-ending journey. It is very necessary to set up a new team for quality up gradation and begin the programme over again with an emphasis on ‘Zero Defects Programmes’. This 'do it all over again' helps quality to become deep-rooted or embedded in the organisation.

1.12 Contribution of Kaoru Ishikawa

Kaoru Ishikawa was born in July 13, 1915. He graduated in applied chemistry in 1939. He was a Japanese organizational theorist, Professor at the Faculty of Engineering at The University of Tokyo. He is one of the Japan’s quality control pioneers. He was a Japanese quality authority until his death. He is known for his quality management innovations. He is considered a key figure in the development of quality initiatives in Japan, particularly ‘the quality circles’ in which small group of employees meet regularly to improve quality and productivity. He developed the Ishikawa or cause and effect diagram or fishbone diagram often used in the analysis of industrial processes. He emphasised the development of participation and bottom-up of quality which is now main philosophy of the Japanese approach to quality management. He advocated that the first concern for management is the happiness of the people connected with it. If people are not happy then it does not deserve to survive. He got the Grant Award in 1971 from the American Society for Quality Control for his educational programmes in quality control. He died in April 16, 1989.

1.13 Ishikawa Diagram

Kaoru Ishikawa invented Ishikawa Diagram in 1968. Ishikawa diagram is also known as fishbone diagram or cause-and-effect diagrams. It is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. It shows the causes of a specific event. The Ishikawa diagram is used in quality defect prevention to identify potential factors causing an overall effect. Each cause or reason causes variability in the output. Causes are grouped into major categories to identify the real source of variation. The categories categorically can be people, methods/process, machines, materials, measurements, environment, equipment etc.

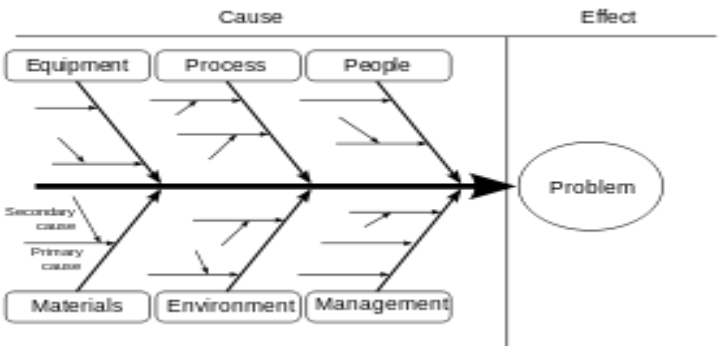


Fig: Fishbone Diagrams/Cause-and-Effect Diagrams

Fishbone or Cause-and-Effect diagram has a fishbone shape and the diagram resemble the skeleton of a fish. The main causes are the categories drawn as 'bones' attached to the spine of the fish. The broad causes in the form of categories are people, methods/process, machines, materials, measurements, environment, equipment etc. Cause-and-effect diagram can give a view of key relationships among various causes and the possible causes provide additional insight into process behaviour. These causes can be derived from brainstorming sessions. Then, these groups are to be labelled as categories of the fishbone.

1.14 Uses of Cause and Effect Diagram

Using the Cause and Effect Diagram to identify the root cause(s) of a problem provides several benefits to the quality improvement team like:

- Construction of a Cause and Effect diagram is straightforward, simple and easy to learn.
- It is helpful to identify potential causes of the problem.
- It is helpful to summarize major causes under categories.
- It is a visual tool for organizing critical thinking and gives an overall view of the problems to the whole team.
- It is helpful to explore root causes of the problems.
- It also helps to analyse the situation at one go and take corrective actions.

1.15 Summary

William Edwards Deming was an American engineer, statistician, professor, author, lecturer, and management consultant. He was born in October 14, 1900 Sioux City, Lowa, United States and died in December 20, 1993). He helped in the development of the sampling techniques which are still used by the U.S. Department of the Census and the Bureau of Labor Statistics. He always advocated that there is no substitute for knowledge. He found great inspiration in the work of Walter Shewhart like Statistical Process Control, Operational Definitions, and the PDSA (Plan-Do-Study-Act) Cycle. The Deming called PDSA as 'The Shewhart Cycle'. He taught statistical process controls to the Japanese engineers and managers and the message was very much clear that the improvement in quality will reduce expenses while increasing productivity and market share. Deming is best known for his 14 Points for quality and his system of

thought called the System of Profound Knowledge. He stressed that the system of profound knowledge is very important because it helps the managers to transform within their organizations which improves the outcomes in the form of quality. The four parts of the System of Profound Knowledge are: Appreciation of a System, Knowledge of Variation, Theory of Knowledge and Knowledge of Psychology. The fourteen principles are named as (i) Constancy of Purpose (ii) Adopt the New Philosophy (iii) End Lowest Tender Contracts (iv) Improve Every Process (v) Institute Training on the Job (vi) Drive Out Fear (vii) Break-down Barriers (viii) Eliminate Exhortations (ix) Eliminate Arbitrary Numerical Targets (x) Permit Pride in Workmanship (xi) Encourage Education (xii) Top Management Commitment to Action (xiii) Cease the Need for Mass Inspection (xiv) Institute Leadership.

Joseph M. Juran was an industrial engineer. He Joined Western Electric in the 1920s. He authored 'The Quality Control Handbook' which is often referred to as the quality bible and is a classic reference for quality engineers. Juran proposed a simple definition of quality: "fitness for use." This definition of quality suggests that it should be viewed from both external and internal perspectives; that is, quality is related to "(1) product performance that results in customer satisfaction; (2) freedom from product deficiencies, which avoids customer dissatisfaction." He believed that quality improvement should be achieved through projects. He revolutionized the Japanese philosophy on quality management. Dr. Juran was the first to incorporate the human aspect of quality management which is referred to as Total Quality Management. He focused on three major quality processes, called the Quality Trilogy namely quality planning, quality control and quality improvement. Juran has given 10 Points for Quality Improvement.

Philip Bayard Crosby, (June 18, 1926 – August 18, 2001) was a businessman and author who contributed to management theory and quality management practices. He is best known in relation to the concepts of 'Zero Defects' and 'Do it Right First Time'. He authored a number of books, of which the book entitled 'Quality is Free' is the most popular in which he stated that "Quality is free. It's not a gift, but it is free. What costs money are the unquality things -- all the actions that involve not doing jobs right the first time." His two other books are 'Quality without Tears' and 'The Art of Getting Your Own Sweet Way'. Crosby's TQM approach is based on his four absolutes of Quality Management namely: Quality is defined as conformance to requirements, Second absolute: Problems are functional in nature, Third absolute: there is no optimum level of defects and Fourth absolute: cost of quality is the only useful measurement. Philip Crosby has developed 14 steps for an organization to follow an effective quality program: Management Commitment, Quality Improvement Team, Quality Measurement, Calculate the Cost of Quality, Raise Quality Awareness among Employees, Instigate Corrective action, Monitor Progress of Quality Improvement – establish a 'Zero Defects' Committee, Train Supervisors in Quality Improvement, Zero Defects Day, Encouraging Employees to Create Quality Improvement Goals, Error-cause Removal, Recognise Participants' Effort, Create Quality Councils, Do it over again.

Kaoru Ishikawa was born in July 13, 1915. He graduated in applied chemistry in 1939. He was a Japanese organizational theorist, Professor at the Faculty of Engineering at The University of Tokyo. He is one of the Japan's quality control pioneers. He is considered a key figure in the development of quality initiatives in Japan, particularly 'the quality circles' in which small group of employees meet

regularly to improve quality and productivity. He developed the Ishikawa or cause and effect diagram or fishbone diagram often used in the analysis of industrial processes. He emphasised the development of participation and bottom-up of quality which is now main philosophy of the Japanese approach to quality management. He advocated that the first concern for management is the happiness of the people connected with it. If people are not happy then it does not deserve to survive.

1.16 Self Assessment Questions

Q.1 Enumerate Deming's fourteen points.

Q.2 Elaborate Juran's triology and his 10 points for quality improvement.

Q.3 Explain with suitable example the use of the cause and effect diagram.

Q.4 Critically evaluate Crosby's 14 principles of quality and concept of zero defects.

Q.5 Compare the approaches of Deming and Juran on quality.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **5**	Vetter: **Dr. Sanjay Tiwari**
Quality Planning: Understanding Customers and their Needs	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic concepts of quality planning and quality plan
- Know the importance of planning tools.
- Understand the customer and their needs.
- Know the models of customer satisfaction and customer need analysis.

1.1 Quality Planning

Quality Planning is the initial step of the quality management programme in which a clear definition of the goal and objective of the quality plan is mentioned. It is the task of determining what factors are important for the quality of the products or services or processes and to figure out how to meet those factors. Quality planning is the process for identification of quality standards and determining how to implement them.

Quality planning is a systematic process that translates quality policy into measurable objectives and requirements, and lays down a sequence of steps for realizing them within a specified time frame.

Quality planning is an essential part of quality management, which is required for the effective management of quality from the buying of raw materials/parts to the final delivery of products or services to the customers. An effective quality planning defines quality policies, procedures, standards, criteria for and areas of application, and roles, responsibilities and authorities. It is to identify what standards are relevant and how the team will meet them. There are three steps involved in a quality management: Quality Planning, Quality Assurance and Quality Control. The quality planning is crafted during the strategic planning phase of the organisation and is important for the managers, team, employees, suppliers, etc. Quality planning is necessary to maintain the standard of quality for the processes. It is the establishment of procedures, standards, and tools for all the processes of the organisation. It ensures the consistent and timely delivery of product with reduced delivery risk.

The major questions to be answered while deciding the objective of the plan are: What is the product or deliverable supposed to accomplish? What does it look like? What is it supposed to do? How do you measure customer satisfaction? How do you determine

whether or not the project was successful? An appropriate answer to these questions can help you to identify and define the goals for the quality management. Once the goals have been decided, the discussion can be made for the tools and techniques used for achieving the set goals. An effective quality planning includes assessing the risks to success, setting high standards, documenting everything, and defining the methods and tests to achieve, control, predict and verify success. It should ensure that an effective and efficient quality plan is maintained in the project plan to track the quality metrics of the entire project.

1.2 Principles of Quality Planning

The organisations should follow some principles for the quality planning:

- **Customer Satisfaction is the Prime Task**

The focus of quality planning is customers' satisfaction. The customer ultimately determines the level of quality. No matter what an organisation does to foster quality improvement, the customer determines whether the efforts are worthwhile or not. Quality is defined by the requirements of the customers. Hence, a better quality planning is required for the consistent improvements in the processes to meet customer's expectations or to lower down the customers' dissatisfaction level.

- **Quality Planning is the Responsibility of Management**

The quality concept is initiated by the top management. The whole credit of the initiation of quality management goes to the top management. The top management is

responsible for all the costs of the quality management. Hence, the quality planning is an important consideration and serious issue.

- **Continuous Improvements in Quality**

A continuous improvement in quality of products and processes is a never ending process and the top management is completely involved in the quality improvement process rather than simply supportive of it. For this purpose, a consistent quality planning is very necessary to ensure quality. It includes the formulation of plans that integrates quality as a core process with other processes.

- **Prevention over Inspection**

It is better to avoid mistakes than to inspect and repair the mistakes. Better quality planning is a pro-active approach for this issue.

1.3 Quality Plan

A quality plan is a document that specifies quality standards, practices, resources, specifications, and the sequence of activities relevant to a particular product, service, process, project, or contract. It helps to set quality targets to meet the needs of the customers. It can be used further to schedule quality control and quality assurance activities to assure the customers that the quality targets will be met.

1.4 Quality Plan Components

A good quality plan describes the following components:

- It covers quality objectives of the organisation

- It covers key processes for desired quality in the organisation
- It covers quality specifications and standards desired to keep the processes right
- It covers the allocation of responsibilities, authority, and resources
- It covers quality assurance and control activities for quality planning to be successful
- It covers suitable testing methods, inspection, examination, and audit programs for controlling the processes and quality of products or services
- It covers quality tools to be used in the organisation

1.5 Uses of Documenting Quality Plan

Documenting the quality plan(s) has multiple uses, such as:

- It assures conformance to customer requirements;
- It assuring conformance to external and internal standards and procedures;
- It facilitates traceability;
- It providing objective evidence;
- It furnishes a basis for training; and
- It provides a basis for evaluating the effectiveness and efficiency of the quality management system.

1.6 Quality Planning Tools

There are seven management and planning tools named as Affinity Diagram, Relations Diagrams, Tree Diagrams, Matrix Diagrams, Arrow Diagrams, Process Decision, Program Charts, and Matrix data analysis. These tools are useful in

structuring the unstructured ideas, making plans and organising as well as controlling projects.

1.7 Affinity Diagram

The term affinity diagram was devised by Jiro Kawakita in the 1960s and it is also called as the 'KJ Method'. It is designed to organise the unstructured ideas resulted from brainstorming. It is a group decision-making technique designed to sort a large number of ideas, process variables, concepts, and opinions into naturally related groups. These groups are connected by a simple concept. The affinity diagram organizes ideas. When the related ideas are grouped into the meaningful categories, it is called affinity sets. In the affinity diagram process, first of all each idea is recorded on cards or notes then look for ideas that seem to be related and in last, sort cards into groups until all cards have been used.

Affinity diagram is a tool/method that gathers large amounts of intertwined verbal data. It organizes the verbal data into groups based on natural relationship. Such formation of distinct groups helps a meaningful picture to emerge, thereby making it feasible for further analysis and to find a solution to the problem.

1.8 Procedure of Design Affinity Diagram

The following steps are needed to design Affinity Diagram:

Step 1: Select a topic. Describe the problem or issue

Step 2: Generate ideas by brainstorming and collect the data

Step 3: Write each idea on a separate card and put these on a wall or flip chart or spread the cards on the table. The purpose of this step is the visibility of all the cards at one go

Step 4: Move data cards into groups of similar themes. Sort data cards on the basis of similarity of ideas or connectivity of ideas

Step 5: Combine statements on data cards to create new affinity statement

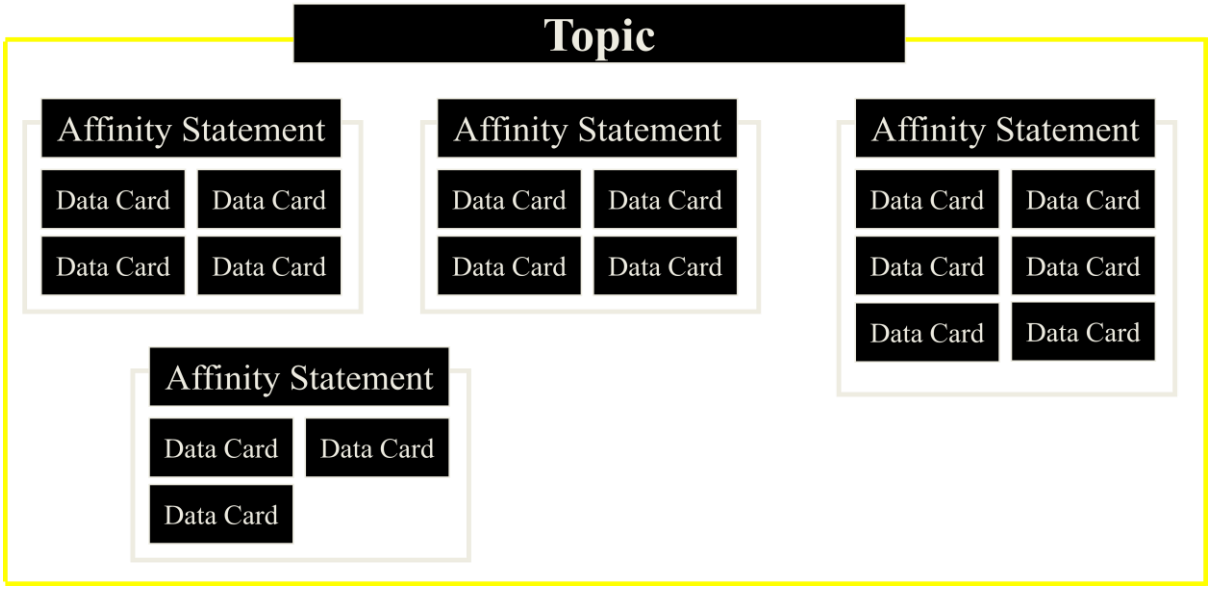

Figure 5.1: The Affinity Diagram

Step 6: Continue to combine until 4- 5 groups

Step 7: Once the cards have been sorted into groups the team may sort large clusters into subgroups for easier management and analysis

Step 8: Complete the diagram

1.9 Advantages of the Affinity Diagram

There are many advantages of the affinity diagram as follows:

- The tool is commonly used as quality planning tool.

- It facilitates breakthrough thinking and stimulates fresh ideas.
- It allows large numbers of ideas stemming from brainstorming which are to be sorted into groups.
- It permits the problem to be pinned down accurately
- It is beneficial when the team is confronted with many ideas, thoughts, fact and the situation is becoming a chaos.
- It ensures that everyone clearly recognizes the problem
- It incorporates opinions of entire group and helpful especially when the issues seem too large and complex.
- It encourages team spirit and helpful in promoting group consensus.
- It raises everyone's level of awareness
- It spurs to the group into action

1.10 Tree Diagram

Tree diagram is a diagram with a structure of branching, connecting lines, representing different processes and relationships. It is simply a way of representing a sequence of events. It is also called systematic diagram or analytical tree or hierarchy diagram. It starts with one item that branches into two or more, each of which branch into two or more, and so on. It expands a purpose into the tasks required to accomplish it. It is used to break down broad categories into finer and finer levels of detail. Developing the tree diagram helps you move your thinking step by step from generalities to specifics.

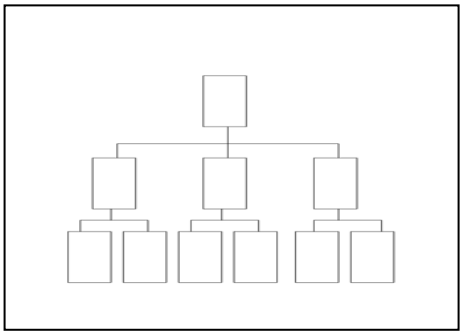

Figure 5.2: Basic Structure of Tree Diagram

1.11 Steps of Tree Diagram Formation

- It begins with the purpose to be accomplished
- It brainstorms all the probable numbers of goals are generated to accomplish the purpose
- It links each goal to the purpose (these are the first branches of the tree)
- It continues the process till all the goals are exhausted
- It reviews the completed tree

1.12 Arrow Diagram

Arrow diagram is a networking techniques which uses nodes to show events and the activities are shown with arrows. It is helpful in planning, scheduling and monitoring of the quality programmes. With the help of this tool ideal plan can be worked out and the progress can be monitored effectively.

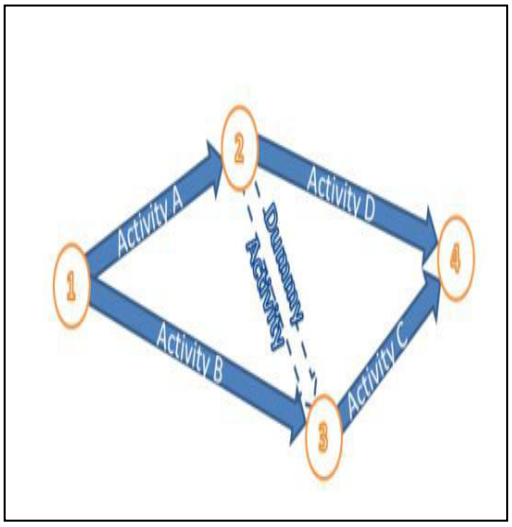

Figure 5.3 : Arrow Diagram

The events are represented by circular nodes and the length of the arrow represent the duration of the activity. All the activities have to be completed before reaching the final node.

1.13 Understanding Customers and their Needs

Mahatma Gandhi, the Father of Nation, had expressed his views about the customer. He had given an important place to customers in the business. He advocated that it is the business that is dependent on the customer. Further, he stated that:

> "A customer is the most important visitor in our premises.
>
> He is not dependent on us. We are dependent on him.
>
> He is not an interruption in our work. He is the purpose of it.
>
> He is not an outsider to our business. He is part of it.
>
> We are not doing him a favour by serving him.
>
> He is doing us a favour by giving us an opportunity to do so.
>
> A customer is not someone to argue with.
>
> Nobody ever won an argument with the customer.
>
> A customer is the person who brings us his wants.
>
> It is our job to handle profitably to him and to ourselves." (Mahatma Gandhi)

A customer is an individual or business that purchases the goods or services produced by a business. The proverb 'the customer is always right' is very famous in the business world. The terms 'customer' and 'consumer' are almost synonymous. Customer is the individual who purchases goods or services and the consumer is the individual who is

the end user. A customer is the end consumer of a product. This distinguishes true customers from resellers and vendors, who usually make purchases to sell later. Businesses take a keen interest in knowing who is purchasing their products and services and who is using/consuming their products and services. So, they conduct regular research activities for this purpose and tailor their marketing mix according to the customer base and their needs. Customers are often segmented according to their demographics, e.g., age, race, sex, marital status, religion, income level, geographic location, etc. The marketer is always interested in the customer's demographic profile. This information helps companies approach the segments with more offers where they are already strong and deepen ties with loyal customers and to approach new segments where sales are weak, thus creating a new base of customers for further expansion.

The satisfied customers are expected to continue buying goods and services again and again from companies that meet their needs. Feedback through questionnaire and interviews is the process through which many companies closely monitor the satisfaction level of the customers. The organisations develop good relationships with customers.

