TECHNIQUES OF QUALITY CONTROL

By

Yogendra Mani Tripathi – Asst. Professor

Faculty of Management and Technology, Harish Chandra PG College

LECTURE CONTENT

- Quality Circle
- 7 QC Tools
- Six Sigma
- ISO 9000-2000 Clauses
- Total Productive Maintenance
- 5S – Japanese system of Quality Control

Quality Circle

A quality circle is a group composed of regular employees who meet together to discuss workplace improvement, and make presentations to management with their ideas. The concept was invented in the United States and introduced in post-war Japan in the early 1950s.

Philosophy of Quality Circle

The Philosophy of QCC is based on the concepts of Participative management and Humanistic management. Humanistic management refers to management that gives importance to people and their feelings. This is because people are the most valuable asset of ‘a department.

Participative management means that worker regardless of his / her position in the organisation is given the opportunity to make meaningful contribution to the department.

QCC is, therefore a mechanism whereby workers are able to participate in the problem-solving process leading to improvement of quality and productivity in their department.

Objectives of Quality Circle

The objective of QCC is to improve and upgrade quality of work through:

(a) The problem solving capability of the workers;

(b) Team work;

(c) The cultivation and assimilation of positive values and work ethics;

(d) Involvement and interest in work;

(e) High motivation for work; and

(f) Awareness of responsibility towards oneself, the group, the department / office and the nation.

Function of Quality Circle

The primary function of QCC is to constitute a group of employees who perform similar duties and meet at periodic intervals, often with management, to discuss work-related issues and to offer suggestions and ideas for improvements, as in production methods or quality control.

The ideal size of a quality circle is from eight to ten members.

7 Quality Control (QC) Tools

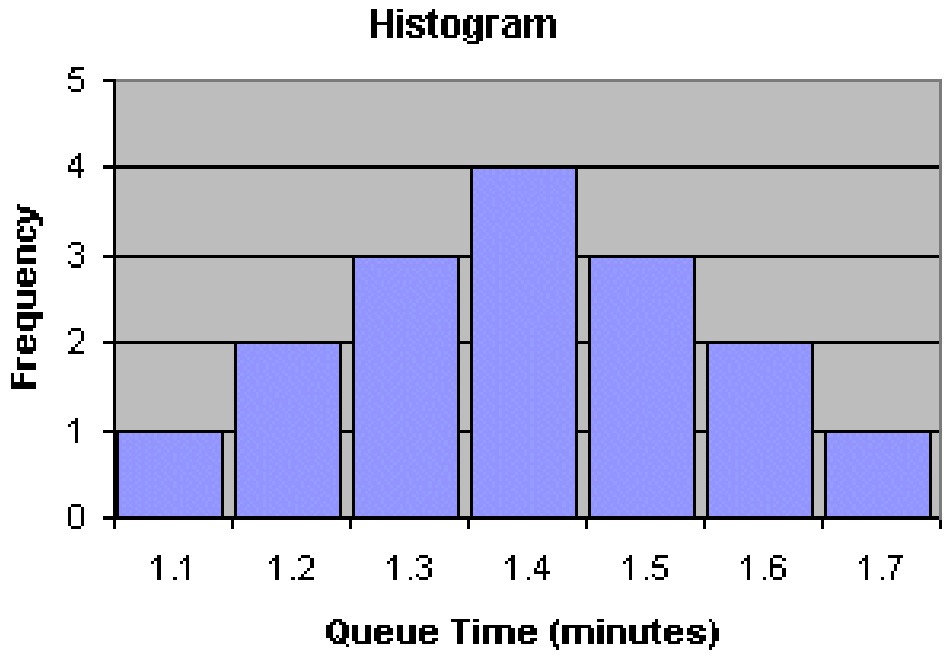
QC tools are the means for collecting data, analyzing data, identifying root causes of any problems and measuring the results. These tools are used to identify, analyze and resolve problems relating to different domains.