1.14 Definitions of Customer

In sales, commerce and economics, a customer (sometimes known as a client, buyer, or purchaser) is the recipient of a good or a service or a product or an idea - obtained from a seller, vendor, or supplier via a financial transaction or exchange for money or some other valuable consideration.

In general, a customer is a party that receives or consumes products (goods or services) and has the ability to choose between different products and suppliers. In quality control a customer is an entity within a firm who establishes the requirement of a process (accounting, for example) and receives the output of that process (a financial statement, for example) from one or more internal or external.

1.15 Customer Groups

Customers may fall into one of three customer groups:

- **Existing Customers**

It consists of customers who have purchased or otherwise used an organization's goods or services, typically within a designated period of time.

- **Former Customers**

This group consists of those who have formerly had relations with the marketing organization typically through a previous purchase.

- **Potential Customers**

The third category of customers includes those who have yet to purchase but possess what the marketer believes are the requirements to eventually become existing customers.

1.16 Customer Needs

The success of an organisation is dependent on its ability to create and deliver products and/or services according to the customer needs. Despite this fact, number of companies fails to do so. More specifically, the marketers fail to find the characteristics of the structured customer need statement should possess. The first and foremost step to become a customer-centric organization is to research and define customer needs accurately. Understanding customer need is must before developing solutions. It is the hallmark of the customer satisfaction. A need assessment is a systematic process for determining and addressing needs, or finding the gaps between current conditions and desired conditions. Research with structured interviews by trained interviewers and structured questionnaire with clear, relevant statements are helpful in determining the real customer needs.

1.17 Basic Requirements of the Customers

Some of the most common and basic requirements of the customers include:

- Customers always expect high levels of quality.
- Customers expect fast, efficient, accurate and timely service.
- Customers are price conscious. They expect high quality products/services at a competitive price.
- Customers expect zero deviation from expected performance of products or services.

- The customers always expect friendly, helpful service staff ready to provide timely information and ready to be served every time. They expect quick response of their queries.

- The customers don’t expect long queues, waits or hold for long time.

- The customers expect easy to surf website(s). They don’t like unnecessary advertisements or promos and unnecessary links.

1.18 Benefits of Meeting Expectations

When the organisations are able to accurately identify and adequately meet the customers' expectations, the customer service reputation and word-of-mouth will automatically be enhanced. Some of the benefits of meeting your customers' expectations include:

- Customers are transformed from first-time visitors to loyal clients.

- The sales are increased as customers feel more comfortable doing business with the organisation.

- More referrals from satisfied customers are generated who bring in additional business by word of mouth.

There is no doubt that adequately meeting customer expectations is an essential part of a robust customer service department. By accurately identifying those expectations, and meeting or exceeding them consistently, the company is likely to enjoy happier customers and a healthier bottom line.

1.19 Customer Orientation

Customer orientation is the prime issue in today's marketing practices. Consumer orientation is a key to achieve business goals. A firm can achieve marketing goals by concentrating on customer satisfaction. A customer orientation approach means that the company gives high importance to the customer and is a customer focused company. Such customer oriented companies design customer oriented marketing strategies. The key to having customer orientation is to add value as much as possible to the product and services. The customers are loyal to the companies which give them value.

Customer orientation is a business strategy that requires management and employees to focus on the changing wants and needs of its customers. In other words, the customer's wants and needs are the first priority of management as well as employees. It refers to a series of actions taken by the management to support the needs of their customers by engaging their employees in order to ensure customer satisfaction.

Customer orientation is a group of actions taken by a business to support its sales and service staff in considering client needs and satisfaction. Business strategies that tend to reflect a customer orientation might include: developing a quality product appreciate by consumers; responding promptly and respectfully to consumer complaints and queries; and dealing sensitively with community issues.

The consumer orientation is modern marketing philosophy and approach that guide the marketing managers to design their marketing mix in such a way that the firm can offer maximum possible satisfaction to target consumers. Every marketing effort and every decision is aimed at satisfying needs and wants of the target consumers. Generally,

most of the satisfied consumers buy large quantities of same products and services more frequently. They generate positive word-of-mouth and give valuable suggestions.

1.20 Steps by Companies to bring Customer Orientation

Customer orientation requires following steps to be taken by organisation:

- The organisation should conduct research and define the target market carefully.
- Find out customers' actual and genuine needs and wants after collecting relevant information.
- The development of the product has to be done keeping the end user in mind. It must be as per their expectations.
- To match the expectation of the customers, the production must be according to the demand. Long wait for products or services affect the satisfaction level of the customers. Always maintain equilibrium in demand and supply.
- The organisation must have fair deal with customers and ensure commitment toward them.
- Establish and maintain long-term relations with consumers. Good relationships with customers are helpful in getting feedback for further development. (Customer Relationship Management etc.)
- The customers always consider value for their money. If they get value for their money, they are satisfied. The delighted customers are those who receive products beyond their expectations.
- Provide them correct information as and when demanded.
- Safeguard their long-term interest/welfare.
- Treat them as business partners.

- Always be ready to get consumers' suggestions, feedbacks and resolve grievances.
- Find out the best way to greet them, and meet their expectations.

1.21 The American Customer Satisfaction Index (ACSI) Model

The American Customer Satisfaction Index (ACSI) model was developed at the Ross School of Business, University of Michigan's. In this model, various multivariable components are measured by several questions that are weighted within the model. Further, it uses customer interviews as input to a multi-equation econometric. The ACSI model is a cause-and-effect model with indices for drivers of satisfaction on the left side (customer expectations, perceived quality, and perceived value), satisfaction (ACSI) in the center, and outcomes of satisfaction on the right side (customer complaints and customer loyalty, including customer retention and price tolerance). The arrows in the model represent 'impacts.' The ACSI model is self-weighting to maximize the explanation of customer satisfaction (ACSI) on customer loyalty. Looking at the indexes and impacts, users can determine which drivers of satisfaction, if improved, would have the most effect on customer loyalty.

Figure 5.4 : ACSI Model

- **Customer Satisfaction (ACSI)**

The customer satisfaction (ACSI) index score is calculated as a weighted average of three survey questions that measure different facets of satisfaction with a product or service. ACSI researchers use proprietary software technology to estimate the weighting for each question.

- **Customer Expectations**

Customer expectations combine customers' experiences with a product or service and information about it via prior personal usage/ experience, media, advertising, salespersons, and word-of-mouth from other customers. Customer expectations influence the evaluation of quality and forecast (from customers' pre-purchase perspective) how well the product or service will perform. It is a measure of the customer's anticipation of the quality of a company's products or services.

- **Perceived Quality**

Perceived quality proves to have the greatest impact on customer satisfaction. It is a measure of the customer's perception about the quality and the recent consumption experience of the company's products or services. Perceived quality is measured through three constructs: (1) overall quality, (2) reliability, and (3) the extent to which a product or service meets the customer's needs.

- **Perceived Value**

Perceived value is a measure of quality relative to price paid. The perceived value directly influences customer satisfaction, and is affected by customer expectations and perceived quality.

- **Customer Complaints**

Customer complaints are measured as a percentage of respondents who indicate they have complained to a company directly about a product or service within a specified time frame. More complaints mean more dissatisfaction.

- **Customer Loyalty**

Customer loyalty is measured by likelihood to purchase a company's products or services at various price points. It is the customer's likelihood to repurchase from the same supplier in the future. Customer satisfaction has a clear effect on loyalty. Customer loyalty is the critical component of the model as it stands as a proxy for profitability.

1.22 The Kano Model – Customer's Need Analysis

The Kano model is useful in understanding a customer's needs. This model is helpful for the company as it analyzes customer needs and it easily determines what delights the customers. In other words, it is a useful technique for deciding which features the organisations should include in a product or service. Kano Model was developed by Dr Noriaki Kano and his colleagues in the 1980s in Tokyo Rika University. This is Kano's theory: For some customer requirements, customer satisfaction is proportional to the extent to which the product or service is fully functional. Dr. Noriaki Kano identified

three levels of customer expectations: that is, what it takes to positively impact customer satisfaction. The figure below portrays the three levels of need: Basic, Performance, and Excitement.

- **Basic Needs:** Satisfying of basic needs allows a company to get into the market.
- **Performance Needs:** Satisfying of performance needs allows a company to remain in the market.
- **Excitement Needs:** Satisfying of excitement needs allows a company to excel, to be world class.

According to this model, a product or service can have three types of attribute or property:

- **Threshold Attributes:** The customers expect threshold attributes to be present in the product.
- **Performance Attributes:** These are not absolutely necessary, but increase the customer's enjoyment of the product.
- **Excitement Attributes:** The customers are unknown about these attributes but are delighted when they find them.

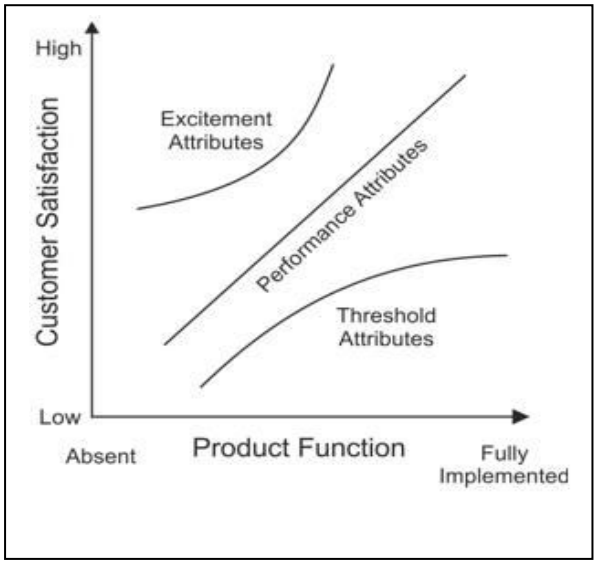

Figure 5.5: The Kano Model

1.23 Steps to use Kano Model

Kano Model is intended to help prioritize customer needs. This model states the philosophy that the company must realize customers' expectations and/or needs which vary over a period of time.

- Brainstorm all of the possible features and attributes of the product or service, and everything the organisation can do to please your customers.
- Classify these as three attributes 'Threshold', 'Performance', 'Excitement' and 'Not Relevant' attribute.
- Make sure your product or service has all appropriate Threshold Attributes. If necessary, cut out Performance Attributes so that you can get these – you're going nowhere fast if these aren't present.
- Where possible, cut out attributes that are "Not Relevant".
- Look at the Excitement Attributes, and think how you can build some of these into your product or service. Again if necessary, cut some Performance Attributes, so that you can "afford" your Excitement Attribute.
- Select appropriate Performance Attributes so that you can deliver a product or service at a price the customer is prepared to pay, while still maintaining a good profit margin.

1.24 Summary

Quality planning is the process for identifying quality standards and determining how to implement them. An effective quality planning defines quality policies, procedures, standards, criteria for and areas of application, and roles, responsibilities and authorities. It is to identify what standards are relevant and how the team will meet them. There are three steps involved in a quality management: Quality Planning, Quality Assurance and Quality Control. The quality planning is crafted during the strategic planning phase of the organisation and is important for the managers, team, employees, suppliers, etc. Quality planning is necessary to maintain the standard of quality for the processes. It is the establishment of procedures, standards, and tools for all the processes of the organisation. It ensures the consistent and timely delivery of products with reduced delivery risk. The organisations should follow some principles for the quality planning like Customer Satisfaction is the Prime Task, Quality Planning is the Responsibility of Management, Continuous Improvements in Quality, Prevention over Inspection.

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, process, project, or contract. It helps to set quality targets to meet the needs of the customers. There are seven management and planning tools named as Affinity Diagram, Relations Diagrams, Tree Diagrams, Matrix Diagrams, Arrow Diagrams, Process Decision, Program Charts, and Matrix data analysis. These tools are useful in structuring the unstructured ideas, making plans and organising as well as controlling projects.

The affinity diagram tool is designed to organise the unstructured ideas resulted from brainstorming. It is a group decision-making technique designed to sort a large number of ideas, process variables, concepts, and opinions into naturally related groups. These groups are connected by a simple concept. The affinity diagram organizes ideas. When the related ideas are grouped into the meaningful categories, it is called affinity sets.

Tree diagram is a diagram with a structure of branching, connecting lines, representing different processes and relationships. It is simply a way of representing a sequence of events. It is also called systematic diagram or analytical tree or hierarchy diagram. It starts with one item that branches into two or more, each of which branch into two or more, and so on.

Arrow diagram is a networking techniques which uses nodes to show events and the activities are shown with arrows. It is helpful in planning, scheduling and monitoring of the quality programmes. With the help of this tool ideal plan can be worked out and the progress can be monitored effectively.

A customer is an individual or business that purchases the goods or services produced by a business. The terms 'customer' and 'consumer' are almost synonymous. Customer is the individual who purchase goods or services and the consumer is the individual who is the end user. Customers are categorised in three groups: Existing Customers, Former Customers, Potential Customers.

A customer orientation approach means that the company gives high importance to the customer and is a customer focused company. Such customer oriented companies design customer oriented marketing strategies. The key to having customer orientation

is to add value as much as possible to the product and services. The customers are loyal to the companies which give them value. Customer orientation is a business strategy that requires management and employees to focus on the changing wants and needs of its customers. In other words, the customer's wants and needs are the first priority of management as well as employees. It refers to a series of actions taken by the management to support the needs of their customers by engaging their employees in order to ensure customer satisfaction.

The ACSI model is a cause-and-effect model with indices for drivers of satisfaction on the left side (customer expectations, perceived quality, and perceived value), satisfaction (ACSI) in the center, and outcomes of satisfaction on the right side (customer complaints and customer loyalty, including customer retention and price tolerance). The arrows in the model represent 'impacts.' The ACSI model is self-weighting to maximize the explanation of customer satisfaction (ACSI) on customer loyalty. Looking at the indexes and impacts, users can determine which drivers of satisfaction, if improved, would have the most effect on customer loyalty.

The Kano model is useful in understanding a customer's needs. This model is helpful for the company as it analyze customer needs and it easily determines what delights the customers. Or we can say that it is a useful technique for deciding which features the organisations should include in a product or service. The figure below portrays the three levels of need: Basic, Performance, and Excitement. According to this model, a product or service can have three types of attribute or property**:** Threshold Attributes, Performance Attributes, Excitement Attributes.

1.25 Keywords

Quality Planning: quality planning defines quality policies, procedures, standards, criteria for and areas of application, and roles, responsibilities and authorities.

Quality Control: It is a very important step in quality management. It is to check the inconsistency in the quality of products and services. It requires extensive, proper and consistent training of employees so that errors can be controlled. Inconsistency in products and services can be avoided by using statistically process control techniques.

Quality Plan

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

1.26 Self Assessment Questions

1. Define Quality Planning. Enumerate the principles for the Quality Planning.
2. What is Quality Plan? What are its Components?
3. Enumerate the uses of documenting Quality Plan.
4. Elaborate the famous seven Planning Tools.
5. What is Affinity Diagram? What is the procedure of design Affinity Diagram?
6. What are the aadvantages of the Affinity Diagram?
7. What is Tree Diagram? Enumerate the steps of Tree Diagram Formation.
8. What is Arrow Diagram? How it is helpful in planning?
9. What do you understanding by customers and their needs?
10. Give definition of a Customer and discuss various Customer Groups.

11. What is the importance of Customer Needs?

12. What are the basic requirements of the customers?

13. What are the benefits of meeting customer expectations?

14. Define Customer Orientation. Enumerate the steps of Customer Orientation.

15. Discuss the use of American Customer Satisfaction Index (ACSI) Model.

16. What is the importance of The Kano Model – Customer's Need Analysis?

17. Enumerate the steps to use Kano Model.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **6**	Vetter: **Dr. Sanjay Tiwari**
Quality of Purchased Materials: Determinations and Description	

Structure

1.0 Objectives

1.1 Quality of Purchased Material

1.2 Materials Management

1.3 Supply Chain Management

1.4 Purchasing

1.5 Organizational Purchase

1.6 Purchasing Process/Cycle

1.7 Materials Requirement Planning (MRP)

1.8 Just-in-time (JIT)

1.9 Quality Inspection of Incoming Materials and Parts

1.10 Importance of Receiving and Incoming Quality Inspection

1.11 Materials Handling

1.12 Objectives of Material Handling

1.13 Value Analysis

1.14 Supplier Evaluation and Supplier Selection Process

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic concept and various factors of quality of purchased materials.
- Know the importance of materials management, SCM, MRP, JIT in the quality of purchased materials.
- Understand the role of supplier evaluation and selection process
- Know the vendor rating and warehouse managment.

1.1 Quality of Purchased Material

The quality of purchased materials and parts is helpful in the improvement of productivity with fewer defects and waste. Hence, it strengthens the competitive position of the organisation. It generates the adaptability to changing or emerging market conditions and to environmental and other government regulations. The quality

production is the result of the quality raw materials and parts. The output of this exercise is the improvement in the market image and market share. The quality of purchase materials and parts leads the reduction in the overall production cost due to less wastes and defects. Thus, it helps in better cost management. More customers are satisfied due to good quality and the customer loyalty is increased. All the shareholder and stakeholder are happy with the improved value and innovative processes. The quality of purchased materials is determined by many factors like Materials Management, Purchasing Management, Purchasing Process, Materials Requirement Planning (MRP), Just-in-time (JIT), Quality Inspection, Material Handling, Value Analysis, Supplier Evaluation and Selection Process, Vendor Rating, Warehouse Management, etc.

1.2 Materials Management

Materials management consists of many activities which determine the quality of materials and parts purchased. Material management is defined as the planning, acquiring, storing, moving and controlling of materials as per the requirement of the organisation. It is basically related with the smooth flow of materials. It includes planning, organising, communicating, directing and controlling of all those activities mainly concerned with the flow of materials into an organisation. Material management views material flows as a system. The major activities covered under materials management are the anticipation of the materials required in the organisation from time-to-time. It involves ordering and obtaining materials from the suppliers, introducing the materials to the organisation and monitoring the status of materials. It helps to optimize the usage of facilities, personnel and funds and to provide service to the user in the line

with the organizational aims. Materials management is the coordination and control of the various material activities. The key material activities are:

- **Purchasing Activities**

  It involves mainly identification of materials needs, market research, maintaining materials records etc.

- **Procurement Activities**

  It involves material specifications, materials studies, receiving materials etc.

- **Inventory Management**

  It involves planning and controlling of materials handling, storing materials and managing material supplies etc.

- **Supply Management**

It involves monitoring in-plant material handling, strategic planning of materials etc.

1.3 Supply Chain Management

Supply chain management consists of many activities which determine the quality of materials and parts purchased. Supply chain management (SCM) is the flow of materials, information, products and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. Supply chain management involves coordinating and integrating these flows both within and among companies. The key activities involved in supply chain management are purchasing, logistics, warehousing and information handling. In fact, the purchasing is the key and integral part of the supply chain management.

1.4 Purchasing

The smooth functioning of the production department depends upon a large extent on the right type of materials purchased at right time, at right cost and at right quality. The right quality of materials purchased leads to good saving. It is possible through efficient buying. For the quality materials buying, the purchase manager must be technically skilled, innovative, intelligent, vigilant and efficient in bargaining.

Quality purchasing describes the effective process of buying. It is the learning of the right requirement, identifying & selecting a right supplier, and settlement of price through negotiation. Quality purchasing is an element of the wider function of procurement and it includes many activities such as ordering, expediting, receipt and payment. Quality purchasing is responsible for obtaining the right materials, parts, supplies and services needed to produce of right product or service.

1.5 Organizational Purchase

A purchase will be considered to be organizational if it is made in the name of a company or organization, regardless of size, from a medium sized company up to a multinational or state company. Organization consists of business, industries, retailers, wholesaler, government and non- government organizations.

- Business and industries purchase materials for business use or as a raw material to produce other product.
- Wholesalers/Retailers/traders buy product for resell at profit.
- Government organisations purchase products for use in offices or provide services to people.
- Non-government organizations purchase products to provide services to their client.

1.6 Purchasing Process/Cycle

Purchasing process/cycle consists of many activities which determine the quality of materials and parts purchased. The purchasing process begins with a genuine request generated from within the organization to purchase materials, parts, equipments, supplies, or other items from outside the organization with the right description. The important step in the quality purchasing is the right selection of the supplier. Then, the order is placed after the bargaining of terms, conditions and price and the order is monitored & followed. The purchase department is notified about the satisfactory arrival of shipment and the process ends with the approval of the payment to the supplier. The main steps in the purchasing cycle are as under:

- Right recognition and right description of need
- Right selection of suppliers
- Determination of prices through bargaining
- Preparation and placing the order with a right supplier
- Monitoring and follow up the order
- Receiving the ordered materials in the stipulated time period
- Checking and approving for payment to supplier

In the whole purchasing process, the quality is an important part and the checking quality matters as the raw materials and parts enter the factory. Before any part or raw material is used in the manufacturing process, it is the responsibility of the purchasing department to ensure that the materials and parts that arrive are of right quality specification. Right recognition and right description of need is possible through Materials Requirement Planning (MRP).

1.7 Materials Requirement Planning (MRP)

Materials requirement planning consists of many activities which determine the quality of materials and parts purchased. It is a computerized inventory control system. It helps in knowing the need of raw materials and helps to calculate the demand for a particular item. It takes into account the lead time required to order automatically with the help of software. It helps in tracking the records of the raw materials especially when the materials like raw materials or components parts are required. Basically MRP is an information system which generates automatic results in the area of systematic planning of materials requirement. It uses three important input data: bill of materials data, inventory data, and master production schedule to calculate the demand for particular items like raw materials or components parts. Many upgraded versions are made available till now. The benefits of MRP are remarkable as it generates work orders and purchase orders automatically. Now in these days MRP-II is available, which is known as Manufacturing Resource Planning.

1.8 Just-in-time (JIT)

Just-in-time consists of many activities which determine the quality of materials and parts purchased. It is a philosophy which means purchasing only what is needed, when it is needed, not early, not late; not less, not more. The key target is achieving high volume production using minimal inventories. JIT purchasing involves fewer suppliers dependency and developing long-term relationships with the suppliers. According to this philosophy, anything which is not generating value is called waste. JIT advocates minimising all types of wastes. The success of JIT philosophy lies in the commitment of the employees. This philosophy covers the whole organisation under one umbrella.

All the departments have to work with coordination and follow the guidelines with full spirit. The top executives have to be the leaders involved in JIT and they must be the guiding light for all the employees. Getting everyone involved and committed is the first step to successful implementation of JIT and the first step to an increase in continuous improvement. Applications of JIT are as follows:

- **Inventory Reduction as a Tool for Improvement**

  Inventory reduction is directly related with cost. Costs are reduced greatly if inventory is reduced.

- **Waste Reduction**

  If any activity that increases cost but does not add value to any process in an organisation is called waste. Eliminate waste of labor, material or equipment. JIT advocates zero waste in organisation.

- **Supplier Relationships**

  There must be good relationship with suppliers. Its helps in getting raw material supply exactly when required.

- **Minimum batch sizes**

  The batch sizes must be kept as small as possible. The defects can be observed easily in small batches.

- **Minimum Movements**

  The movements must be kept low in production plants. The computerized equipments are very much helpful in minimising the movements in the plants.

- **Total Quality Assurance**

  The production department must control all the processes time to time to control the variation in the production output in terms of quality. Proper training is very much in the total quality assurance.

- **Preventive Maintenance**

  The inspection after the accident is useless. Preventive maintenance is needed to reduce variation in the process. This requires a regular and complete examination of all the processes on a regular basis.

1.9 Quality Inspection of Incoming Materials and Parts

Quality inspection consists of many activities which determine the quality of materials and parts purchased. It aims at regular checking, measuring and testing of the following: (i) incoming materials and parts; (ii) one or more processes; and (iii) finished goods. Quality inspection of incoming materials and parts is also called receiving inspection. It is checking, measuring and testing of incoming materials and parts that are supplied before they are taken to store or inventory. Incoming inspection can be conducted either at supplier's end or at manufacturer's gate. If the incoming materials are bulky or large in quantity and involve huge transportation cost, it is economical to inspect them at the place of vendor or supplier.

1.10 Importance of Receiving and Incoming Quality Inspection

Quality Inspection consists of checking, measuring and testing of all the purchased raw materials and parts received from the suppliers. It is must before the materials and parts are taken into stock. Receiving Inspection is the most important aspect because the

purchased raw materials and parts are to be used in the manufacturing. The sub-standard raw materials and spare parts generate sub-standard products which is unacceptable at any stage by any stakeholder.

Receiving and incoming of materials and parts is a routine work, hence, it is considered as clerical task and understated by some companies. Sometimes this job is considered very light in terms of receiving, incoming and generating documents. It is a very serious mistake. If the poor quality, pilferage, shortage or damaged quantity is overlooked at the receiving stage and the problem(s) is discovered at later stage, it will prove to be a disaster. It will not only increase the cost of the product, but also waste the precious time of the employees. The problem(s) must be considered at the receiving to run the production smoothly.

1.11 Materials Handling

Materials handling consists of many activities which determine the quality of materials and parts purchased. It is the movement, protection, storage and control of raw materials, parts and products in the plant. Wide ranges of manual, semi-automated and automated equipments are incorporated in it. Material handling means providing the right amount of the right raw materials/parts/products, in the right condition, at the right place, in right sequence, at the right time, in the right position, and for the right cost, by using the right method. It is simply picking up, moving, and lying down of raw materials/parts/products in the organisation at various places. It applies to the movement of raw materials, parts in process, finished goods, packing materials, and disposal of scraps. In general, hundreds and thousands tons of materials are handled daily requiring the use of large amount of manpower along with manual, semi-automated and automated equipment. The materials move within the confines of a

building, between building and a transport vehicle, from one place to another place, one plant to another plant, from one processing area to another or from one department to another department of the plant. The cost of material handling is very important as it contributes significantly to the total cost of manufacturing. In some industries, the ratio of handling cost to processing cost is very high. In such industries, material handling is a very important function. If our material handling system is properly designed, integrated and automated then it provides remarkable cost saving opportunities. It is also helpful in providing magnificent and great customer services.

1.12 Objectives of Material Handling

The primary objective of a properly designed, integrated and automated material handling system is to reduce the cost of production. The other objectives are:

- The material handling is helpful to lower unit materials handling cost.
- It provides better control of the flow of materials in the organisation.
- It reduces the manufacturing cycle time.
- It reduces delays and damage of raw materials/parts/semi-finished or finished goods.
- It increases storage capacity.
- It promotes safety and improves working conditions in the organisation.
- It is helpful to maintain or improve product quality.
- It provides contribution for better quality by avoiding damages to products.
- It provides higher productivity at lower manufacturing costs.

1.13 Value Analysis

Value analysis consists of many activities which determine the quality of materials and parts purchased. It is an organized creative approach aimed at identifying unnecessary costs and eliminating the same from the product without affecting the quality of the product. While eliminating the unnecessary costs of the product, due care must be given that there is not loss of functional utility/guarantee/safety performance. There is no compromise regarding the functional utility or safety performance of the product. The concept of value analysis or value engineering works before the actual production starts. This process involves the right substitution of materials/parts/components of the product to be manufactured at the lowest cost. It is an approach of providing the required function of the product at the desired time and place at the lowest cost. This approach is a perfect blend of right quality, right design specification, right standards, right methods of manufacture, etc. and involves the substitution of materials/parts/components at a lesser price or better quality. The application of the value analysis/value engineering ideas during design and engineering stage of the product before its actual production is known as Value Engineering.

1.14 Supplier Evaluation and Supplier Selection Process

Supplier evaluation and supplier selection process consists of many activities which determine the quality of materials and parts purchased. It is very important factor in the determination of quality of materials to be purchased. This process covers evaluating and analysing the suppliers' performance and seeks suppliers who support or meet buyers' strategic goals while continually looking for ways to manage cost, quality and other evaluation parameters. The supplier evolution and selection process consists of steps like indentifying the need of the supplier evaluation, identifying criteria for

supplier evaluation, determine sourcing strategy, determine method of supplier evaluation and selection and select supplier and reach agreement.

- **Identifying the Need of Supplier Evaluation**

At this stage, the buyer organisations identify a need to evaluate and select a supplier. The supplier evaluation may be requested by purchase officers, production manager, quality manager or design managers.

- **Identifying Criteria for Supplier Evaluation**

At this stage the criteria for supplier evaluation is fixed. It can be on-time delivery/delivery commitments, quality of raw materials/parts, technical performance, production capabilities, design verification, evaluation of product samples, innovation and management expertise, meeting specific requirements/standards, suppliers' financial viability, customer service, reliability and responsiveness, records of past achievement etc. These are the parameters on which the evaluation of the supplier(s) is decided.

- **Determine Sourcing Strategy**

The sourcing will differ from requirement to requirement of the buyer organisations. It can be like dependency on single supplier or multiple suppliers, short-term or long-term contracts and domestic suppliers or foreign supplier. According to sourcing strategy, the supplier(s) are identified. Various internal as well as external sources of information are used to identify the supplier(s). The buyer organisation may get a long list of suppliers. The list must be narrowed down on the basis of some criteria like financial risk analysis evaluation of previous performance of the suppliers, evaluation of information provided by suppliers etc.

- **Determine Method of Supplier Evaluation and Selection**

After reducing the number of suppliers, the method is to be determined regarding suppliers' evaluation and selection. The evaluation process often includes use of questionnaire tools, interviews and supplier's site visit. The possible areas to evaluate during a supplier visit are workforce capability, production capability, quality parameters, supplier agility and flexibility, supplier's supply chain management capabilities, production scheduling and control systems, statistical quality control methods etc.

- **Select Supplier and Reach Agreement**

In the last stage, the supplier(s) is finalised and negotiated for certain stipulated terms and conditions.

1.15 Vendor Rating

Vendor rating consists of many activities which determine the quality of materials and parts purchased. A vendor is any person or company that supplies raw materials/parts, goods or services to the buyer organisations. The effectiveness of the purchasing department is judged by the quality and reliability of its suppliers. Good suppliers need to be cultivated to meet current and future demand of the buyer organisations. The buyer organisations want to work with the suppliers that give them value. Therefore, the suppliers' performance matters a lot. Vendors or suppliers are rated on the basis of their performance, consistency in delivery, lead time, quality products and services, price or some combination of these variables. Rating evaluation is done on a periodic basis and it may take the form of a hierarchical ranking from poor to excellent.

1.16 Objectives of Vendor Rating

Assessment of vendor's performance on certain criteria is called vendor rating. Vendor rating is the result of a formal vendor evaluation system.

The key objectives of vendor rating are as under:

- **Selection of Right Suppliers**

  It helps the buyer organisations in the selection of right suppliers.

- **Rating Assessment of Suppliers**

  It rates the entire performance of the suppliers and gives a clear-cut vision about the quality, cost, reliability of the products and services to be provided by the suppliers.

- **Negotiation with Suppliers**

  It provides buyer organisations with the information helpful in subsequent negotiation with suppliers.

- **Proper Feedback**

  It gives a feedback to suppliers to further improve their performances.

- **Useful Information**

  It provides the buyer organisations with the important information which is helpful in the development of the suppliers.

- **Reward**

  It recognizes and rewards outstanding suppliers.

- **Standardised Practices**

  It generates suppliers' standard practices.

1.17 Warehouse Management

Warehouse management consists of many activities which determine the quality of materials and parts purchased. The organisations need a variety of items, raw materials and parts of different uses for different purposes at different time. Some items/materials/ parts are required instantly and some are required after some time. Some are required throughout the year without any break. Some are required in high amount in a particular season. So, storage is very important concern. Storage involves proper arrangement for preserving items/materials/parts from the time of their production or purchase till the actual use. The role of storage is very important in smooth production. When the storage is done on a large scale and in a specified manner it is called 'warehousing'. The place where goods are kept is called 'warehouse'. It is a planned space for the storage and handling of goods and material. Warehouses provide a very essential function in the operations of many organisations. The warehouses are for storage, distribution, consolidation and transition of different types of cargos.

Warehousing refers to the activities involving storage of raw materials/parts and finished goods on a large-scale in a systematic and orderly manner and making them available conveniently when needed. Warehousing is one of the important auxiliaries to trade. It creates time utility by bridging the gap between requirements of materials/parts and production.

1.18 Summary

The quality of purchased materials is determined by many factors like Materials Management, Purchasing Management, Purchasing Process, Materials Requirement Planning (MRP), Just-in-time (JIT), Quality Inspection, Material Handling, Value Analysis, Supplier Evaluation and Selection Process, Vendor Rating, Warehouse Management, etc.

Materials management is defined as the planning, acquiring, storing, moving and controlling of materials as per the requirement of the organisation. The key material activities are: Purchasing Activities, Procurement Activities, Inventory Management, and Supply Management.

Supply chain management (SCM) is the flow of materials, information, products and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer. In fact, the purchasing is the key and integral part of the supply chain management.

Quality purchasing describes the effective process of buying. It is the learning of the right requirement, identifying & selecting a right supplier, and settlement of price through negotiation. Quality purchasing is an element of the wider function of procurement and it includes many activities such as ordering, expediting, receipt and payment. Quality purchasing is responsible for obtaining the right materials, parts, supplies and services needed to produce of right product or service.

Purchasing process/cycle consists of many activities which determine the quality of materials and parts purchased. The purchasing process begins with a genuine request generated from within the organization to purchase materials, parts, equipment, supplies, or other items from outside the organization with the right description. Next, the important step in the quality purchasing is the right selection of the supplier. Then, the order is placed after the bargaining of terms, conditions and price and the order is monitored & followed. The purchase department is notified about the satisfactory arrival of shipment and the process ends with the approval of the payment to the supplier.

Materials requirement planning is a computerized inventory control system. It helps in knowing the need of raw materials and helps to calculate the demand for a particular item. It takes into account the lead time required to order automatically with the help of software. It helps in tracking the records of the raw materials especially when the materials like raw materials or components parts are required.

Just-in-time is a philosophy which means purchasing only what is needed, when it is needed, not early, not late; not less, not more. JIT purchasing involves fewer suppliers dependency and developing long-term relationships with the suppliers. According to this philosophy, anything which is not generating value is called waste. JIT advocates minimising all types of wastes. The success of JIT philosophy lies in the commitment of the employees. Applications of JIT are as follows: Inventory Reduction as a Tool for Improvement, Waste Reduction, Supplier Relationships, Minimum batch sizes, Minimum Movements, Total Quality Assurance, and Preventive Maintenance.

Quality inspection consists of checking, measuring and testing of all the purchased raw materials and parts received from the suppliers. It is must before the materials and parts are taken into stock. It aims at regular checking, measuring and testing of the incoming materials and parts. Quality inspection of incoming materials and parts is also called receiving inspection. It is checking, measuring and testing of incoming materials and parts that are supplied before they are taken to store or inventory. Incoming inspection can be conducted either at supplier's end or at manufacturer's gate. If the incoming materials are bulky or large in quantity and involve huge transportation cost, it is economical to inspect them at the place of vendor or supplier.

Materials handling is the movement, protection, storage and control of raw materials, parts and products in the plant. Wide ranges of manual, semi-automated and

automated equipment are incorporated in it. Material handling means providing the right amount of the right raw materials/parts/products, in the right condition, at the right place, in right sequence, at the right time, in the right position, and for the right cost, by using the right method. It is simply picking up, moving, and lying down of raw materials/parts/products in the organisation at various places. The primary objective of a properly designed, integrated and automated material handling system is to reduce the cost of production.

Value analysis is an organized creative approach aimed at identifying unnecessary costs and eliminating the same from the product without affecting the quality of the product. While eliminating the unnecessary costs of the product, due care must be given that there is not loss of functional utility/guarantee/safety performance. There is no compromise regarding the functional utility or safety performance of the product. The concept of value analysis or value engineering works before the actual production starts. This process involves the right substitution of materials/parts/components of the product to be manufactured at the lowest cost.

Supplier evaluation and supplier selection process is very important factor in the determination of quality of materials to be purchased. This process covers evaluating and analysing the suppliers' performance and seeks suppliers who support or meet buyers' strategic goals while continually looking for ways to manage cost, quality and other evaluation parameters. The supplier evolution and selection process consists of steps like indentifying the need of the supplier evaluation, identifying criteria for supplier evaluation, determine sourcing strategy, determine method of supplier evaluation and selection and select supplier and reach agreement.

Vendor rating consists of many activities which determine the quality of materials and parts purchased. A vendor is any person or company that supplies raw materials/parts, goods or services to the buyer organisations. The effectiveness of the purchasing department is judged by the quality and reliability of its suppliers. Good suppliers need to be cultivated to meet current and future demand of the buyer organisations. Vendors or suppliers are rated on the basis of their performance, consistency in delivery, lead time, quality products and services, price or some combination of these variables. Rating evaluation is done on a periodic basis and it may take the form of a hierarchical ranking from poor to excellent. The key objectives of vendor rating are as following: Selection of Right Suppliers, Rating Assessment of Suppliers, Negotiation with Suppliers, Proper Feedback, Useful Information, Reward, and Standardised Practices.

Warehouse management consists of many activities which determine the quality of materials and parts purchased. Storage involves proper arrangement for preserving items/materials/parts from the time of their production or purchase till the actual use. The role of storage is very important in smooth production. It is a planned space for the storage and handling of goods and material. Warehousing refers to the activities involving storage of raw materials/parts and finished goods on a large-scale in a systematic and orderly manner and making them available conveniently when needed.

1.19 Keywords

Materials Management

Materials management is defined as the planning, acquiring, storing, moving and controlling of materials as per the requirement of the organisation.

Supply Chain Management (SCM)

Supply chain management is the flow of materials, information, products and finances as they move in a process from supplier to manufacturer to wholesaler to retailer to consumer.

Warehousing and Warehouse

When the storage is done on a large scale and in a specified manner it is called 'warehousing'. The place where goods are kept is called 'warehouse'.

Vendor

A vendor is any person or company that supplies raw materials/parts, goods or services to the buyer organisations.

Quality Inspection

Quality inspection is the checking, measuring and testing of incoming materials and parts that are supplied before they are taken to store or inventory.

Just-in-time

Just-in-time is a philosophy which means purchasing only what is needed, when it is needed, not early, not late; not less, not more.

1.20 Self Assessment Questions

1. Define the concept of quality of purchased material.
2. Enumerate the factors determining the quality of purchased materials.
3. Define materials management. How it is useful in quality control?
4. Define supply chain management. Explain its scope.
5. What is purchasing? How it affects the quality control?

6. “The smooth functioning of the production department depends upon a large extent on the right type of materials purchased at right time, at right cost and at right quality.” Discuss the statement.
7. What is an organizational purchase?
8. Illustrate the stages of purchasing process/cycle.
9. Define the concept of Materials Requirement Planning (MRP).
10. What is the role of Just-in-time (JIT) philosophy in quality of purchased materials? Discuss.
11. How to conduct quality inspection of incoming materials and parts?
12. Enumerate the importance of receiving and incoming quality inspection.
13. Discuss the concept of materials handling and its applicability in quality control.
14. Enumerate the objectives of material handling.
15. Discuss how the value analysis is helpful in quality of purchased materials?
16. Define supplier evaluation and supplier selection process.
17. What is vendor rating? What are the objectives of vendor rating?
18. How warehouse management is helpful in quality management?

1.21 References / Suggested Readings

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **7**	Vetter: **Dr. Sanjay Tiwari**
Quality of Manufacturing Process	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic concept of process, manufacturing process and quality of manufacturing process.
- Know the importance of process improvement methodologies.
- Understand the process of statistical process control.
- Know the benefits of modernisation and quality control of production process.

1.1 Process: An Introduction

A process is a sequence of activities that is required to achieve the desired results. A typical process requires inputs and unique combination of elements, conditions, and environment to produce a given set of results. Process can be product design, manufacturing, supply chain management, materials handling, supplier, customer care support etc. The quality management gurus namely Dr. W. E. Deming and Dr. Joseph Juran have emphasised that maximum of the problems are process driven and a few are caused by workers themselves. Process management involves planning and administering the activities necessary to achieve standard performance in the process.

1.2 Manufacturing Process: An Introduction

Manufacturing is the production of goods or services using valuable resources like manpower/labour, materials, money, machine tools, chemical and biological processing, or formulation for the purpose of sale or use. It is the creation and assembly of components and finished products or services. Manufacturing processes are the steps through which raw materials are transformed into final product/services. It begins with the planning phase of the production process. Next phase is the development of the product or service design and the requirement of the materials for the same. These materials are then modified through manufacturing processes to become the required part. The transformation process can include treating such as heating, melting, coating, machining, spraying or reshaping the materials. The manufacturing process also includes inspection, tests and checks for quality assurance during or after the manufacturing.

Manufacturing process includes the mechanical or chemical steps used to create an object, usually repeated to create multiple units of the same item. Generally involves the use of raw materials, machinery and manpower to create a product.

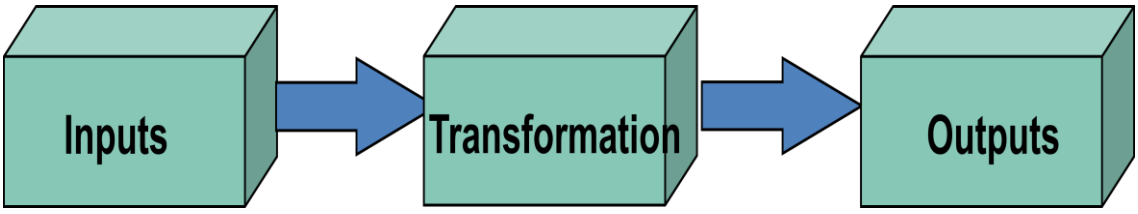

Figure 1.1: Production Process

Simply, we can say that manufacturing is the process of transforming the raw materials into finished goods and services with the help of wide range of human activities,

energy, time and with the use of technology. Such finished goods or services may be used by the customers or may be used for manufacturing of other goods and services. The goods or services may be sold through wholesalers and retailers. The products or goods can be simple or can be highly technical products. The complex products are aircraft, x-ray machines, automobiles etc. The simple products can be household appliances or the products of day-to-day use. In a free market economy, manufacturing is usually directed toward the mass production of products or services for sale to consumers at a profit.

The production of process goods usually requires the raw materials to go under the thermal or chemical process, such as heat, boiling, time, pressure etc. The product typically cannot be disassembled to its constituent parts. It is very difficult to break down the products into its ingredients. For example, it is very difficult to convert soap, detergents back into its ingredients. The term contrasts with discrete manufacturing refers to such products or services which involves products or services that can be counted and labelled on an individual basis. For example, the industries like automobiles, equipment, appliances, apparel, toys and electronics items such as LED, processor, hard disk, washing machine etc.