The QC tools have been categorized into the following 7 categories

- Cause and Effect Diagram
- Pareto Diagrams
- Check Sheets
- Control Charts
- Flowchart
- Histograms
- Scatter Diagrams

1. Histogram

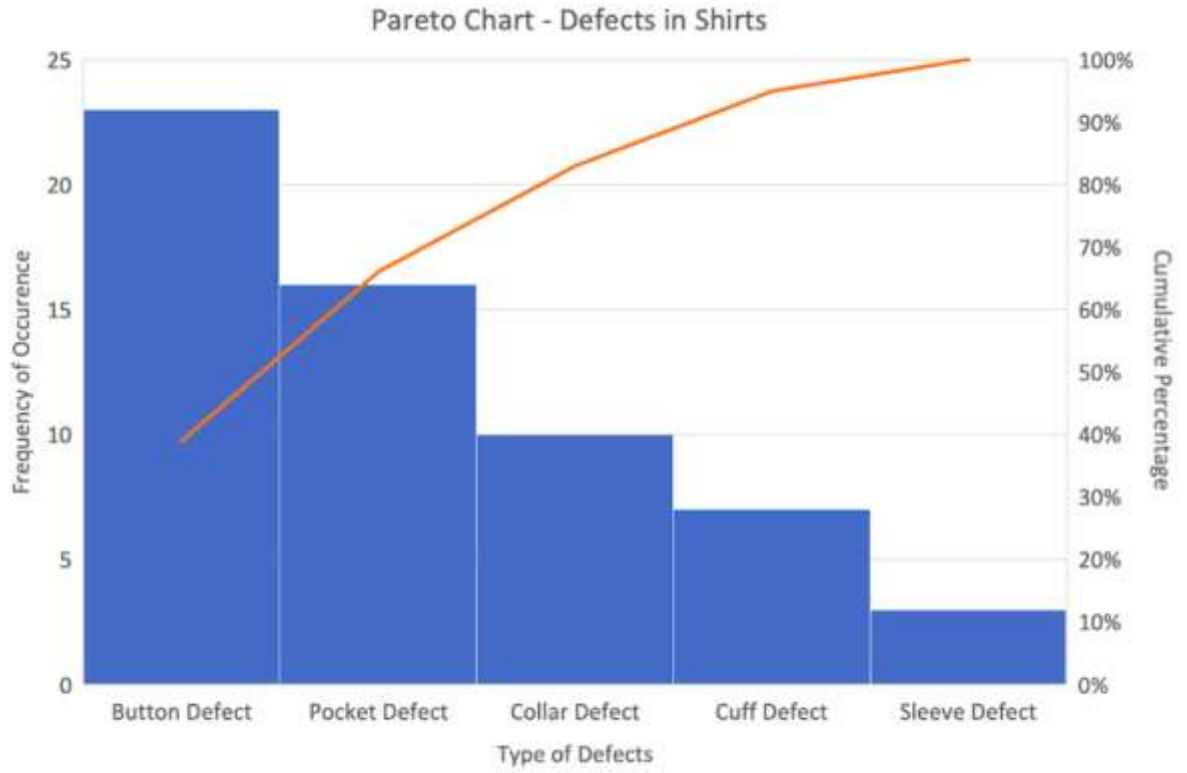
A histogram is a tool for summarizing, analyzing, and displaying data. It provides the user with a graphical representation of the amount of variation found in a set of data. Histograms sort observations or data points, which are measurable data, into categories and describe the frequency of the data found in each category.



2. Pareto Chart

A **Pareto chart** is a type of **chart** that contains both bars and a line **graph**, where individual values are represented in descending order by bars, and the cumulative total is represented by the line.

It indicates the frequency of defects, as well as their cumulative impact. **Pareto Charts are** useful to find the defects to prioritize in order to observe the greatest overall improvement.



A Pareto Chart for the defects in shirts.

1) Each bar usually represents a type of defect or problem. The height of the bar represents any important unit of measure — often the frequency of occurrence or cost.

2) The bars are presented in descending order (from tallest to shortest). Therefore, you can see which defects are more frequent at a glance.

3) The line represents the cumulative percentage of defects.

3. Check Sheets

Check sheets is a statistical quality control tool which allow the user to collect data from a process in an easy, systematic, and organized manner.

Also, data collected using check sheets can be used as input data for other quality tools such as Pareto diagrams.

There are four main types of check sheets used for data collection (custom check sheets can also be designed to fit specific needs):

A. Defective Item Check Sheet:

This type of check sheet is used to identify what types of problems or defects are occurring in the process. Usually these check sheets will have a list of the defects or problems that may occur in the process. When each sample is taken, a mark is placed in the appropriate column whenever a defect or a problem has been identified. The type of data used in the defective item check sheets is countable data. Table 1 below shows an example of a defective item check sheet for the wave solder manufacturing process.

Table 1. Wave Solder Defect Count.

Defect Type	Insufficient Solder	Cold Solder	Solder Bridge	Blow Holes	Excessive Solder
Frequency	xxxxxxx	xx	xxx	xxxxxxxxxxxxx	xx
Total	7	2	3	14	2

B. Defective Location Check Sheet:

These type of check sheets are used to identify the location of the defect on the product. They are used when the external appearance of the product is important. Usually this type of check sheet consists of a picture of the product. On this picture, marks can be made to indicate were defects are occurring on the surface of the product.