1.3 Improving Quality of Manufacturing Process

The organisations can improve the manufacturing process in the following manner:

- The first step is to understand the existing production process
- Improve design of products with the features that meet customers' needs

- Introducing production process changes to achieve organisational objectives which are usually focused on quality improvement, cost reduction and schedule acceleration
- Try to reduce manufacturing defects (defect reduction) and cycle time
- Try to eliminate the over-inventory or under-inventory problem, materials handling and transportation problems
- Eliminating scrap, rework problems and focusing on consistent improvements

1.4 Process Improvement Methodologies

Process improvement methodologies are used to identify, analyze and improve existing processes within an organization to meet new goals and objectives. There are various tools and techniques like Kaizen, Benchmarking, 5S approach, DRIVE approach, Inspection, Statistical Quality Control etc.

1.5 Kaizen: A Continuous Improvement Tool

Kaizen is a Japanese word and the meaning is continuous improvement. It's made up of two words in Japanese: *kai*, which means 'change,' and 'zen,' which means 'good.' 'Kaizen' word was used by Masaaki Imai in his book entitled 'The Key to Japan's Competitive Success' first time in 1986. Kaizen is the practice of continuous improvement. It is considered a slow but it is an ongoing process of improvement. It illustrates an organisational culture where everyone from the top to the bottom is involved in the regular evaluation of his or her work and sense the ways to improve it. The concept is that small improvements on a regular basis will head towards the large

improvements over time. One of the most notable features of kaizen is that big results come from many small changes accumulated with the passage of time. However, this has been misunderstood to mean that kaizen equals small changes. Today Kaizen is acknowledged worldwide as an important part of an organization's long-term competitive strategy. Kaizen means involvement for improvements. It is continuous improvement that is based on certain guiding principles like no process is thought to be perfect and it should be improved continuously. Everything can and should be improved. Further, Kaizen is teamwork and it is everybody's business. It is possible with the change in the mindset of employees.

1.6 Benchmarking

Benchmarking is the process of comparing one's business processes and performance to industry bests or with the best-in-class company. In it products, services, and processes are measured against those of organizations known to be leaders in one or more aspects of their operations. The management identifies and select the best organisation only where similar processes exist and compare processes. It helps the organisation to discover its strengths and weaknesses as well as those of industry leaders. The typical benchmarking methodology includes the following steps:

- Step I: To understand the company's current process performance gaps
- Step II: To identify the industry that has similar processes
- Step III: To identify the organizations that are leaders in the industry
- Step IV: To survey companies for measures and practices

- Step V: To identify the gap between the company's processes & practices and leader company

- Step VI: is to implement new and improved business practices

Benchmarking practices are classified into two categories:

Technical Benchmarking

It is the comparison of organisation's products or services with the leader organisation by experts or products/services design staff.

Competitive Benchmarking

It is the comparison of the organisation's important attributes, functions, or values with the leader organization.

1.7 5 S Approach

5 S is a simple methodology to create an orderly environment. It is creating a clean, safe, hygienic, sterile, unpolluted, sterile and orderly high performance work environment. This type of environment helps to increase performance efficiency and productivity. 5S includes sort, set in order, shine, standardise and sustain.

- **Sort**

  It is very simple but important concept. It means sort out or classify the needed items from unneeded and eliminate the latter. It will straightforward and simplify the system. As for example, eliminate the unnecessary data, files, furniture,

materials etc. from the shop floor. It will create more noticeable and visible shop floor.

- **Set In Order/Straighten**

  It is the concept of right place for right thing. It is the recognition of specific spot for every materials and parts and to put in order the same. It is to keep needed items in the correct place to allow for easy and immediate use. This exercise helps the employees to eliminate time wasted in locating items.

- **Shine**

  Keep the workplace and shop floor neat and clean. A dirt-free, spotless, sterile and organized environment can boost employee morale and create a sense of ownership and belonging. It helps to lower down the accidents at the shop floor.

- **Standardize**

  Standardise means some set rules and regulations. It enhances the organizational performance and will eliminate the variability. It encourages consistency in the production process.

- **Sustain**

  It is the maintaining of the standards and procedures. The final S involves the effective, ongoing application of 5S in order to improve organizational performance.

1.8 Quality Control through Statistical Techniques

Quality control is concerned with the uniform quality of the production. It is a process that measures output relative to standard, and acts when the variation is noticed. The purpose of quality control is to assure that processes are performing as per the stated

standards. The quality of the manufacturing process is controlled by the monitoring process and using statistical techniques like Inspection and Statistical Process Control.

Inspection

Inspection is an appraisal activity that compares goods or services to a standard. Quality inspection aims at regular checking, measuring and testing of the following: (i) incoming materials and parts (before production); (ii) one or more processes (during production); and (iii) finished goods (after production). Quality inspection is very much helpful in improving the quality, minimising the manufacturing cost and eliminating the scrap losses. It is the most common method used to attain the standardisation and conformance to quality.

1.9 Stages of Quality Inspection

There are three stages of Quality Inspection:

i) Inspection of incoming materials and parts;

ii) Inspection of production process/processes; and

iii) Inspection of the finished goods.

i) Inspection of incoming materials and parts:

It is also called receiving inspection. It is checking, measuring and testing of incoming materials and parts that are supplied before they are taken to store or inventory. Incoming inspection can be conducted either at supplier's end or at manufacturer's gate. If the incoming materials are bulky or large in quantity and involve huge transportation cost, it is economical to inspect them at the place of vendor or supplier.

ii) Inspection of production process/processes:

This work of inspection is done while the production process is in progress. Inspection at production house is very important to maintain the quality of products. Inspection at this point is very helpful in preventing wastage of resources like materials, parts, time and money. It prevents defective goods and minimizes the wastage.

iii) Inspection of the finished goods:

This is the last stage when finished goods are inspected before delivery to the customers. At this point, the poor quality products are rejected or sent back for further improvement.

1.10 Methods of Inspection

The decision of acceptance or rejection of depends upon the methods of inspection. There are two methods of inspection. These are (i) 100% inspection/Census method; and (ii) Sampling inspection methods.

(i) 100% Inspection/Census Method

Census means that the data are to be obtained from each and every unit of the population. This type involves careful inspection of quality in detail as every piece is separately inspected. The effort, money and time are required to carry out complete inspection. Even more number of inspectors is required and hence it is a costly method. There is no chance of sampling error as each item has gone through the process of inspection. However, inspection errors arising out of fatigue, negligence, difficulty of supervision etc. cannot be neglected in this case. It is suitable only when a small

number of pieces require inspection or a very high degree of quality is required. This method is suitable for the organisations dealing in the business of jet engines, aircraft, medical and scientific equipment etc.

(ii) Sampling Inspection

Sampling is the process of learning about the population on the basis of a sample drawn from it. In sampling inspection, money and time is saved. Here, less number of inspectors is required in comparison to census method. In this method randomly selected samples are inspected instead of every receiving raw materials and parts. Samples taken from different batches of products are representatives and the conclusions are drawn on that basis for the entire receiving. If the sample proves defective, the entire concerned is to be rejected. Sampling inspection is cheaper and quicker. In this process, how you draw the sample matters a lot. This method is very suitable and frequently used in the organisations making CFL tubes, fans, A.C., music systems, washing machine etc.

1.11 Statistical Process Control (SPC)

Statistical Process Control is a statistical tool for reducing the variability in processes which are the cause of most quality problems. In it, the output of the process is evaluated to determine if it is statistically acceptable or not. It is helpful in monitoring and controlling a process to ensure it is optimized. Its most common application is quality control in manufacturing. SPC is based upon the Central Limit Theorem which tells us, in effect, that the samples will follow a normal distribution regardless of the shape of the parent distribution.

SPC tool is used with the help of Control Chart. The purpose of control chart is to study the variation in the process. All control charts are based on the periodic sampling and measurement of items. With the help of control chart the process output can be monitored to see if it is random (in control) or not (out of control). Control chart is a graphical presentation obtained from the representative sample means taken at regular time interval. The data collected will allow the calculation of a centerline, and upper and lower control limits. The upper and lower control limits define the range of acceptable variation. The centerline is the mean of all samples, whereas the control limits are, conceptually, the mean +/- three standard deviations. There are two types of variations Common Cause Variation and Special / Assignable Cause Variation.

1.12 Benefits of Statistical Quality Control

- It controls variation in the processes and hence controls quality.
- It provides a means of detecting error during production.
- It helps to have standardised quality of production.
- It is helpful in the production of uniformity of the quality of output.
- It reduces inspection costs.
- It is used to identify abnormal condition and trouble spot in the process.
- It provides a means of determining the capability of the manufacturing process.

1.13 Managing Quality through Modernisation of Manufacturing Process

Integrating quality into manufacturing process is a challenging task. A typical manufacturing process includes the following phases: planning & development phase, design phase, production phase, assembling phase and then inspection phase. Every production manager wants to minimise the labour cost and lower down the production cost. But the quality production is the prime function for them. In this competitive world, the best companies are using latest software for products designing, robots & latest sensor technology like 3D sensors and adopting automatic controlling of the environmental conditions like temperature at the shop floor. For these companies quality is the making and using batch quality inspection for the final approvals is must.

1.14 Automation and Robotics

Automation is the use of computers to control a particular process in order to increase reliability and efficiency, often through the replacement of employees. For a manufacturer, this could entail using robotic assembly lines to manufacture a product.

Automation or **automatic control** is the use of various control systems for operating equipment with minimal or no human intervention. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices, computers, and robots usually in combination. One of the most important application areas for automation technology is manufacturing. Robots are used in manufacturing to create efficiencies all the way from raw material handling to finished product packing. Robots can be programmed to operate 24/7 in the situation of continuous production. Complicated systems, such as modern factories, airplanes and ships typically use all these combined techniques of automation. The industries using

automation are Food and Beverages, Retail Stores, Mining, Pharmaceutical, Cement, Chemical, Aerospace, etc.

1.15 Advantages of Automation

The main advantages of automation are:

- It increases productivity by reducing the cycle time.
- It reduces operation time and work handling time significantly.
- It replaces hard physical or monotonous work.
- It improves quality or increased predictability of quality as automation provides high level of accuracy, better quality without variation.
- It improves strength of processes and generates consistency in the output.
- It reduces direct human labor costs and expenses as automation is helpful in the tasks especially very hard work or monotonous work.
- It is helpful in the conditions of hazardous environment like high temperature/heat, radioactive rays, toxic chemicals etc.
- It is helpful in faster mass production.
- It can be maintaining the production with simple quality checks regularly.
- It is beneficial in the optimum utilisation of the floor space.

1.16 Benefits of Quality Control in Manufacturing Process

Some of the importance or benefits of quality control are as under:

- **Encourages the Quality Culture**

The quality control programme run by management to control the quality is very much helpful for the employees. It creates a quality culture in the organisation and makes them conscious for the quality issues and helps them to give their optimum contribution.

- **Increase in Consumers Satisfaction**

Quality control ensures production of quality products which is immensely helpful in attracting more customers for the product or service thereby generating positive word of mouth. The consumers are greatly benefited as they get better quality products on account of quality control. It gives them satisfaction and generates loyalty.

- **Reduction in Production Cost**

The effective inspection and control programme is helpful in the reduction of the production cost. The production processes and operations run smoothly and production costs are considerably reduced. Quality control further ensures the optimum utilisation of resources and checks the wastage, scrap and inferior products or services. It is helpful to lower down the overall production cost.

- **Reduction in Inspection Costs**

Implementation of quality control programmes in the production process leads to reduction in the inspection activities. The overall cost of inspection is reduced drastically.

- **Higher Morale of Employees**

An effective system of quality management is greatly helpful in increasing the morale of employees as they feel proud of being the part of such a qualitative environment. They feel that they are working in the organisation producing high quality products and services. Such environment leads to cordial employer-employee relations.

1.17 Summary

A process is a sequence of activities that is required to achieve the desired results. Process management involves planning and administering the activities necessary to achieve standard performance in the process. **Manufacturing** is the production of goods or services using valuable resources like manpower/labour, materials, money, machine tools, chemical and biological processing, or formulation for the purpose of sale or use. The manufacturing is the process of transforming the raw materials into finished goods and services with the help of wide range of human activities and with the use of technology. **Process improvement methodologies** are used to identify, analyze and improve existing processes within an organization to meet new goals and objectives. There are various tools and techniques like Kaizen, Benchmarking, 5S approach, DRIVE approach, Inspection, Statistical Quality Control etc. **Kaizen** is the practice of continuous improvement. It is considered a slow but it is an ongoing process of improvement. It illustrates an organisational culture where everyone from the top to the bottom is involved in the regular evaluation of his or her work and sense the ways to improve it. The concept is that small improvements on a regular basis will head towards the large improvements over time. One of the most notable features of kaizen is that big results come from many small changes accumulated with the passage of time. Kaizen is

teamwork and it is everybody's business. It is possible with the change in the mindset of employees. **Benchmarking** is the process of comparing one's business processes and performance to industry bests or with the best-in-class company. The management identifies and select the best organisation only where similar processes exist and compare processes. It helps the organisation to discover its strengths and weaknesses as well as those of industry leaders. Benchmarking practices are classified into two categories: Technical Benchmarking and Competitive Benchmarking. **5S** is a simple methodology to create an orderly environment. It is creating a clean, safe, hygienic, sterile, unpolluted, sterile and orderly high performance work environment. This type of environment helps to increase performance efficiency and productivity. 5S includes sort, set in order, shine, standardise and sustain. **Quality control** is concerned with the uniform quality of the production. It is a process that measures output relative to standard, and acts when the variation is noticed. The purpose of quality control is to assure that processes are performing as per the stated standards. There are three stages of Quality Inspection: (i) Inspection of incoming materials and parts; (ii) Inspection of production process/processes; and (iii) Inspection of the finished goods. The decision of acceptance or rejection of depends upon the methods of inspection. There are two methods of inspection. These are (i) 100% inspection/Census method; and (ii) Sampling inspection methods. **Statistical Process Control** is a statistical tool for reducing the variability in processes which are the cause of most quality problems. It is helpful in monitoring and controlling a process to ensure it is optimized. SPC tool is used with the help of Control Chart. The purpose of control chart is to study the variation in the process. With the help of control chart the process output can be monitored to see if it is random (in control) or not (out of control). Control chart is a graphical presentation obtained from the

representative sample means taken at regular time interval. The upper and lower control limits define the range of acceptable variation. There are two types of variations random variation and assignable variation. **Automation** or **automatic control** is the use of various control systems for operating equipment with minimal or no human intervention. One of the most important application areas for automation technology is manufacturing. Some of the importance or benefits of quality control are: Encourages the Quality Culture, Increase in Consumers Satisfaction, Reduction in Production Cost, Reduction in Inspection Costs, and Higher Morale of Employees.

1.18 Keywords

Process

A process is a sequence of activities that is required to achieve the desired results. Process can be product design, manufacturing, supply chain management, materials handling, supplier, customer care support etc.

Manufacturing

Manufacturing is the process through which raw materials are transformed into final product/services.

Kaizen

Kaizen is the practice of continuous improvement. The guiding principle is that no process is thought to be perfect and it should be improved continuously. It is teamwork and it is everybody's business.

Benchmarking

Benchmarking is the process of comparing one's business processes and performance to industry bests or with the best-in-class company.

Quality Inspection

Quality inspection is the regular checking, measuring and testing of incoming materials/ parts/one more processes/finished goods.

Statistical Process Control

Statistical Process Control is a statistical tool for reducing the variability in processes which are the cause of most quality problems.

Automation

Automatic is the use of various control systems for operating equipment with minimal or no human intervention.

1.19 Self Assessment Questions

1. Define process with examples.

2. Define manufacturing process.

3. Elaborate the steps to improving quality of manufacturing process.

4. Enumerate process improvement methodologies.

5. Define and discuss Kaizen as a continuous improvement tool.

6. Define benchmarking. How it helps in the continuous improvement of the processes?

7. Discuss 5S approach and its constituents.

8. Discuss the concept of quality control through statistical techniques.

9. Enumerate the stages of quality inspection.

10. What are the methods of inspection?

11. Discuss the concept of statistical process control (SPC).

12. What are the benefits of statistical quality control?

13. How the quality is managed through modernisation of manufacturing process?

14. What are the uses of automation and robotics?

15. Point out the advantages of automation.

16. Enumerate the benefits of quality control in manufacturing process.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **8**	Vetter: **Dr. Sanjay Tiwari**
Quality Control & Control Charts	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic concepts and importance of Quality Control.
- Know the concepts and importance of Statistical Quality Control and Control Chart.
- Understand the process plotting the quality control charts.

1.1 Introduction

In this era of growing competition, it is necessary for the management to keep a continuous control over the quality of the goods/services produced. Good quality products/services generate goodwill and satisfaction which leads to increase in sales. However, if the consumers are unsatisfied with the quality of product/service and complaints are not addressed properly, it will be impossible for the manufacturer to continue in the market. The need for maintaining and improving quality standard is growing day-by-day with increasing cut-throat competition. The concept of quality control is not a new one. For the purpose of quality control, the organisations use statistical techniques which are helpful in controlling the quality standards. The importance of statistical quality control is very high for maintaining and improving the quality.

The term ‘quality’ in statistical quality control is usually related to some measurement made on the items produced and good quality items are one which conform a standard specified for the measurement. Quality of product means the product must be within the acceptable limits of acceptance and rejection. The benefits from quality and process improvements to organization are in terms of improved quality; less rework, fewer mistakes and hence cost decreased; capture the market with better quality and lower price; improved business; and improved productivity.

1.2 Definition of Quality Control

There are various definitions of quality control as under:

Quality control is a process through which a business seeks to ensure that product quality is maintained or improved and manufacturing errors are reduced or eliminated. Quality control requires the business to create an environment in which both management and employees strive for perfection. This is done by training personnel, creating benchmarks for product quality, and testing products to check for statistically significant variations.

Quality control refers to that quality related activities which are associated with the creation of project deliverables. Quality control is used to ensure that deliverables are complete, correct and within the acceptable quality. Examples of quality control activities include inspection, deliverable peer reviews and the testing process.

The need of quality control arises whenever it is found that the even after specifying the quality standards, some variation in quality is recorded. For example, a machine is producing 1,00,000 wedges per day of 4 cm. length. It is very unlikely that all screws are exactly 4 cm. in length. If the measuring instrument is sufficiently precise we can detect some screws which are slightly less than 4 cm. and some which are slightly more than 4 cm. It means that the further examination of the existence of variation in the product specification/quality is required. There are mainly two methods used in quality control:

- Statistical process control (SPC)
- Acceptance sampling (AS)

The first method is statistical process control and it uses a graphical display known as Control Chart to monitor production process. The goal of this method is to find whether the process can be continued or whether it should be adjusted to achieve a desired standard quality level. The second method is acceptance sampling which is used in situations where a decision to accept or reject a group/lot of products is be dependent on the quality found in sample.

1.3 Benefits of Quality Control

There are various benefits of quality control as under:

- It is helpful to monitor production process.
- It provides a means of detecting error through quality tools.
- It is helpful in maintaining the uniform/standardised quality of production.
- It increases satisfaction of customers.
- It reduces inspection costs.
- It reduces the number of rejects and saves the cost of material.
- It provides a basis for attainable standards.
- It is helpful in the optimum utilisation of resources.
- It reduces wastes, scrap and points out the bottlenecks and trouble spots.
- It provides a means of enhancing the capability of the manufacturing process.

1.4 Statistical Process Control

This technique was developed by W. A. Shewart while working for the Bell Telephone Co, USA. He applied statistical process control for solving the problem of inconsistency of a very large number of components during the manufacturing. Statistical quality

control involves the statistical analysis of the data collected through inspection. The data is collected through random sampling and sample should follow a normal distribution curve. SPC is based upon the Central Limit Theorem which tells us, in effect, that the samples will follow a normal distribution regardless of the shape of the parent distribution.

Meaning of Statistical Process Control

"Statistical process control (SPC) as a subset of statistical quality control traditionally consists of tools and methods to monitor, control, and improve the quality of manufactured products. Monitoring a manufacturing process is required to ensure it operates properly." (Ahangar & Chimka, 2015)

"Statistical Process Control (SPC) is a collection of statistical techniques providing a rational management of a manufacturing process, which allows high quality final products to be produced." (Wu, Castagliola, & Khoo, 2016)

"Statistical process control is a powerful collection of problem solving tools useful in capability through the reduction of variability. SPC can be applied to any process. The eventual goal of SPC is the elimination of variability in the process." (Saravanan & Nagarajan, 2013)

SPC tool is used with the help of Control Chart. "One of the most important tools used in SPC is the control chart. There are always variations in production due to common and special causes, and the control chart is an effective tool to continually monitor the production process." (Ahangar & Chimka, 2015). "Charts are undeniably the most widely used for identifying changes in processes." (Wu, Castagliola, & Khoo, 2016)

There are two types of variations namely Common Cause Variation and Special/Assignable Cause Variation:

- **Common Cause Variation**

It is the common natural variations in the output of a process. The reasons of this type of variation can be many minor factors which are negligible. A process is said to be in statistical control when only common cause variation exists.

- **Special or Assignable Cause Variation**

This type of variation is because of some specific reasons. The process is said to be out of control when a special cause variation occurs.

We can conclude from the above definitions and discussions that:

- Statistical Process Control is a statistical tool for reducing the variability in processes which are the cause of most quality problems.
- The major objective of SPC is to quickly detect the occurrence of assignable causes of process variability so that examination of the process and corrective action can be taken to avoid nonconforming units to be manufactured.
- In it, the output of the process is evaluated through Control Charts to determine if it is statistically acceptable or not.
- It is helpful in monitoring and controlling a process to ensure it is optimized. Its most common application is quality control in manufacturing.
- SPC is based upon the Central Limit Theorem.