C. Defective Cause Check Sheet:

This type of check sheet tries to identify causes of a problem or a defect. More than one variable is monitored when collecting data for this type of check sheets. For example, we could be collecting data about the type of machine, operator, date, and time on the same check sheet. Table 2 below is an example of this type of check sheets. As we can see most of the error is occurring at machine 2 and at the afternoon shift. This could suggest that machine 2 has problems when it is run in the afternoon shift.

Table 2. Defect cause check sheet.

		Machine 1	Machine 2
Operator A	Morning	X	X
	Afternoon	XX	XXXXXX
Operator B	Morning	X	XX
	Afternoon	XX	XXXXXXXXX

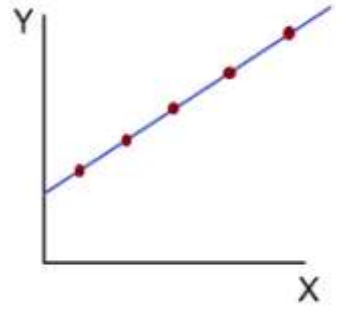
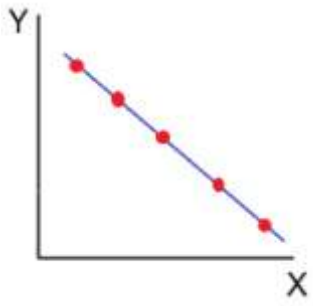
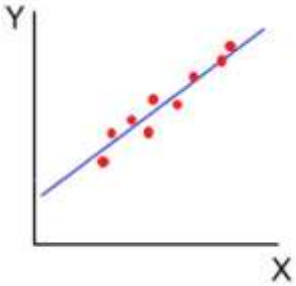
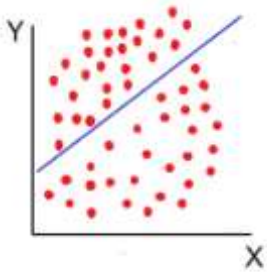
X= Number of times the supervisor is called per day.

D. Checkup Confirmation Check Sheet:

This type of check sheet is used to ensure that proper procedures are being followed. These check sheets usually will have a list of tasks that need to be accomplished before the action can be taken. Examples of checkup confirmation check sheets are final inspection, machine maintenance, operation checks, and service performance check sheets.

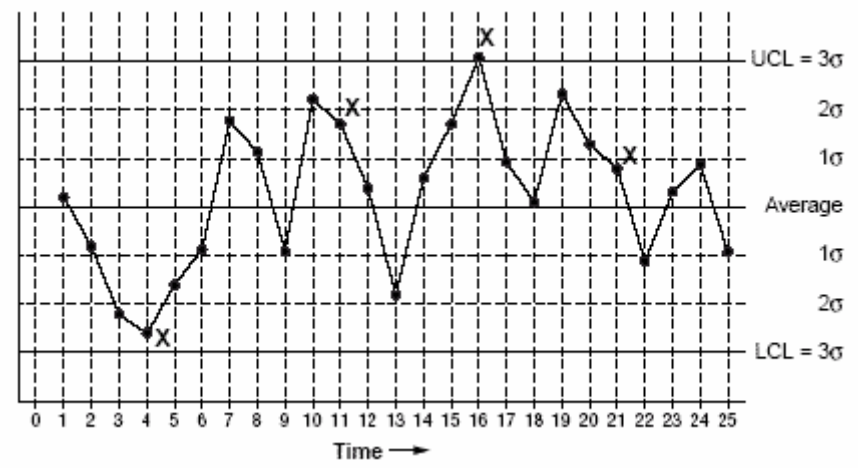
4. Scatter Diagrams

A scatter diagram is a non-mathematical or graphical approach for identifying relationships or correlations that might exist between two different numeric variables on horizontal and vertical axis of a graph. This graphical approach is quick, easy to communicate to others, and generally easy to interpret.

Case-1: Perfect Positive Correlation (r=+1) 	Case-2 : Perfect Negative Correlation (r=-1) 
Case-3: High Degree of Positive Correlation 	Case – 4: No Correlation 

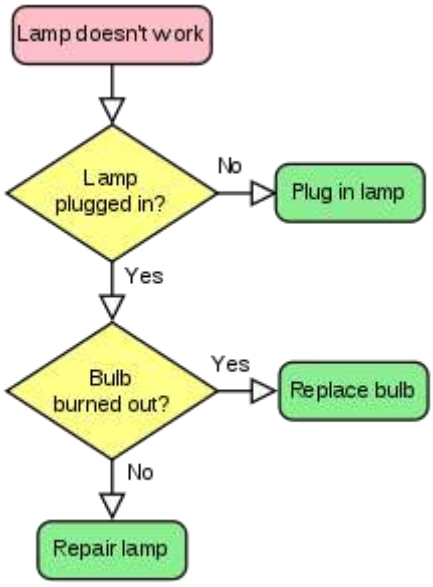
5. Control Charts

Also called as Shewhart chart or statistical process control chart, it can be defined as a graph used to study how a process changes over time. Data are plotted in time order. A control chart always has a central line for the average, an upper line for the upper control limit, and a lower line for the lower control limit. These lines are determined from historical data. By comparing current data to these lines, you can draw conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation).



6. Flow Chart

A **flowchart** is a type of diagram that represents a workflow or process. A **flowchart** can also be defined as a diagrammatic representation of an algorithm, a step-by-step approach to solving a task. The **flowchart** shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows.

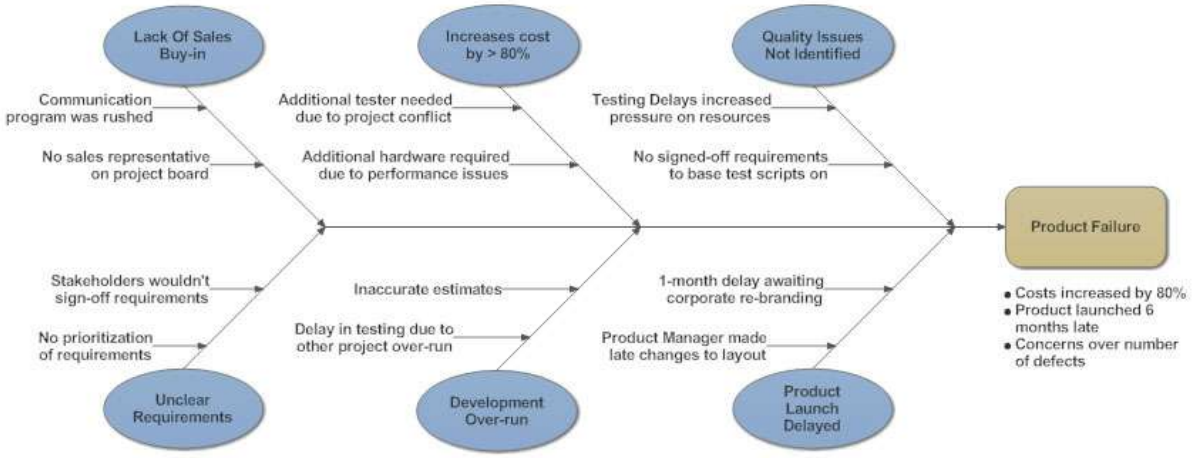


7. Cause and Effect Diagram

A cause and effect diagram examines why something happened or might happen by organizing potential causes into smaller categories. It can also be useful for showing relationships between contributing factors. One of the Seven Basic Tools of Quality, it is often referred to as a **fishbone diagram** or **Ishikawa diagram**.

One of the reasons cause & effect diagrams are also called fishbone diagrams is because the completed diagram ends up looking like a fish's skeleton with

the fish head to the right of the diagram and the bones branching off behind it to the left.



Action Plan:
- Carry out review of testing approach and procedures (QA Manager)
- Source suitable requirements and estimating training for development team (HR)
- Arrange meeting with Sales to revitalize product support (Project Manager)
- Revisit project communications to ensure clear project massage has been given (Project Manager)

Six Sigma – Tool of Quality Control

A SIGMA process refers to a process or methodology through which we come to know at what distance, in terms of standard deviation, the specified limits are placed from the QUALITY target value or in other words **the total number of defects or defective product allowed per million products manufactured**.

The Sigma scale of measure is perfectly correlated to such characteristics as defects-per-unit, parts-per-million defective, and the probability of a failure/error.

The concept was introduced in the year 1985-86 by Motorola Company and was later on popularized by GE and Allied Signals once they started using this methodology for manufacturing process in 1994-96. At present it is being practised in almost all the sectors of economy including both Govt and Private Sector.

In the early period of evolution, all emphasis regarding the statistical process control, were designed on the basis of 3 Sigma limits. However, with gradual improvement in technology and the production technique, this concept was challenged and the organization pushes their boundaries to start looking for quality levels beyond 3 Sigma.