1.5 Control Chart

Control Chart is a statistical tool consists of three horizontal lines called; Upper Control Limit (UCL), Center Line (CL) and Lower Control Limit (LCL). The center line in a control chart denotes the average value of the quality characteristic under study. It is used to measure how a process changes over time called variability. Its purpose is to study the variation in the process. Simply, variability means whether the process is consistent/under control/stable or unpredictable/out of control/unstable. It is a graphic representation of the process stability or instability over time. So, the variability of a process can be determined by plotting data regarding the pre-defined upper and lower control limits. The reasons for variation in any process can be Common Causes or Special Causes. The control chart is used for a process to distinguish between variations resulting from common causes and special causes.

1.8 Conditions to Use a Control Chart

Control chart can be used in the following conditions:

- To control the process by finding and correcting the variations as they occur.
- To predict the expected range of outcomes from a process.
- To determine whether the process is within control or out of control.
- To explore the patterns of a process.
- To examine causes of the variation i.e. whether the variation is from the special causes (non-routine events) or common causes (built into the process).
- To support the management's quality improvement programme. Control chart is a very good tool to be used prevents specific problems or to make fundamental changes to the process and helpful in making the quality improvement programmes successful.

1.6 Graphical Representation of Control Chart

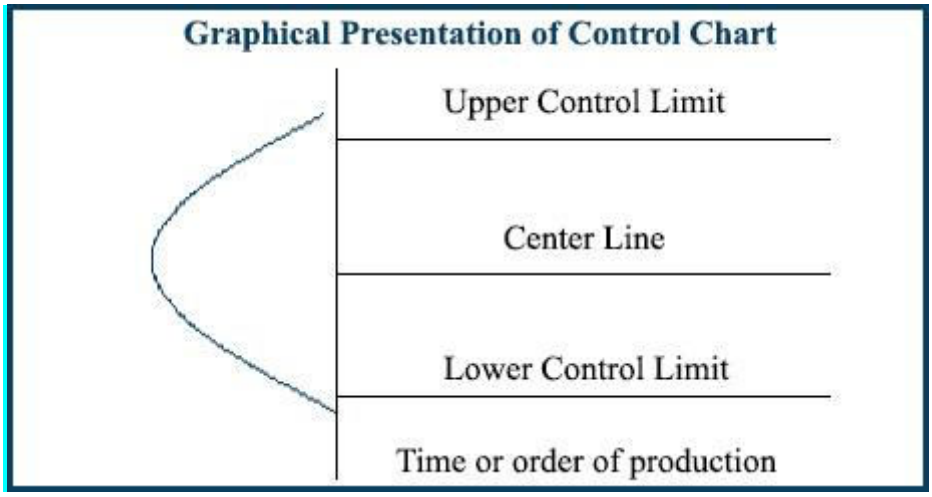

Figure 1.1: Control Chart

All control charts are based on the periodic sampling and measurement of items. With the help of control chart the process output can be monitored to see if it is within control or out of control. It is obtained from the representative (random) sample means taken at regular time interval. The data collected is helpful in the calculation of a center line, upper control limit and lower control limit. The upper and lower control limit identifies the range of acceptable variation. The center line is the mean of all samples, whereas the control limits are, conceptually, the mean +/- three standard deviations. A control chart has following components:

Center line: Center line in control chart is the indication of desired ideal capability of a process. Center line is the calculated mean of all the samples.

Control Limits: Upper and lower control limits define the variation range. Data points of a process are plotted to perform trend analysis toward either of control limits and with respect to centre line.

1.7 Basic Procedure to Draw Control Chart

The basic procedure to draw and analyse the control chart is as follows:

- Collect the sample data from the actual process.
- Determine the appropriate time period for collecting and plotting data.
- Plot Control Chart for the sampled data.
- Analyse the Chart.
- Follow the golden rules to identify the 'out-of-control signals' on the control chart. When one is identified, mark it on the chart and investigate the cause. Document how you investigated, what you learned, the cause and how it was corrected.

Sub Group	Data	Sub Group	Data
1	15	26	-5
2	7	27	12
3	-2	28	-6
4	-5	29	-9
5	-10	30	-8
6	7	31	19
7	2	32	11
8	-8	33	6
9	-7	34	0
10	-10	35	4
11	-2	36	24
12	-7	37	6
13	-11	38	6
14	-15	39	1
15	-20	40	-6
16	-3	41	6
17	-8	42	-4
18	-12	43	-5
19	-18	44	-10
20	-19	45	-12
21	4	46	23
22	-3	47	17
23	-8	48	11
24	-14	49	9
25	-19	50	-5

Figure 1.1: Data for Control Chart

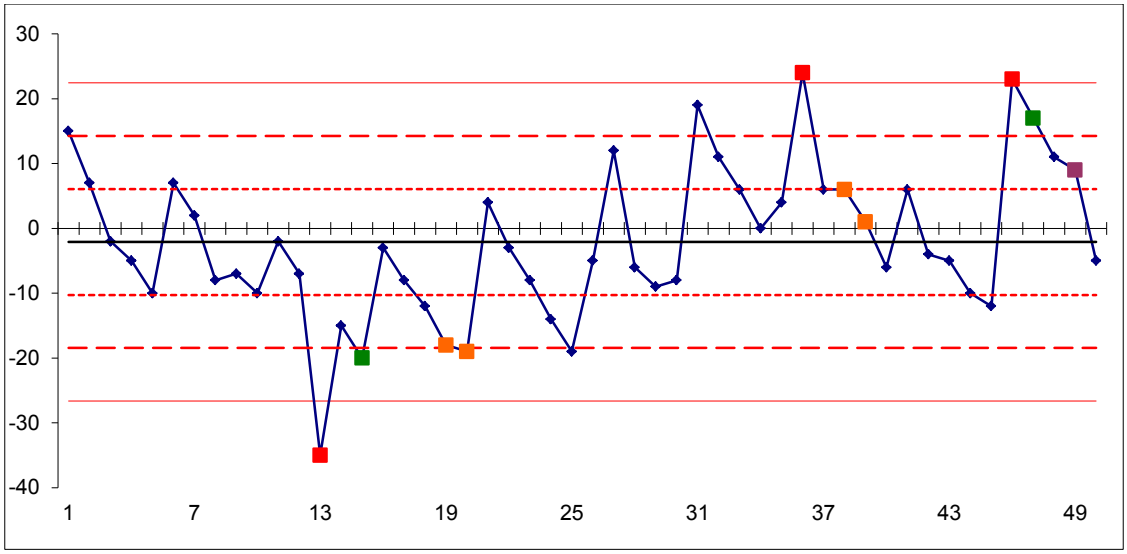

Figure 1.2 (i): Individual Chart

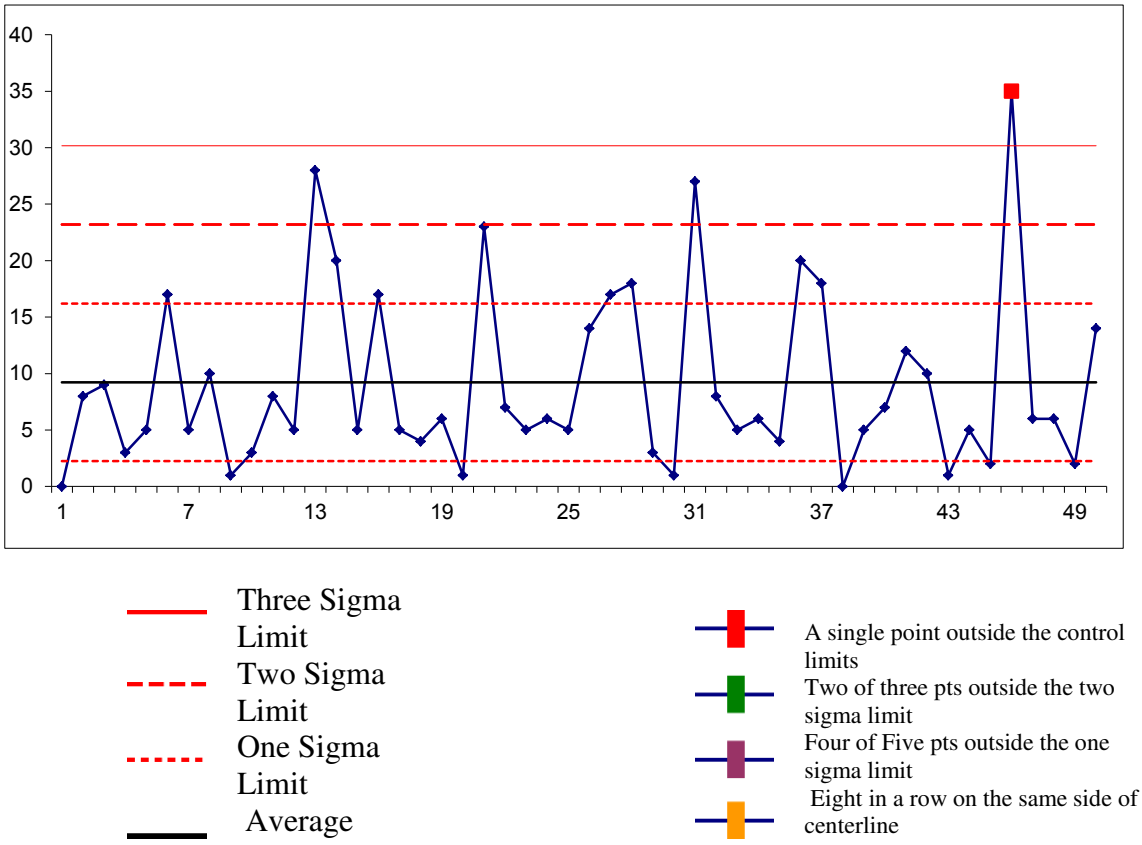

Figure 1.2(ii): Moving Range Chart
(Showing a single point outside the control limits)

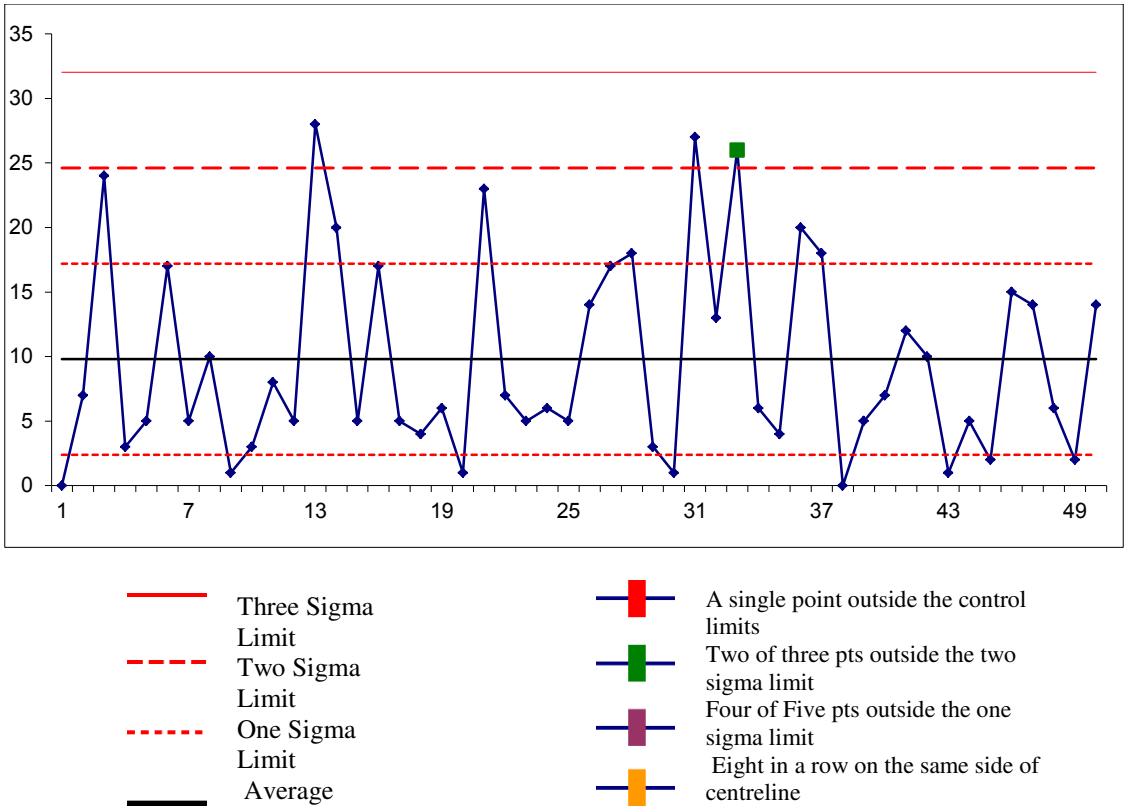

Figure 1.2(iii): Moving Range Chart
(Showing two of three points outside the two sigma limit)

The above figure nos. 1.2 (i), 1.2(ii) and 1.2 (iii) are the examples of Control Chart. These control charts are plotted after getting the sample data from the real process. The Control Charts are predictable on the basis of the golden rules of control charts given at heading no. 1.10. The control chart predicts variation in the process if it follows the pattern according to any of the golden rule. As for example one of the golden rules is "Two of three consecutive points fall in zone C in one-half of the chart", then it is said that the process is out of control. Now, see figure no. 1.2(iii), two of three consecutive points fall in zone C in one-half of the chart. It clearly shows that there is a problem in the process.

1.8 Golden Rules of Control Charts

"If a point lies within UCL and LCL, then the process is deemed to be under control. Otherwise, a point plotted outside the control limits can be regarded as evidence representing that the process is out of control and, hence preventive or corrective actions are necessary in order to find and eliminate the assignable cause or causes." (Saravanan & Nagarajan, 2013) There are some golden rules to find special cause variation. There is a variation (in the production process) if outcome/pattern of the process is following any one of the rule stated under:

Rule No. 1: Any point falls outside the control limits.

Rule No. 2: Two of three consecutive points fall in zone C in one-half of the chart.

Rule No. 3: Four of five consecutive points fall in zone B in one-half of the chart.

Rule No. 4: Six consecutive observations are increasing (or decreasing.)

Rule No. 5: Eight consecutive points outside of the A zones.

Rule No. 6: Nine consecutive observations fall on one side of the mean.

Rule No. 7: 14 observations alternate above and below the mean.

Rule No. 8: 15 consecutive observations in the A zones.

1.9 Benefits of Statistical Quality Control

The benefits of the Statistical Quality Control are as follows:

- It controls variation in the processes and hence controls quality.
- It provides a means of detecting error during production.
- It is used to monitor the process stability which ensures the predictability of the process.
- It helps to have standardised quality of production.

- It is helpful in the production of uniformity of the quality of output.
- It is helpful in the consistency of the quality of products/services which improves the customer satisfaction.
- It reduces inspection costs.
- It reduces the nonconforming units which help to reduce the production cost.
- It provides a basis for attainable specifications.
- It is used to identify abnormal condition and trouble spot in the process.
- It provides a means of determining the capability of the manufacturing process.

1.10 Summary

Quality control is a process through which a business seeks to ensure that product quality is maintained or improved and manufacturing errors are reduced or eliminated. It refers to that quality related activities which are associated with the creation of project deliverables. There are various benefits of quality control like it is helpful in maintaining the uniform/standardised quality of production, it provides a basis for attainable standards. **Statistical Process Control (SPC)** as a subset of statistical quality control traditionally consists of tools and methods to monitor, control, and improve the quality of manufactured products. Monitoring a manufacturing process is required to ensure it operates properly. SPC is based upon the Central Limit Theorem. There are two types of variations namely Common Cause Variation and Special/Assignable Cause Variation. Statistical Process Control is a statistical tool for reducing the variability in processes which are the cause of most quality problems. **Control Chart** is a statistical

tool consists of three horizontal lines called; Upper Control Limit (UCL), Center Line (CL) and Lower Control Limit (LCL). The center line in a control chart denotes the average value of the quality characteristic under study. It is used to measure how a process changes over time called variability. Its purpose is to study the variation in the process. There are some golden rules to find special cause variation. There is a variation (in the production process) if outcome/pattern of the process is following any one of the rule.

1.11 Keywords

Statistical Process Control (SPC)

Statistical process control (SPC) as a subset of statistical quality control consists of tools and methods to monitor, control, and improve the quality of manufactured products. One of the most important tools used in SPC is the control chart.

Control Chart

Control Chart is a statistical tool and is used as graphic display for the process variability over time.

1.12 Self Assessment Questions

1. Define quality control. What are the benefits of quality control?
2. Discuss the concept of statistical process control.
3. Elaborate the concept of control chart. How control charts are helpful in quality control? Discuss.
4. Give graphical representation of control chart.
5. What is the basic procedure to draw control chart?

6. Enumerate the conditions to use a control chart.

7. List the benefits of Statistical Quality Control.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **9**	Vetter: **Dr. Sanjay Tiwari**
Test of Significance	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Elaborate the concept of test of significance
- Understand the types of hypothesis and hypothesis testing
- Know the procedure of hypothesis testing and usage of normal distribution curve

1.1 Test of Significance

The concept of statistical significance was given by Ronald Fisher in 1925. He developed statistical hypothesis testing which he described as 'tests of significance'. Fisher suggested a probability of one in twenty (0.05) as a convenient cut off level to reject the null hypothesis. It was further recommended that the significance level (e.g. 0.05) be set ahead of time prior to any data collection.

Usually, in the organisation the decision about the population is taken on the basis of information drawn from the sample. As for example, on the basis of sample data the production manager has to determine whether a process is working properly according to the standard set or not by checking the quality of the product. The product is selected through sampling technique. This type of decision is called statistical decision. The theory of testing hypothesis or test of significance employs various statistical techniques to arrive such decision on the basis of sample study.

Once sample data has been gathered through an observational study or experiment, statistical inference allows analysts to consider some evidence or some claim about the population from which the sample has been drawn. The methods of inference used to support or reject claims based on sample data are known as tests of significance.

Test of Significance is required to check two important aspects:

- Checking the difference between sample estimate and population values and finding whether it is significant or not?
- Checking the differences between different sample estimates and finding whether it is significant or not?

The Basic Concepts of the Test of Significance

The basic concepts of the test of significance are:

- Hypothesis or Statistical Hypothesis
- Type I Errors and Type II Errors
- Level of Significance
- Critical Region or Rejection Region
- One Tailed Test and Two Tailed Test
- Critical Value

1.2 Hypothesis or Statistical Hypothesis

There are two types of hypotheses in a statistical test, normally called Null hypothesis and Alternative hypothesis. The null hypothesis simply asserts that there is no real difference in the sample and the population.

- **Null Hypothesis**

Null hypothesis is denoted by H_0. It represents a theory that has been put forward, either because it is believed to be true or because it is to be used as a basis for argument, but has not been proved. For example, regarding the training of the employees the null hypothesis is 'H_0: Training has not benefitted the employees'. A null hypothesis usually states that there is no relationship between the two variables.

- **Alternative Hypothesis**

The alternative hypothesis is denoted by H_a. It is a statement of what a statistical hypothesis test is set up to establish. For example, regarding the training of the employees, the alternative hypothesis is 'H_a: Training has benefitted the employees'.

1.3 Type I and Type II errors

There can be two types of errors whenever we draw an inference about a population, Type –I and Type-II error.

- **Type I error:** When H_o is true but it is rejected.
- **Type II error:** When H_o is false but it is accepted.

Both Type I and Type II errors are very dangerous. Type I error is committed by rejecting the true H_o and Type II error is committed by accepting when H_o is false. Type I error is the incorrect rejection of the null hypothesis and Type II error is the incorrect acceptance of the null hypothesis.

Condition	**Decision**	
	Accept H_o	**Reject H_o**
H_o is True	Correct Decision	Type I Error
H_o is False	Type II Error	Correct Decision

Table 1.1: Type I and Type II errors

1.4 Level of Significance

In hypothesis testing, the significance level is the criterion used for rejecting the null hypothesis. If the probability is less than or equal to the significance level, then the null hypothesis is rejected and the outcome is said to be statistically significant. Significance levels indicate how likely a pattern in data is due to chance. In the maximum experiments two levels are in practice either 0.05 level (5% level) or the 0.01 level (1% level). The choice of levels is largely subjective. 5 % level means that the finding has a 95% chance of being true. Therefore, the 0.01 level is more conservative than the 0.05 level. The lower the significance level, the more the data must diverge from the null hypothesis to be significant. The Greek letter alpha (α) is used to indicate the significance level. The decision of the significance level for the test has to be decided before going for hypothesis test. The use of significance level gives judgement whether the test results are statistically significant or not. The significance level also determines the probability of error that is inherent in the test. Usually, a significance level of 0.05 is selected.

1.5 Critical Region or Rejection Region

Values of the test statistic that do not fall within the specified range are said to be in the critical region and H_0 will be rejected for such values. Values of the test statistic that fall within the specified range are in the acceptance region. Typically, α (often referred to as the "level of significance") is set equal to .05 or .01. If, for example, α = .05, we would erroneously reject H_0 when H_0 is true 5% of the time. Rejecting H_0 when H_0 is true is referred to as a Type I error, and α = probability of a Type I error. Accepting H0 when H0 is false is referred to as a Type II error, and ß = probability of a Type II error.

1.6 One Tailed Test and Two Tailed Test

Single-tail hypothesis test is used when the direction of the results is anticipated or we are only interested in one direction of the results. For example, a single-tail hypothesis test may be used when evaluating whether or not to adopt a new textbook. We would only decide to adopt the textbook if it improved student achievement relative to the old textbook.