Sigma Rating	PPM (Defect per million opportunity)	% Quality	Quality Benchmarks
1	690,000 defects		POOR
2	308,537 defects		POOR
3	66,807 defects	99.73	AVERAGE
4	6,210 defects	99.9937	AVERAGE
5	233 defects	99.999943	WORLD CLASS
6	3.4 defects	99.9999998	WORLD CLASS

It can be therefore summarized as a culture of continuous improvement where emphasis on improving business performance through greater customer satisfaction, profitability & competitiveness by process improvement and also learning to build processes that delivers flawless quality of output continuously.

ISO 9001:2015 – Quality Management System

ISO 9001 is defined as the international standard that specifies requirements for a quality management system (QMS). Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements. It is the most popular standard in the ISO 9000 series and the only standard in the series to which organizations can certify.

ISO 9001 was first published in 1987 by the International Organization for Standardization (ISO), an international agency composed of the national standards bodies of more than 160 countries. The current version of ISO 9001 was released in September 2015.

Scope of ISO 9001:2015 QMS

ISO 9001 is based on the plan-do-check-act methodology (PDCA cycle) and provides a process-oriented approach to documenting and reviewing the structure, responsibilities, and procedures required to achieve effective quality management in an organization. Specific sections of the standard contain information on many topics, such as:

- Requirements for a QMS, including documented information, planning and determining process interactions
- Responsibilities of management
- Management of resources, including human resources and an organization's work environment
- Product realization, including the steps from design to delivery
- Measurement, analysis, and improvement of the QMS through activities like internal audits and corrective and preventive action

Fig: 7 Principles of ISO 9001:2015 Certificate

Total Productive Maintenance (TPM)

Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.

TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

Why TPM ?

TPM was introduced to achieve the following objectives. The important ones are listed below.

- Avoid wastage in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.
- Produce a low batch quantity at the earliest possible time.
- Goods send to the customers must be non defective.

Motives of TPM	1. Adoption of life cycle approach for improving the overall performance of production equipment. 2. Improving productivity by highly motivated workers which is achieved by job enlargement. 3. The use of voluntary small group activities for identifying the cause of failure, possible plant and equipment modifications.
Uniqueness of TPM	The major difference between TPM and other concepts is that the operators are also made to involve in the maintenance process.
TPM Objectives	1. Achieve Zero Defects, Zero Breakdown and Zero accidents in all functional areas of the organization. 2. Involve people in all levels of organization. 3. Form different teams to reduce defects and Self Maintenance.
Direct benefits of TPM	1. Increase productivity and OPE (Overall Plant Efficiency) by 1.5 or 2 times. 2. Rectify customer complaints. 3. Reducethe manufacturing cost by 30%. 4. Satisfy the customers needs by 100 % (Delivering the right quantity at the right time, in the required quality.) 5. Reduce accidents. 6. Follow pollution control measures.
Indirect benefits of TPM	1. Higher confidence level among the employees. 2. Keep the work place clean, neat and attractive. 3. Favorable change in the attitude of the operators. 4. Achieve goals by working as team. 5. Horizontal deployment of a new concept in all areas of the organization. 6. Share knowledge and experience. 7. The workers get a feeling of owning the machine.

5S – KAIZEN based Japanese system of Quality Control

5S stands for 5 initials of the following Japanese words

- Seiri – Sort
- Seiton – Set in order
- Seiso – Shine
- Seiketsu – Standardize
- Shitsuke – Sustain

- The first step of 5S, - Sort,
  It involves going through all the tools, furniture, materials, equipment, etc. in a work area to determine what needs to be present and what can be removed.

- Seiton – Set in order – It ensures that all items are organized and each item has a designated place. It organizes all the items left in the workplace after sorting in a logical way so they make tasks easier for workers to complete.

- Seiso – Shine
  The Shine stage of 5S focuses on cleaning up the work area, which means sweeping, mopping, dusting, wiping down surfaces, putting tools and materials away, etc. In addition to basic cleaning, Shine also involves performing regular maintenance on equipment and machinery.

- Seiketsu – Standardize
  Standardize systematizes everything that just happened and turns one-time efforts into habits. It assigns regular tasks, creates schedules, and posts instructions so these activities become routines and constitute the part of standard operating procedures.

- Shitsuke – Sustain
  Sustain new practices and conduct audits to maintain discipline. This means the previous four S's must be continued over time. This is achieved by developing a sense of self-discipline in employees who will participate in 5S.