In hypothesis testing, the hypotheses are always statements about a population parameter which partitions the set of possible values that the parameters may take. For example, letting μ be the parameter for which the hypothesis test is performed, a null hypothesis, referred to as H_0 , may be defined as $H_0 : \mu = \mu$ and its two-sided alternative hypothesis, referred to as H_1 , is defined as $H_1 : \mu \neq \mu_0$ The alternative hypothesis H_1 does not make a statement about whether μ is greater than μ_0 or less than μ_0 , which makes this a two-sided test. The difference between a one sided test and a two-sided test lies solely in the specification of the alternative hypothesis. As a consequence, while a one-sided test specifies in its alternative hypothesis that the parameter is either greater than or less than the value specified in the null hypothesis (H_1 is either $\mu > \mu_0$ or $\mu < \mu_0$), in a two-sided test the direction of the alternative hypothesis is left unspecified.

• One tailed tests are directional:

$H_0: \mu_1 - \mu_2 \leq 0$

$H_A: \mu_1 - \mu_2 > 0$

• Two tailed tests are not directional:

$H_0: \mu_1 - \mu_2 = 0$

$H_A: \mu_1 - \mu_2 \neq 0$

Figure 1.1 : A Two-tailed Test (The Normal Distribution)

1.7 Critical Value

The critical value of the standard normal variate (z) for both the two-tailed and one tailed test at different level of significance varies often required in hypothesis testing. For example when level of significance $\alpha = 0.05$ then critical value of Z (for on tailed test) -1.645 or + 1.645 and critical value of Z (for two tailed test) -1.96 or +1.96.

Application of Test of Hypothesis/Test of Significance/Sampling Test

The applications of test of hypothesis or test of significance or sampling tests are conducted for large samples and small samples.

1.8 A General Procedure for Hypothesis Testing

The general procedure for hypothesis testing is as follows:

Step 1: Formulate the hypotheses

Step 2: Choose level of significance

Step 3: Select an appropriate test

Step 4: Collect data and calculate test statistic

Step 5: Determine the probability (or critical value)

Step 6: Compare the probability and take the decision

1.9 The Normal Distribution Curve

When random variation conforms to a particular bell shaped probability distribution is known as the normal distribution. It is the most commonly observed probability distribution. The shape of the normal distribution resembles that of a bell, so it sometimes is referred to as the 'bell curve'.

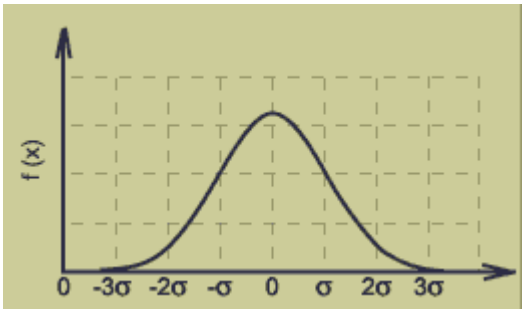

Figure 1.2: Normal Distribution

The normal distribution can be precisely explained by two parameters namely mean and standard deviation. If the mean and standard deviation are known, then one essentially knows as much as if one had access to every point in the data set. The empirical rule is a handy quick estimate of the spread of the data given the mean and standard deviation of a data set that follows the normal distribution. The empirical rule states that for a normal distribution: 68% of the data will fall within 1 standard deviation of the mean, 95% of the data will fall within 2 standard deviations of the mean, and almost all 99.7% of the data will fall within 3 standard deviations of the mean.

Example of Testing of Hypothesis

Question: The mean values of the practices of 25 small scale exporters, 25 middle scales exporters and 25 large scale exporters regarding 'the measures taken to improve sales appeal of garments abroad' is given below. Prove that there is a significance

difference among small, middle and large scale RMG exporters' practices regarding 'the measures taken to improve sales appeal of garments abroad'.

Small scale (25)	2.00	2.68	1.60	2.12	2.80
Middle scale (32)	2.72	3.03	2.69	2.72	3.06
Large scale (17)	4.24	4.65	4.71	4.59	4.76

Null Hypothesis:

H_0 = There is no difference among small, middle and large scale RMG exporters' practices with respect of 'Sales Appeal'

Calculations for Analysis of Variance (ANOVA):

X_1	$(X_1)^2$	X_2	$(X_2)^2$	X_3	$(X_3)^2$
2.00	4.00	2.72	7.40	4.24	17.98
2.68	7.18	3.03	9.18	4.65	21.62
1.60	2.56	2.69	7.24	4.71	22.07
2.12	4.49	2.72	7.40	4.59	22.66
2.80	7.84	3.06	9.36	4.76	

$\Sigma X_1 = 11.20$ $\Sigma (X_1)^2 = 26.07$ $\Sigma X_2 = 14.22$ $\Sigma(X_2)^2 = 40.58$ $\Sigma X_3 = 22.95$ $\Sigma(X_3)^2 = 105.51$

$N_1 = 5$ $N_2 = 5$ $N_3 = 5$

$T = 11.20 + 14.22 + 22.95 = 48.37$

c.f. = $(48.37)^2$/ 15 = 2339.66/15 = 155.98

SST = Total sum of Squares

$(X_1)^2 + \Sigma(X_2)^2 + \Sigma(X_3)^2 - C.F.$

= 26.07 + 40.58 + 105.51 – 155.98 = 172.16 – 155.98 = 16.18

SSB = Sum of Squares between sample

= [$(11.20)^2$/5 + $(14.22)^2$/ 5 + $(22.95)^2$ / 5] – 155.98

= 125.44/5 +202.21/5 + 526.70/5 = 170.87 – 155.98 = 14.89

SSW = SST – SSB

= 16.18 – 14.89 = 1.29

			Degree of Freedom	F
Between samples	14.89 (SSB)	2	2.01/ 2 = 1.005	1.005 /0.11 = 9.14
Within samples	1.29 (SSW)	12	1.29/ 12 = 0.11	
Total	16.18 (SST)	14		

For v_1 = 2, v_2 = 12, the table value of F at **5 % level of significance** is 3.89. The calculated value (9.14) is greater than the table value (3.89). **Hence the null hypothesis is rejected** and concluded that there is a significance difference among, small, middle and large scale RMG exporters' practices with respect of 'the measures taken to improve sales appeal of garments abroad'.

1.10 Summary

Once sample data has been gathered through an observational study or experiment, statistical inference allows analysts to consider some evidence or some claim about the population from which the sample has been drawn. The methods of inference used to support or reject claims based on sample data are known as **tests of significance.** There

are two types of hypotheses in a statistical test, normally called Null hypothesis and Alternative hypothesis. The null hypothesis simply asserts that there is no real difference in the sample and the population. There can be two types of errors whenever we draw an inference about a population, Type –I and Type-II error. Traditionally, two levels are used: either the 0.05 level (sometimes called the 5% level of significance) or the 0.01 level (1% level of significance). Values of the test statistic that do not fall within the specified range are said to be in the critical region and H_0 will be rejected for such values. Values of the test statistic that fall within the specified range are in the acceptance region. When random variation conforms to a particular bell shaped probability distribution is known as the normal distribution. It is the most commonly observed probability distribution.

1.11 Keywords

Test of Significance

Test of Significance is checking the difference between sample estimate and population values and finding whether it is significant or not.

Normal Distribution Curve

When random variation conforms to a particular probability distribution known as the normal distribution, which is the most commonly observed probability distribution.

1.12 Self Assessment Questions

1. Define the concept of test of significance.

2. What is hypothesis or statistical hypothesis? List the types of hypothesis with examples.
3. What are Type I and Type II errors?
4. Discuss null hypothesis and alternate hypothesis with examples.
5. Write down the steps of general procedure for hypothesis testing.
6. How to plot normal distribution curve? Discuss its use in hypothesis testing.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **10**	Vetter: **Dr. Sanjay Tiwari**
Business Process Reengineering	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic concept and importance of business process reengineering.
- Know how business process reengineering works.
- Understand the difference among TQM, Automation, Rationalization of Procedures, Paradigm Shift, & BPR
- Get you familiar with the reasons of BPR failure.

1.1 Business Process and Business Process Reengineering: Introduction

Business process is a set of related work activities that are performed by employees to achieve business goals. Business process is the way we perform our work. Business Process Reengineering (BPR) is redesigning business processes in the organisation. It is the analysis and redesign of workflows within and between enterprises in order to optimize end-to-end processes and automate non-value-added tasks.

Business process re-engineering (BPR) is defined as an integrated set of management policies, project management procedures, and modeling, analysis, design and testing techniques for analyzing existing business processes and systems; designing new processes and systems; testing, simulating and prototyping new designs prior to implementation; and managing the implementation process.

BPR is the process of changing the way we do our work. We do it better after the implementation of BPR. The basic idea behind BPR is to make organisations more flexible, responsive, efficient and effective for all stakeholders including customers, employees, shareholders, suppliers and owners. Its main objective is to break away from old ways of working, and brings radical changes. It is the redesign of processes

to achieve dramatic improvements in critical areas such as cost, quality, service, and response time through the in-depth use of information technology. Companies reduce organizational layers and eliminate unproductive activities in two key areas. First, they redesign functional organizations into cross-functional teams. Second, they use technology to improve data dissemination and decision making. BPR is also called business process redesign.

1.2 Applications of Business Process Reengineering

Business Process Reengineering could be applied to companies that confront problems such as the following:

- The operational costs are very high and unbearable and consequently the organisation is unable to compete in the market.
- The organisation is losing its market share and the customer complaints are increasing. Low quality to customers can be great concern.
- There is high level of 'blockage' in the key processes particularly in peak seasons.
- The performance of middle level managers is poor.
- There is inappropriate distribution of resources and jobs in order to achieve maximum performance, etc.

1.3 Objectives of Business Process Reengineering

The following objectives should be focused while applying the BPR to a business organization:

i. Customer Focus:

Customer satisfaction is the top priority. There should be a change from management focus to customer focus. The organisation should adopt customer service oriented processes. The customer oriented processes eliminate customer complaints.

ii. Reducing Average Cycle Time

The organisation has to focus on key business processes and try to reduce average cycle time. For instance, if process before BPR had an average cycle time 5 hours, after BPR the average cycle time should be cut down to half an hour.

iii. Empower Employees

The management should empower the employees involved in decision making in the processes. This will generate a sense of responsibility among employees.

iv. Emphasis for Managing Activities

The management must change its vision of focusing on results only. It should emphasis on managing activities. The approach must be how we can get the results by managing activities effectively and efficiently.

v. Flexibility

The organisation must be ready to change its processes and structures according to the changing conditions and competition. The organisation must develop the awareness mechanism to remain very close to the customers so that it can rapidly

spot the requirement of change in the process and adapt to new requirements of the market quickly.

vi. Obsession for Quality

The organisation should have obsession to deliver the superior service and value to the customers. The level of quality should always be controlled and monitored by the processes.

vii. Innovation

The management must have leadership through imagination to provide competitive advantage to the organisation.

viii. Adopt Simple Processes

The organisation wants to get rid of very complex processes and wants to have simple and streamlined processes. It will improve productivity drastically.

1.4 Requirement of Business Process Reengineering

Business Process Reengineering is the radical redesign of processes. Its objective is to achieve dramatic improvements in productivity, cycle times and quality. In business process reengineering, companies start from beginning or scratch, identify the goals and purposes, analyse the current process and commit action to bring radical changes. The customer is the focus and to deliver more values to the customers the companies refocus on the existing processes. They typically adopt a new value system that places increased emphasis on customer needs. It is the redesign of processes to achieve dramatic improvements in critical areas such as cost, quality, service,

and response time through the in-depth use of information technology. BPR is also called business process redesign. Companies use business process reengineering to improve performance substantially on key processes that impact customers. Business process reengineering is required for the following purposes:

- **Reduce Costs and Cycle Time**

Business process reengineering improves productivity, reduces costs and cycle times by eliminating unproductive activities and the employees who perform them. Business process reengineering accelerates information flows, and eliminates wastes and errors.

- **Improve Product/Service Quality**

Business process reengineering improves quality by reducing the fragmentation of work and establishing clear ownership of processes. Employees gain responsibility for their output and can measure their performance based on prompt feedback.

1.5 BPR Implementation Procedure

Business process reengineering is a dramatic change initiative that contains the following four major steps:

i) Start from Beginning / Scratch

At this stage, the organisation must refocus the customer needs and then refocus the company values according to the requirements. It is the time to refocus about the customers' satisfaction level, the existing distribution system, development of innovative products, present production system etc. Listen to your customers

cautiously. It is the time to rethink organisational and customers' grievances, complaints and issues.

ii) Identification of Goals and Purposes

Identifying the goals and purposes is important. What we can achieve with the change in the process? Is it going to increase customer satisfaction? Is it going to make the distribution system more efficient? Is it going to make our production system more efficient? Is the changed process will boost the development of innovation process? If yes, then it means the goals and purposes of BPR are identified correctly.

iii) Analysis of Current Processes

There is always scope for improvement in current processes. Compare your existing processes with the desired processes. Concentrate on the filling of the gap between existing and desired processes, if any.

iv) Action Time

At this stage, improve those processes that bring value to the customers and change or eliminate those do not contribute. Be committed to have radical changes on the processes, if required. Use the information technology to redesign core processes. Improve the business processes across the organisation to enable improvements.

1.6 Difference between TQM & BPR

Parameter	TQM	BPR
Change	Incremental	Radical
Focus	Current Practice	Start again
Primary Enabler	Statistical Control	High Role of IT

Frequency	Continuous	One attempt
Participation	Bottom-up	Top-down
Risk & Rewards	Low & Moderate	High
Type of Change	Work design	Structure, culture roles

1.7 Difference among Automation, Rationalization of Procedures, Paradigm Shift, & BPR

Automation

Automation refers to computerizing processes to speed up the existing tasks to improve efficiency and effectiveness.

Rationalization of Procedures

It refers to streamlining of standard operating procedures, eliminating obvious bottlenecks, so that automation makes operating procedures more efficient.

Business Process Reengineering

It refers to radical redesign of business processes. It aims at eliminating repetitive, paper-intensive, bureaucratic tasks, reducing costs significantly and improving product/service quality.

Paradigm Shift

It refers to a more radical form of change where the nature of business and the nature of the organization are questioned. It is a part of strategic decision making of the organization.

1.8 Strategic Sense in Business Process Reengineering

Business Process Reengineering is very important strategically because:

- It lowers cost.
- It increases customers' satisfaction.
- It helps organisation to face competitiveness.
- It generates excellent capability advantages.
- It helps to improve efficiency.

1.9 Reasons of Business Process Reengineering Failure

BPR brings radical changes in the processes those generate value to the customers. It makes the employees to be more productive for their customers not their bosses. It generates empowered employees who work in process teams rather in functional departments. The controlled employees are empowered employees who are read to perform multidimensional work. BPR helps to understand and measure the existing processes. It helps to develop a vision and sense of belonging among employees. It helps to develop solution and make new processes operational. But sometimes, BPR fails. There are many reasons of the failure as mentioned below:

i. If organisation fails to focus on the customers' actual needs and satisfaction level.
ii. BPR is required to take the help of information technology to redesign core processes. The organisation may fail to integrate information technology.
iii. Sometimes, the management underestimates the actions required by employees. Managers may get confused and assume that the change will bring insecurity. It can cause employees to shed their functional mind-sets and will forge them instantly

into a team aiming to achieve common goals. To get the desired results, there is requirement to guide the employees and take the employees in confidence. To make new processes operational, it is required to develop vision and a sense of belonging among employees.

1.10 Summary

Business process reengineering (BPR) is redesigning business processes in the organisation. BPR brings radical changes in the processes those generate value to the customers. Business process reengineering is a dramatic change initiative which is processed in four steps: (i) Start from beginning / scratch; (ii) Identification of goals and purposes; (iii) Analysis of current processes; and (iv) Action time. It makes the employees to be more productive for their customers not their bosses. It generates empowered employees who work in process teams rather in functional departments. The controlled employees are empowered employees who are read to perform multidimensional work. BPR helps to understand and measure the existing processes. It helps to develop a vision and sense of belonging among employees. It lowers cost and increases customers' satisfaction. It helps organisation to face competitiveness and generates excellent capability advantages. It helps to improve efficiency. It helps to develop solution and make new processes operational. But sometimes, BPR fails because the organisation is failed to focus on the customers' needs and satisfaction level. The organisation may fail to integrate information technology. Sometimes, the managers get confused and assumed that the change will bring insecurity.

1.11 Keywords

Business Process

Business process is a set of related work activities that are performed by employees to achieve business goals. Business process is the way we perform our work. As for example accounting, production, marketing, sales, information technology, product design, etc.

Business Process Reengineering (BPR)

BPR is the process of changing the way we do our work. The BPR is to make organisations more flexible, responsive, efficient and effective for all stakeholders.

1.12 Self Assessment Questions

1. Define business process reengineering. What types of companies require implementing BPR?
2. What is strategic sense in business process reengineering?
3. Elaborate the procedure of business process reengineering.
4. Why sometimes business process reengineering fails? Discuss.
5. Differentiate between Total Quality Management and BPR.

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **11**	Vetter: **Dr. Sanjay Tiwari**
Total Productivity Management	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Understand the basic concept of the tools used for total productivity management.
- Know the steps to draw Check Sheet, Pareto Chart and Histogram diagrams.
- Understand the uses and construction of Control Chart.
- Know the benefits and usage of Flow chart, Cause and Effect Chart and Scatter diagram.

1.1 Total Productivity Management

The total productivity management is to improve the overall productivity. The management consistently make efforts and takes pain to increase it. There are many quality tools to improve the productivity of the processes namely: Check Sheet, Pareto chart, Histogram, Control Chart, Cause-and-Effect diagram (also known as the 'Fishbone' or Ishikawa Diagram), Scatter diagram, Stratification (alternately, flow chart or run chart) etc. The manufacturers can choose from these varieties of tools. These are called basic tools because they are suitable for employees with little formal

training in statistics. These tools can be used to solve the vast majority of quality-related issues The quality tools can make the process proceed more quickly and systematically. The quality tools for total productivity management are problem solving tools. These are helpful:

- To identify and prioritise problems quickly and more effectively.
- To help in the basic problem-solving and quality improvement process.
- To assist in the decision making process. Hence, helps to increase the productivity.
- To provide very simple but powerful tools for use in continuous improvement activity.
- To provide a way of extracting information from the data collected.

1.2 Check Sheet

A check sheet is a simple and effective method of gathering information. It is a non-statistical, relatively simple and can be created easily. It is used to capture data in a manual, reliable, formalized way so that decisions can be made based on facts. It ensures consistency of data collected and simplifies the data collection and analysis. It highlights trends and spots problems directly from the check sheet. In the following chart, the check sheet shows a list of defects on a production line covering a week's time. One can easily depicts where to set priorities based on results shown on the check sheet. It is assumed that the production flow is the same on each day and the part with the largest number of defects carries the highest priority for correction. The chart shows the weekly chart of the occurrence of defects from 1 to 10 in the production process. It clearly depicts that the defect no. 3 is occurring most frequently i.e. 16 times.

Project Name: .....

Data Recorder Name:.....

Place: .....

Date: ....

Defect Types/ Event Occurrence	Dates							TOTAL
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	
Defect 1	3	3	4	2	0	1	1	14
Defect 2	1	4	2	3	2	1	2	15
Defect 3	3	2	2	1	2	4	2	16
Defect 4	1	2	1	2	1	2	1	10
Defect 5	2	2	2	3	1	1	1	12
Defect 6	1	2	1	2	1	1	2	10
Defect 7	2	1	2	1	1	2	2	11
Defect 8	1	1	2	2	1	2	3	12
Defect 9	2	1	1	3	1	3	1	12
Defect 10	1	1	1	3	1	1	1	9
TOTAL	17	19	18	22	11	18	16	**121**

Figure 1.1: Check Sheet

1.3 Pareto Chart

The Pareto diagram is named after Vilfredo Pareto (a 19th-century Italian economist) who postulated that a large share of wealth is owned by a small percentage of the population. This basic principle translates well into quality problems—most quality problems result from a small number of causes. Pareto Chart is an effective on-going

improvement tool. It is commonly known as 'the 80:20 rule' which means 80% of problems are attributed to 20% of the causes. It identifies the most significant problem to be worked first. This tool distinguishes between the vital few and the trivial many. A Pareto Chart organizes and displays information in order to show the relative importance of various problems or causes of problems. In it data categories are arranged in order of frequency - starting with the most frequent. It is one of the most effective yet simple tools available. It is represented with a vertical bar chart with items organized in order from the highest to the lowest, relative to a measurable effect: i.e. frequency, cost, time. The following chart shows the occurrence of defects from 1 to 10 in order from the highest to the lowest occurrence in the production process. The graph clearly depicts that the defect no. 3 is occurring most frequently i.e. 17 times. It means the defect no. 3 is the problem is the main problem and to be corrected or eradicated first of all.

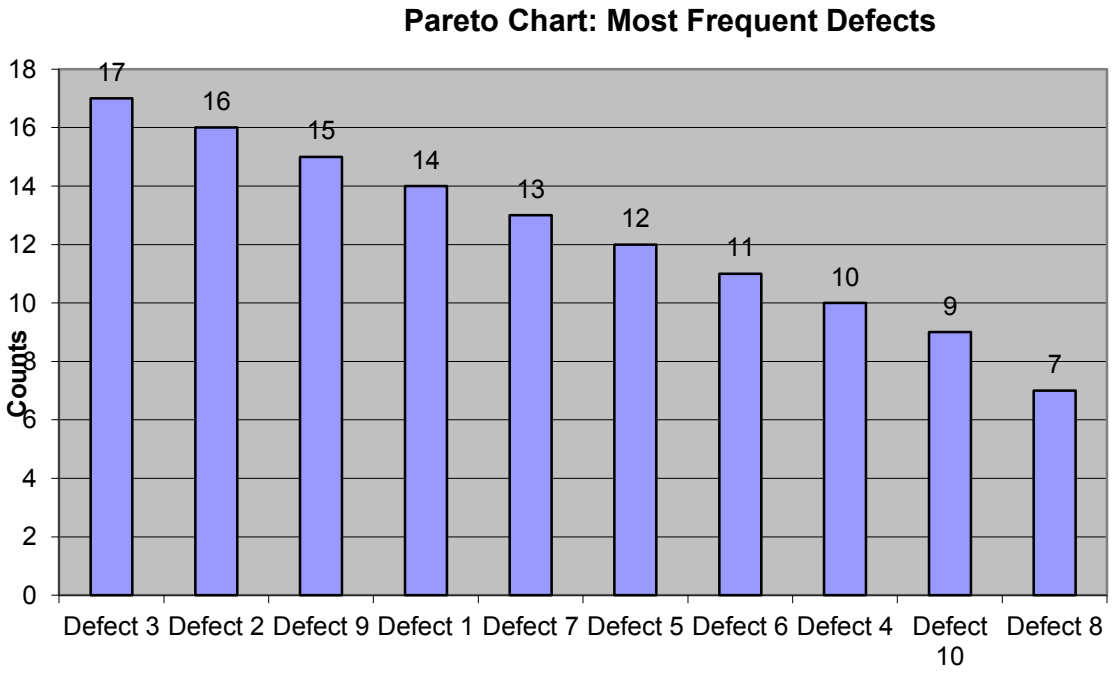

Figure 1.2: Pareto Chart

1.4 Histogram

Histogram is a form of bar chart. It is a visual way of representing data. It is easier to display and interpret data with the help of histogram. It is used to measure the frequency distribution of data that is commonly grouped together. In fact, it depicts a picture of the process behaviour at a given process of time. It has much in common with the Pareto Diagram. It can be vertical or horizontal of data than using tables. Histograms work best with small amounts of data that vary considerably.

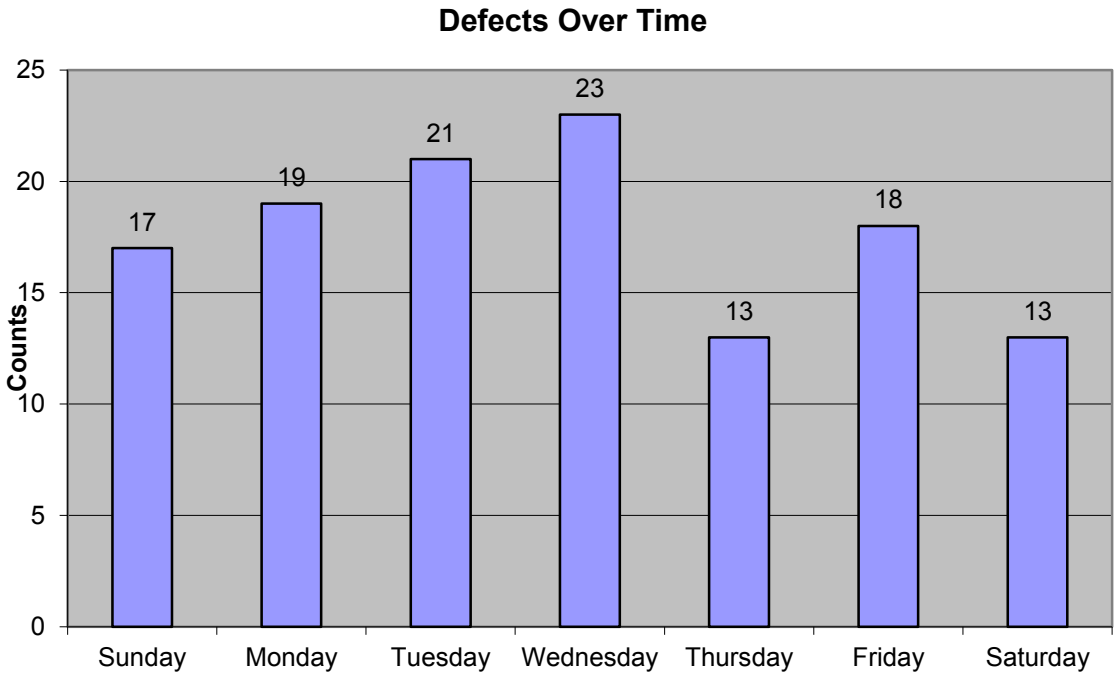

Figure 1.3: Histogram

1.5 Benefits of Histogram

- It depicts clearly to make sense of data.
- It shows patterns clearly that are difficult to see in tables of numbers.
- It is very simple to construct and helpful in taking decision.

1.6 Control Chart

Control Chart is a graphic display of the process stability or instability over time. It is a statistical tool used to measure how a process changes over time called variability. Simply, variability is whether the process is consistent/under control or unpredictable/out of control. The variability of a process can be determined by plotting data against pre-defined upper and lower control limits. The reasons for variation in a process are from two causes namely: Common Causes and Special Causes. The control chart is a statistical tool used for a process to distinguish between variations resulting from common causes and variation resulting from special causes.

1.7 Benefits of Control Charts

- It is used to make judgements of the process performance over a certain period of time.
- It provides a means of detecting error during production.
- It is used to monitor the process stability which ensures the predictability of the process.
- It helps to have standardised quality of production.
- It is helpful in the consistency of the quality of products/services which improves the customer satisfaction.
- It reduces inspection costs and reduces the nonconforming units.

1.8 Cause-and-Effect Diagram

Kaoru Ishikawa invented ‘Cause-and-Effect Diagram’ in 1968 which is also known as ‘fishbone diagram’ or ‘Ishikawa Diagram’. It is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. It shows the causes of a specific event. The Ishikawa diagram is used to identify potential factors causing an overall effect. Each cause or reason causes variability in the output. The causes are grouped into major categories to identify the real source of variation. The categories can be people, methods/process, machines, materials, measurements, environment, equipment etc.

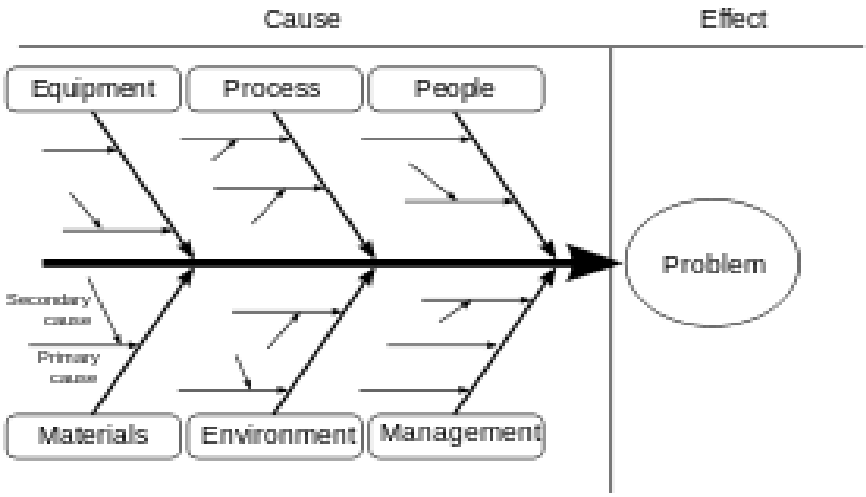

Fig 1.4: Fishbone Diagrams/Cause-and-Effect Diagrams

The Cause-and-Effect diagram has a fishbone shape and the diagram resemble the skeleton of a fish. The main causes are the categories drawn as ‘bones’ attached to the spine of the fish. The broad causes in the form of categories are people, methods/process, machines, materials, measurements, environment, equipment etc. Cause-and-effect diagram gives a view of key relationships among various causes and the possible causes provide additional insight into process behaviour. These causes can

be derived from brainstorming sessions. Then, these groups are to be labelled as categories of the fishbone.

1.9 Uses of Cause-and-Effect Diagram

Using the Cause and Effect Diagram to identify the root cause(s) of a problem provides several benefits to the quality improvement team like:

- It illustrates the relationship between the outcome and the factors that influence it.
- It is helpful to identify potential causes of the problem.
- It is helpful to summarize major causes under categories.
- It is a visual tool for organizing critical thinking and gives an overall view of the problems to the whole team.
- It also helps to analyse the situation at one go and take corrective actions.

1.10 Flowchart

A flow chart is a visual representation of a process. It describes a process in such a manner that it is possible to have an overview of the process and the sequence of process step by step in proper manner. Flow chart can be drawn for any process such as flow of materials, sequence of operations, etc. Although it is not statistical, but is used to piece together the actual process as it is carried out. A good flowchart shows all the steps of the process to the expert team and identifies critical process points for control. It should suggest areas for further improvement and should be self-explanatory. The flow chart is helpful in identifying both inefficiencies and potential improvements easily.

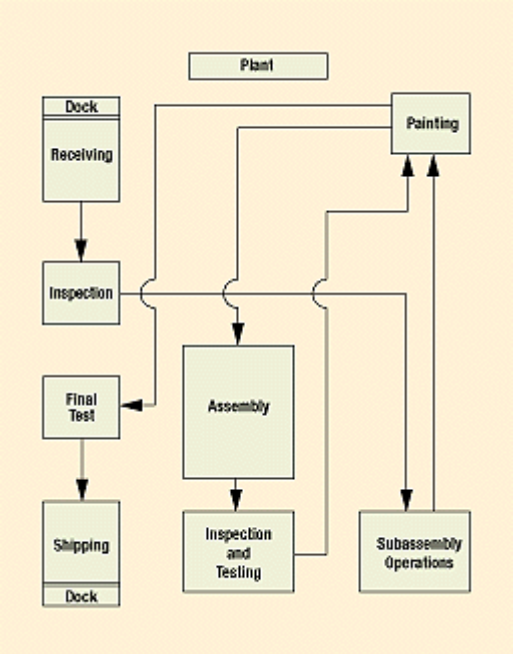

Figure 1.5: A basic production process flowchart displays several paths a part can travel from the time it hits the receiving dock to final shipping. (Source: www.mddionline.com)

1.11 Benefits of Flowchart

- It provides a clear-cut overview of the process at a glance.
- It clearly depicts the relationships of one process with the others.
- It provides insight for data collection and control points.
- It is helpful in identifying the improvements in the process.

1.12 Scatter Diagram

Scatter Diagram is a graphical tool allowing the identification of possible relationships between two different sets of variables. It is also called Scatter Plot or X-Y graph. It is a highly effective tool to be used to identify whether there is a relationship between two

variables or not. In the following example, table 1.6(iii) depicts the results from table 1.6(ii) that there is no relationship between both X and Y variables.

	Input (X)	**Output (Y)**
1	63	98.9
2	60	98.8
3	49	98.53
4	40	98.35
5	45	98.55
6	45	98.95
7	30	98.75
8	34	98.65
9	32	98.8
10	21	98.75
11	40	99.55
12	34	99.5
13	30	99.5
14	24	99.75
15	23	99.65
16	13	98.85
17	30	98.75
18	34	98.65
19	40	99.95
20	34	99.5

Figure 1.6 (i): Data for Scatter Diagram

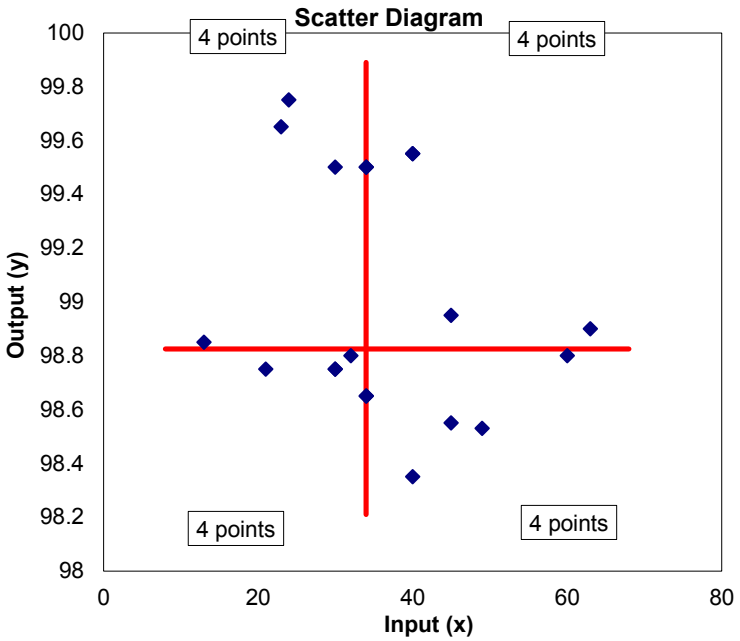

Figure1.6 (ii): Scatter Diagram

Sr. No.	Output	Results
1.	# in 1st Q	4
2.	# in 2nd Q	4
3.	# in 3rd Q	4
4.	# in 4th Q	4
5.	A = 4 + 4	8
6.	B = 4 + 4	8
7.	Q = min	8
8.	N = # pts	16
9.	Trend test limit	3
10.	Q < Limit?	No
11	Correlated?	No

Figure 1.6(iii): Results of the Scatter Diagram from table 1.6(ii)

1.13 Summary

The quality tools are used as the basis for problem solving, to investigate a process and to identify areas for improvement in the production process. However, it is not important

just to use any tool, it is important to know how and when to use them. There are many quality tools to improve the productivity of the processes namely: Check Sheet, Pareto chart, Histogram, Control Chart, Cause-and-Effect diagram (also known as the "fishbone" or Ishikawa diagram), Scatter diagram, Stratification (alternately, flow chart or run chart) etc. **A check sheet** is used to capture data in a manual, reliable, formalized way so that decisions can be made based on facts. It ensures consistency of data collected and simplifies the data collection and analysis. In the check sheet, one can easily depicts where to set priorities based on results shown on the check sheet. **The Pareto diagram** is is commonly known as 'the 80:20 rule' which means 80% of problems are attributed to 20% of the causes. The basic principle translates well into quality problems—most quality problems result from a small number of causes. Pareto Chart is an effective on-going improvement tool. It identifies the most significant problem to be worked first. **Histograms** are a form of bar chart. With the help of this tool, it is easier to display and interpret the data. It is used to measure the frequency distribution of data that is commonly grouped together. Histograms work best with small amounts of data that vary considerably. **Control Chart** is a graphic display of the process stability or instability over time. It is a statistical tool used to measure how a process changes over time called variability. The variability can be determined whether the process is under control or out of control by plotting this data. There are two reasons of variation in a process namely: Common Causes and Special Causes. **Cause-and-Effect diagram** is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. It shows the causes of a specific event. It is used to identify potential factors causing an overall effect. Causes are grouped into major categories to identify the real source of variation. The categories are people,

methods/process, machines, materials, measurements, environment, equipment etc. **A flow chart** is a visual representation of a process to describe a process to have an overview of the process and the sequence of process step by step in proper manner. It suggests areas for further improvement. It is helpful in identifying both inefficiencies and potential improvements easily. **Scatter Diagram** is a graphical tool allowing the identification of possible relationships between two different sets of variables.

1.14 Keywords

Check Sheet

A check sheet is a non-statistical, simple and effective method of gathering information used to capture data in a manual, reliable, formalized way so that decisions can be made based on facts.

Pareto Rule

Pareto Rule is commonly known as 'the 80:20 rule' which means 80% of problems are attributed to 20% of the causes.

Histogram

Histogram is a form of bar chart used to measure the frequency distribution of data that is commonly grouped together.

Control Chart

Control Chart is a graphic display used to measure how a process changes over time by

plotting data against pre-defined upper and lower control limits.

Cause-and-Effect Diagram

Cause-and-Effect Diagram is a tool and helps to identify, sort and display possible causes of a specific problem used along with brainstorming.

1.15 Self Assessment Questions

1. Enumerate the quality tools used in total productivity management.
2. Define Check Sheet. How to draw and interpret the Check Sheet? Discuss.
3. How to draw and interpret Pareto Chart. Discuss.
4. Define Histogram. Where can we use Histogram for quality management?
5. List the benefits of Histogram in the production process.
6. Define and discuss the benefits of the Control Chart.
7. Discuss and elaborate the Cause-and-Effect Diagram.
8. Enumerate various uses of Cause-and-Effect Diagram.
9. Define and how to draw Flowchart? Discuss.
10. List the benefits of Flowchart.
11. What is a Scatter Diagram? How it is useful in quality control?

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Subject: **Total Quality Management**	
Course Code: **POM-324**	Author: **Dr. Vijender Pal Saini**
Lesson No.: **12**	Vetter: **Dr. Sanjay Tiwari**
JIT, ISO-9000 & Quality Audit	

Structure

1.0 Objectives

After going through this lesson, you will be able to:

- Elaborate the concept of JIT, pre-requisites of JIT Implementation and benefits of JIT system.
- Understand the concept, meaning, importance of IS0-9000.
- Know the importance, significance and process of Quality Audit.

1.1 Just In Time (JIT): Introduction

Just-in-time was invented by Taiichi Ohno of Toyota Motor Company in Japan shortly after World War II. It is a management philosophy which involves providing the right items of the right quality and quantity at the right place and at the right time. JIT is not merely an inventory reduction programme, but is much broader in effect so that the organization operates more efficiently and with minimum resources. (Mukhopadhyay, 1995) JIT is an inventory strategy in which companies increase efficiency and decrease waste by receiving materials only as they are needed in the production process, thereby reducing inventory costs. JIT is an all-encompassing philosophy found on eliminating waste. Anything that does not add value to process is called waste.

The success of just-in-time (JIT) on the production floor in reducing costs, improving quality and enhancing responsiveness has led many firms to attempt to extend the

philosophy to the entire supply chain. The application of JIT to the sourcing arena has become more important in the past few years because the value of purchased inputs, as a percentage of costs of goods sold, has increased steadily in many production environments. Research has indicated that a firm will source outside its home borders if it expects to achieve dramatic and immediate improvement in four critical areas: (Humphreys, Yeung, 1998)

- Cost reduction
- Quality improvement
- Increased exposure to technology
- Delivery and reliability improvements

1.2 Definitions of JIT

Just-in-time is a philosophy which means producing only what is needed, when it is needed, not early, not late; not less, not more. The key target is achieving high volume production using minimal inventories. It is an integrated but simplified system. The JIT mandate is the elimination of all types of waste in the organisation. According to this philosophy, anything which is not generating value is called waste.

Just-in-time (JIT) is a highly coordinated processing system in which goods move through the system, and services are performed, just as they are needed. Supplies and components are 'pulled' through the system to arrive where they are needed when they are needed.

Just-in-time is defined as the production of the minimum number of units in the smallest possible quantities at the latest possible time, which eliminates the need for inventory. It does not mean to produce on time but to produce "just in time".

JIT is defined as an approach for providing smoother production flows and making continual improvements in processes and products. (Svensson, 2001)

The fundamental aim of JIT purchasing is to ensure that production is as close as possible to a continuous process from receipt of raw materials/components through to the shipment of finished goods. The success and resulting performance of purchasing system is based upon cooperation between the purchaser and supplier. Some of the elements of this system are as follows: (i) smoothed flow of materials between suppliers and buyers; (ii) order cost reduction; (iii) stock reduction; (iv) quality; and (v) product simplification (Gunasekaran, 1999).

JIT is more than an inventory system. It is an operational philosophy which includes:

- Short lead time
- A maintenance improvement system
- A quality improvement system
- A productivity improvement system
- Minimum inventory-level
- Closely coupled flow-lines

1.3 Pre-requisites of JIT Implementation

Top management is responsible for change in the organisation. For that sake, it has to create an environment in the organisation. The management has to develop a culture in the organisation. In order for JIT implementation to be successful, the organisation must frame these policies regarding JIT and must get commitment from the employees to follow the guidelines lead down in the policies by words and means. The implementation

of JIT is not just for the sake of change. Most of the organisations implement JIT just for the sake to beat the competitors. In this way they miss the true essence of the philosophy and the results are like half-hearted. The success of JIT philosophy lies in the commitment of the employees. This philosophy covers the whole organisation under one umbrella. All the departments have to work with coordination and follow the guidelines with full spirit. The top executives have to be the leaders involved in JIT and they must be the guiding light for all the employees. So, the success of JIT philosophy depends upon the strategic planning that runs deep in the commitment of all the departments and all the employees. Getting everyone involved and committed is the first step to successful implementation of JIT and the first step to an increase in continuous improvement.

A properly implemented JIT system must have:

- Visible goals
- Produce products as per the customers' requirements
- Continuous improvement of all the processes
- Doing right at first time
- Producing at the rate customers want them
- Delivering right quality and quality at first time
- Produce instantly with zero unnecessary lead time
- Advocating zero waste of labor, material or equipment
- Following zero-defect policy

1.4 Just-in-time Uses/Application

JIT has an enormous impact on a company's profitability, especially in a competitive environment characterized by small profit margins. Furthermore, the application of JIT technologies such as small lot size, lead time reduction and quality improvement play a significant role in achieving JIT purchasing. (Yang & Pan, 2007) The benefits are as follows:

- Part Costs – Low scrap costs; low inventory carrying costs
- Quality – fast detection and correction of unsatisfactory quality, and ultimately higher quality purchased parts
- Capital requirements – reduced rework inventories of purchased parts, raw materials, work-in-progress and finished goods.
- Administrative efficiency – fewer suppliers; minimal expediting and order release work; simplified communications and receiving activities. (Chung & Bakar, 2001)

Other financial benefits of JIT include:

- Lower investments in factory space for inventories and production;
- Less obsolescence risk in inventories;
- Reduction in scarp and rework;
- Decline in paperwork;
- Reduction in direct material costs through quantity purchases. (Kootanaee, Babu, Talari, 2013)

Benefits of JIT implementation include:

- Reductions in lead-time ;
- Inventory-levels reduction;

- Consistent quality improvement culture;
- Zero wastage in the organisation;
- Involvement of employees;
- Stabilize production schedules;
- Increased equipment utilization; and
- Reduction in customer-related problems

Applications of JIT are as follows:

- **Inventory Reduction as a Tool for Improvement**

  Inventory reduction is directly related with cost. Costs are reduced greatly if inventory is reduced.

- **Waste Reduction**

  If any activity that increases cost but does not add value to any process in an organisation is called waste. Eliminate waste of labor, material or equipment. JIT advocates zero waste in organisation.

- **Supplier Relationships**

  There must be good relationship with suppliers. Its helps in getting raw material supply exactly when required.

- **Minimum batch sizes**

  The batch sizes must be kept as small as possible. The defects can be observed easily in small batches.

- **Minimum Movements**

The movements must be kept low in production plants. The computerized equipments are very much helpful in minimising the movements in the plants.

- **Total Quality Assurance**

  The production department must control all the processes time to time to control the variation in the production output in terms of quality. Proper training is very much in the total quality assurance.

- **Preventive Maintenance**

  The inspection after the accident is useless. Preventive maintenance is needed to reduce variation in the process. This requires a regular and complete examination of all the processes on a regular basis.

1.5 ISO-9000: Introduction (International Organisation for Standardisation)

Today is the world of competition and the industries require quality tools to compete and improve the quality of their products and services. It's a very simple to take decision by any organisation to implement ISO-9000. However, without a set of standards it is very difficult to say from where to start and how to start this quality improvement programme? They need standardisation of all the processes to deliver consistent quality to their customers. Generally, the organisations develop standards and guidelines for quality management and quality control purposes. For the same purpose, i.e., to standardise quality requirements, the delegates from 25 countries met at the Institute of Civil Engineers in London in 1946. They decided to create a new international organization for unification of industrial standards all over the world. The new organisation, ISO, officially began operations from the very next year. ISO stands for International

Organisation for Standardisation. It has members from 163 countries. The organisation has formed 3,368 technical bodies for standard development. ISO's headquarter is in Geneva, Switzerland with more than 150 official staff to facilitate the international coordination. ISO-9000 is helpful to show the customers that the organisation have adopted quality procedures, quality processes and quality standards. It helps external auditors to show that all the internal processes are in place and well documented.

ISO is a nongovernmental, worldwide organisation that encompasses the international standards. ISO is derived from the Greek word 'isos', meaning 'equal'. ISO is the world's largest developer of International Quality Standards. The organisations certified with ISO-9000 are assured to have International Quality Standards. The ISO-9000 was developed to effectively design and implement efficient quality systems. The quality standards given by ISO have some specifications for standardisation of products, services and good practice. These standards are developed to help organisation work effectively. The ISO-9000 standards provide a framework that can provide guidance for the processes to be made auditable. These standard practices help the organisations to be more efficient and effective. ISO has published more than 19,500 International Quality Standards covering almost all the areas of technology, manufacturing and business. To follow ISO standards is voluntary. It is not legally to require these standards. But, ISO standards are recognised internationally as these are made by experts and market driven. The ISO quality standards are frequently followed for food safety, data security, agriculture, healthcare industry, information technology, textile, food processing industry education & training etc. Quality Standards developed by ISO impact our lives by giving consistent & confirmed quality and standard products. In fact, it is helpful in raising our standard of living.

1.6 Meaning of Standard

A standard is a document that provides requirements, specifications, guidelines or characteristics. It can be used consistently to ensure that materials, products, processes and services are fit for their purpose. More than 19500 International Standards can be purchased from the ISO store. Originally ISO-9000 standard was published in 1987. It has undergone revisions in 1994, 2000 and 2005. It covers definitions, requirements and continual improvements. The standards are revised at least once in a five year. It can be maintained, modified, or withdrawn.

1.7 Standard Format

- International standards format is:

  ISO[/IEC] [/ASTM] [IS] nnnnn[-p]:[yyyy] Title, where *nnnnn* is the number of the standard, *p* is an optional part number, *yyyy* is the year published, and *Title* describes the subject.

- *IEC* for International Electro-technical Commission is included if the standard results from the work of ISO/IEC JTC1 (the ISO/IEC Joint Technical Committee).

Examples:

i) ISO/IEC TR 17799:2000 Code of Practice for Information Security Management
ii) ISO/TS 16952-1:2006 Technical product documentation — Reference designation system

iii) ISO/IEC Guide 2:2004 Standardization and related activities — General vocabulary

1.8 Eight Principles of Quality Management

ISO standards are based on eight principles of quality management that can be applied by senior managers to improve their organisation:

i) Customer Focus

Customers are the backbone of the organisation. The organisations must have clear understanding of the customers' needs and do their best to meet the needs. Through regular survey the customers' dissatisfaction can be known.

ii) Leadership

Leaders should be ready to take the front positions at the time of problems. Only best leaders can guide their employees the right vision.

iii) Involvement

At the time of requirement or problem, the employees can be involved and their talent as well as skills be utilised.

iv) Process Approach

Companies' activities are managed in the form of processes. The input, transformation and output are managed as a process.

v) System Approach to Management

At this step, all the processes of the organisation are examined thoroughly.

vi) Continuous Improvements

At this step, the management should try to find the long-term and consistent solutions of the problems.

vii) Right Approach of Decision Making

The decision making must be based on the relevant data and information subsequently.

viii) Long Term Relationships with Suppliers

Long term relationships with the suppliers create value.

If, the company has problem(s) like high customer complains, dissatisfaction, poor employees turnover, increased absenteeism, shrinking market share etc. these problems can be managed with the help of having customer focus, leadership, employees' involvement and with right process approach.

1.9 Process for Getting ISO Certificate

Organizations willing to achieve ISO-9000 certification require the following steps:

Step I: The first step is to think and decide at top management about why the organisation should get the ISO-9000 certification, the benefits of the ISO-9000 and the quality culture required in the organisation

Step II: Go through the requirements mentioned in the ISO-9000 standards. Compare the existing work practices being followed in the company with the standards and identify gaps against requirements mentioned in ISO-9000 standards.

Step III: Prepare action plan describing work to be done to fulfil the gap.

Step IV: Arrange trainings to all employees of organization about how to fulfil the gap and achieve ISO-9000 certificate requirements.

Step V: Complete necessary documentation like manual, procedures preparations.

Step VI: Follow the requirements defined in the ISO-9000 standards in routine and overcome difficulties in following the standards.

Step VII: Conduct internal audit.

Step VIII: Contact ISO certification agencies and sign a 3 years contract with them.

Step IX: After ensuring adequate preparations for audit, call certification agency for stage 1 audit.

Step X: Fulfil the gap/shortcomings given by certification agencies during stage 1 audit.

Step XI: Call certification agency for stage 2 (final) certification audit.

Step XII: Fulfil the gap/shortcomings given by certification agency during stage 2 certification audit.

Step XIII: You will receive ISO-9000 certificate after 4-6 weeks of successful completion of stage 2 certification audit.

Step XIV: The organisation can use ISO-9000 logo as per recommendation of certification agency.

1.10 Benefits of ISO-9000

There are many benefits of ISO-9000 as followings:

- **Standardisation Process**

ISO-9000 standards are recognised internationally. It assures all the processes are standardised. These standards help organisations to work effectively. These standards bring technological uniformity. They help to standardise the processes of manufacturing of products and services.

- **Quality Purpose**

ISO certification assures customers that the organisation has designed and managed its process according to the standards led down by ISO to assure delivery of a quality product. Conformity to ISO-9000 assures consumers that products and services are safe, reliable, efficient and meeting all the quality parameters.

- **Waste Reduction**

ISO certification is helpful in setting standard processes which lead to reduction in scraps, wastes etc.

- **Accessibilities of New Markets**

The standards help companies to access new markets. It facilitates free and fair global trade.

- **Cost Reduction**

The ISO-9000 is beneficial for the organisations because it is helpful in cost savings as the operations are standardised and wastes, errors are lowered drastically.

- **Customers' Satisfaction**

Ultimately the customers get quality products and services which generate customer satisfaction. Increase in customer satisfaction and increase in sales means the market size of the organisation is increasing. ISO-9000 standards on road safety, toy safety and secure medical packaging help to make the world a safer place for happy living.

The organisations are required to complete the necessary documentation like manual, procedures preparations. Let's take an example of education industry where if an institution / university want to get ISO-9000 certificate then they have to maintain proper record of different activities conducted in the different departments in the standard proformas. The following is a proforma for quality maintenance in labs and workshops:

Proforma 1

INDICATIVE ISO IMPLEMENTATION CHECK LIST FOR VARIOUS LABS/WORKSHOPS:

Name of Dept./Lab/WS_____

Name of Lab/WS/In-charge_____

N	**ACTIVITY**	**STATUS***		
1	Is the name & code no. of the Lab/WS displayed at the entrance?	**AS ON**	**AS ON**	**AS ON**

2	Is the name of Lab/WS In-charge displayed at the entrance?			
3	Is Notice Board available inside the Lab/WS?			
4	Is list of experiment displayed on the notice board?			
5	Is total investment made in Lab/WS displayed on the notice board?			
6	Is list of staff available with In-charge of Lab/WS?			
7	All types/kind of fittings in order.			
8	General Housekeeping/Cleanliness in order.			
9	No loose wire seen			
10	All electrical connections in order.			
11	All fans/tubes/bulbs in order.			
12	All side boards clean and empty of broken/junk equipment.			
13	List of equipment/experiment displayed in cup board/almirah against each rack.			
14	Equipment/experiment in cup board/almirah kept in order.			
15	All models of experiments available in Lab/WS are in working order & complete.			
16	For equipment under breakdown, corrective & preventive action being taken in time.			
17	Register for breakdown being maintained and monitored by HoD/In-charge.			
18	Equipment/experiments being offered to students in working order and validated.			

19	Journal/Working copies of experiments up-dated and available.			
20	Training needs of Faculty/Staff being identified, organized and record kept by HoDs.			
21	Perception Surveys for studens/parents/faculty being done and analysis of data and Action Plan to improve documented.			
22	Display of charts/important scientists, as per Lab/WS displayed prominently.			
23	Working models of equipments displayed for knowledge of students like computer, sample of experiment like annealing etc.			
24	Arrangement for keeping bags of students in Lab/WS.			
25	Arrangement of students' books for examination properly placed in Lab/WS.			

1.11 Quality Audit: Introduction

Firstly, the customer is the focus for all the organisations. Everybody wants to lower down the complaints and increase the customer satisfaction level. For that sake, the organisations are running various quality improvement programmes. These types of programmes require constant monitoring/examination to product quality products and services and to remain competitive in the market. Secondly, when the size of the organisation increases, its operations and internal as well as external processes require consistent improvement in terms of quality. This is possible only when a consistent quality monitoring programme is going to take place. Hence the organisations require quality audit programme for consistent quality mentoring.

Quality Audit: Definition

Quality audit is defined as a systematic and independent monitoring to determine whether activities and related results comply with planned manuals and whether these manuals are implemented effectively and are suitable to achieve objectives.

A quality audit is a process by which the management reviews and evaluates an element of the business to ensure that it is meeting certain standards.

A quality audit can be applied to various aspects of a business, like it can be applied on inventory or service, employees, management, or databases.

A quality audit is a regular monitoring of all or part of quality system with specific aim of improving the operations and processes to maintain the quality. A quality audit compares what the quality is and what quality is supposed to be. There it cannot be conducted unless all the activities are properly documented. It is usually conducted by outside experts or team appointed by management. Quality standards are used for audit purposes. These standards can be the standards set by a company itself or by the International Organization for Standards (ISO) or American National Standards Institute (ANSI) or six sigma quality standards or Indian Standards Institute (ISI). All these standards provide framework and guidelines about how to conduct proper documentation about the activities conducted in the organisation which are supposed to be audited.

Quality audit is the process of systematic monitoring of a quality system carried out by an internal or external quality auditor or by an audit team with the aim of improving the operations and processes. For quality audit, quality manual is required and quality manual is describes what the quality is supposed to be. A quality audit is a process by which the management reviews and evaluates an element of the business to ensure that it is meeting certain standards. It is an important part of 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. 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 organisation, 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.

1.12 Objectives of Quality Audit

The objectives of the quality audit are as followings:

- Quality audit monitors and drives continuous improvement in quality.
- It ensures quality of the product and determines the required improvement.
- It assesses effectiveness of quality assurance system.
- The management knows problems or potential problems by quality audit.
- It ensures timely correction of problems.
- It shows management support of the quality program and establishes high degree of confidence, trust, understanding and communication among internal employees.

- It ensures that a company or product meets quality standards.
- It is helpful to promote understanding, confidence and communication with external customers like suppliers.

1.13 Types of Quality Audit

There are three types of quality audits, namely, first party (internal), second party (external) and third party (extrinsic) audits.

i) First party quality audit (Internal audit)

When an organization conducts an audit on its own quality system with the help of its own staff / external consultants, the audit is known as first part quality audit or internal quality audit. It is used to measure its own strengths and weaknesses against the requirements. Internal audits examine that an organization is meeting its own quality standards. There are two problems in internal audit. One, the auditing staff may not be trained and efficient to conduct quality audit and second, there are maximum chances of biasness.

ii) Second party quality audit (external quality audit):

One organisation auditing another with which it has or going to have a contract or agreement for the supply of goods or services is called second party quality audit. Let's take an example of the purchasing organization and supplier organization. Here, the second party quality audit is performed by purchasing organisation on supplier organisation. The motive of quality audit here is to have an assessment of the supplier's processes in order to have confidence that the supplier would be able to supply goods or services of an agreed quality level on a sustained basis. The supplier audit will include the

quality management system involved in the production of goods and service provided. Purchasing organization give this task to their trained and experienced employees or an outside agency is hired by them.

iii) Third party quality audit (extrinsic audit):

The third party quality audit is conducted by an independent agency like ISO registered bodies. As for example, USFDA (United States Food and Drugs Administration) regularly conducts quality audit in Indian pharmaceutical companies like Dr. Reddy, Cipla, Lupin etc. regularly and time to time give guidelines and generates notices after the quality audit. As our companies are selling medicines in USA, so USFDA conducts quality audits to raise the standards of the manufacturing of medicines in India companies and quality drugs can be produced. Third party audits normally results in the disruption of day-to-day activities of the organization being audited during the duration of the audit. Apart from the registered certification bodies, the third part audit may also be conducted by some government departments dealing with environment and pollution, health and safety, atomic energy etc. A third party external audit can be done to attain or maintain certification in a quality standard.

1.14 Quality Audit Process

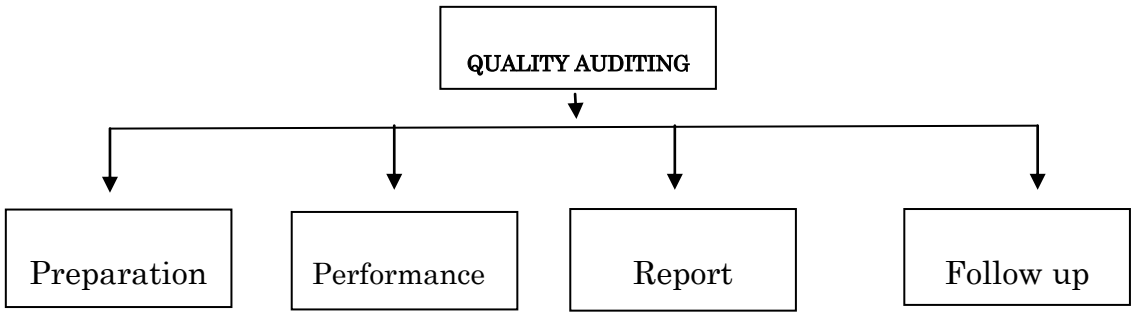

Figure 12.1: Quality Audit Process

Quality Audit process follows the following four stages:

Stage 1: Planning Quality Audit

- It determines the quality audit focus in the organisation.
- The team(s) is selected.
- The quality manual or standards are published at this stage.
- Quality schedules are prepared.

Stage 2: Conducting Quality Audit

- The quality audit is conducted at this stage.
- The main task is to evaluate the actual performance with the standard performance.

Stage 3: Report Writing

- In this stage, the gap(s) are reported in performance, if any.
- The corrective action is determined.

Stage 4: Follow Up

- It is the time to take correction action.
- The findings are updated in the report when actions are completed.
- Last step is to follow up.

1.15 Significance of Quality Audit

Performing quality audits are important for key reasons. The most important is that it is helpful in detecting the potential problems and helpful in minimising the business risk.

The quality programmes running in the organisation are effectively evaluated with the help of quality audit. The knowledge of the current status of these types of programmes is must for smooth running of the organisation.

Quality audit ensures that the business is offering a value to the customers through high-quality product or services. It can increase future sales. It gives information to the customers that the company is committed to quality standards and performs regular audits programmes. It helps to increase consumer confidence in the business. Finally, regular quality audits help protect the business from issues that could arise from selling a poor quality product.

1.16 Summary

Just-in-time is a philosophy which means producing only what is needed, when it is needed, not early, not late; not less, not more. The key target is achieving high volume production using minimal inventories. It is an integrated but simplified system. According to this philosophy, anything which is not generating value is called waste. JIT advocates minimising all types of wastes. Top management is responsible for change in the organisation. For that sake, it has to create an environment in the organisation. The management has to develop a culture in the organisation. In order for JIT implementation to be successful, the organisation must frame these policies regarding JIT and must get commitment from the employees to follow the guidelines lead down in the policies by words and means. The implementation of JIT is not just for the sake of change. Most of the organisations implement JIT just for the sake to beat the competitors. In this way they miss the true essence of the philosophy and the results are like half-hearted. The success of JIT philosophy lies in the commitment of the employees. This philosophy covers the

whole organisation under one umbrella. All the departments have to work with coordination and follow the guidelines with full spirit. The top executives have to be the leaders involved in JIT and they must be the guiding light for all the employees. Getting everyone involved and committed is the first step to successful implementation of JIT and the first step to an increase in continuous improvement. **The ISO-9000** standard was published in 1987 by International Organisation for Standardisation, had undergone revision in 2000 and 2005. It covers definitions, requirements, and continual improvements. To follow ISO standards is voluntary. It is not legally to require standards. But, the standards are recognised internationally. ISO-9000 standards are developed to effectively design and implement efficient quality systems. These provide a framework that can provide guidance for the processes to be made auditable. These standards help organisations to work effectively. ISO-9000 standards are market driven designed by experts. These standards are reviewed once in five years to decide whether to modify, maintained or withdrawn. ISO-9000 is helpful to show the customers that the organisation have adopted quality procedures, quality processes and quality standards. It helps external auditors to show that all the internal processes are in place and well documented. ISO-9000 standards implementation shows that all the processes used for manufacturing products are audited internally and well documented. The ISO quality standards are frequently followed for food safety, data security in computers, agriculture, healthcare industry, education institutions etc. In fact, Quality Standards developed by ISO impact our lives by giving quality and standard products and raising standard of living. **Quality audit** is defined as a systematic and independent monitoring to determine whether activities and related results comply with planned manuals and whether these manuals are implemented effectively and are suitable to achieve objectives. A quality audit is a process by which the management reviews and evaluates an element of the business to

ensure that it is meeting certain standards. A quality audit can be applied to various aspects of a business, like it can be applied on inventory or service, employees, management, or databases. The objectives of the quality audit are to monitor and drives continuous improvement in quality. It ensures quality of the product and determines the required improvement. It assesses effectiveness of quality assurance system. The management knows problems or potential problems by quality audit. It ensures timely correction of problems. It shows management support of the quality program and establishes high degree of confidence, trust, understanding and communication among internal employees. There are three types of quality audits, namely, first party (internal), second party (external) and third party (extrinsic) audits. Quality audit ensures that the business is offering a value to the customers through high-quality product or services. It gives information to the customers that the company is committed to quality standards and performs regular audits programmes. It helps to increase consumer confidence in the business. Finally, regular quality audits help protect the business from issues that could arise from selling a poor quality product.

1.17 Keywords

Just-in-time

It is defined as the production of the minimum number of units in the smallest possible quantities at the latest possible time, which eliminates the need for inventory.

Standard

A standard is a document that provides requirements, specifications, guidelines or characteristics. It can be used consistently to ensure that materials, products, processes and services are fit for their purpose.

Quality Audit

It is the process of systematic examination of a quality system carried out by an internal or external quality auditor or by an audit team with specific aim of improving the operations and processes.

1.18 Self Assessment Questions

1. What you understand about Just-In-Time technique of total quality management?
2. Define Just-In-Time. What are advantages and limitations of Just- In-Time?
3. Discuss the benefits of implementation of JIT system in manufacturing.
4. What are the objectives of ISO-9000?
5. State the benefits of ISO-9000.
6. Discuss the process of ISO-9000 certification.
7. Define quality audit. What are its benefits?
8. Enumerate and elaborate the types, significance and quality audit process.

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