Total Quality Management (TQM)

The principles of TQM

The primary objective of TQM is to achieve customer satisfaction by involving people which deal with product manufacturing, either directly or indirectly. To accomplish customer satisfaction, TQM operates on the basis of the following principles:

1. Involve and respect people associated with the organization, including personnel, customers and suppliers.
2. Processes, not people are the problems
3. Every employee is responsible for quality
4. Everyone is a customer and a supplier
5. Prevent problems: Do not wait for them to occur and then fix
6. Involve the processes of preparing and delivering products and services to customers
7. Quality improvement must be continuous
8. Quality must be managed
9. Plan and organize for quality improvement
10. The quality standard is defect free
11. Goals are based on requirements
12. Life cycle costs, not front end costs

Specific concepts making up the philosophy of TQM

Following are important concepts that make up the philosophy of total quality management.

(1) Customer Focus

The first and overriding feature of TQM is the company's focus on its customers. Quality is defined as meeting or exceeding customer expectations. The goal is to first identify and then meet customer needs. We can say that quality is **customer driven**. However, it is not always easy to determine what the customer wants, because tastes and preferences change. Also, customer expectations often vary from one customer to the next.

(2) Continual Improvement (Continuous improvement)

A philosophy of never-ending improvement which is another concept of the TQM philosophy. Continual improvement requires that the company continually struggle to be better through learning and problem solving. Now let's look at two approaches that can help companies with continual improvement: the plan –do– study – act (PDSA) cycle and benchmarking.

(a) The plan–do–study–act (PDSA) cycle or PDC(check)A cycle comprises of following specific steps.

Plan

Managers must evaluate the current process and make plans based on any problems they find.

Do

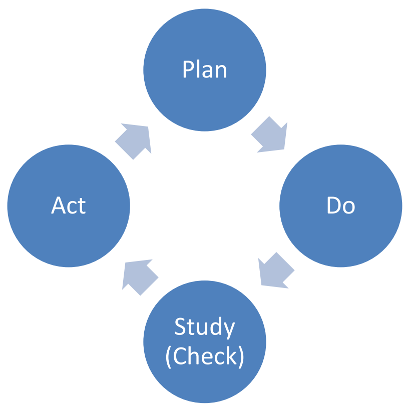
In this step implementation of the plan is done. During the implementation process managers should document all changes made and collect data for evaluation.

Study (or check)

The collected data are evaluated to see whether the plan is achieving the goals established in the plan.

Act

Action is carried out on the basis of the results of the first three phases. The best way to accomplish this is to communicate the results to other members in the company. After we have acted, we need to continue evaluating the process, planning, and repeating the cycle again.



(b) Benchmarking

Companies implement continuous improvement by studying business practices of companies considered “best in class”. The ability to learn and study how others do things is an important part of continuous improvement.

(3) Employee Empowerment

Part of the TQM philosophy is to empower all employees to seek out quality problems and correct them. In TQM, the role of employees is very different from what it was in traditional systems. Workers are empowered to make decisions relative to quality in the production process.

They are considered a vital element of the effort to achieve high quality. Their contributions are highly valued and their suggestions are implemented.

(4) Team Approach

The use of teams is based on the old adage (saying) that "two heads are better than one."Using techniques such as brainstorming, discussion and quality control tools, teams work regularly to correct problems. The contributions of teams are considered vital to the success of the company. Teams vary in their degree of structure and formality, and different types of teams solve different types of problems.

One of the most common types of teams is the **quality circle –** a team of volunteer production employees and their supervisors whose purpose is to solve quality problems. The circle is usually composed of eight to ten members, and decisions are made through group consensus. Open discussion is promoted and criticism is not allowed.

(5) Process Management

According to TQM, a quality product comes from a quality process. This means that quality should be built into the process. **Quality at the source** is the belief that it is far better to uncover the source of quality problems and correct it than to discard defective items after production. If the source of the problem is not corrected, the problem will continue. For example, if you are baking cookies, you might find that some of the cookies are burnt. Simply throwing away the burnt cookies will not correct the problem. You will continue to have burnt cookies and will lose money when you throw them away. It will be far more effective to see where the problem is and correct it. For example, the temperature setting may be too high; the pan may be curved, placing some cookies closer to the heating element; or the oven may not be distributing heat evenly. Quality at the source exemplifies the difference between the old and new concepts of quality.

(6) Managing Supplier Quality

The TQM extends the concept of quality to a company's suppliers. Traditionally, companies tended to have numerous suppliers that engaged in competitive price bidding. The TQM views inspection of materials arrived to check their quality. The TQM views this practice as wasting time and cost. The philosophy of TQM extends the concept of quality to suppliers and ensures that they engage in the same quality practices. If suppliers meet preset quality standards, materials do not have to be inspected upon arrival.

(7) Use of Quality Tools (or may be statistical analysis tools)

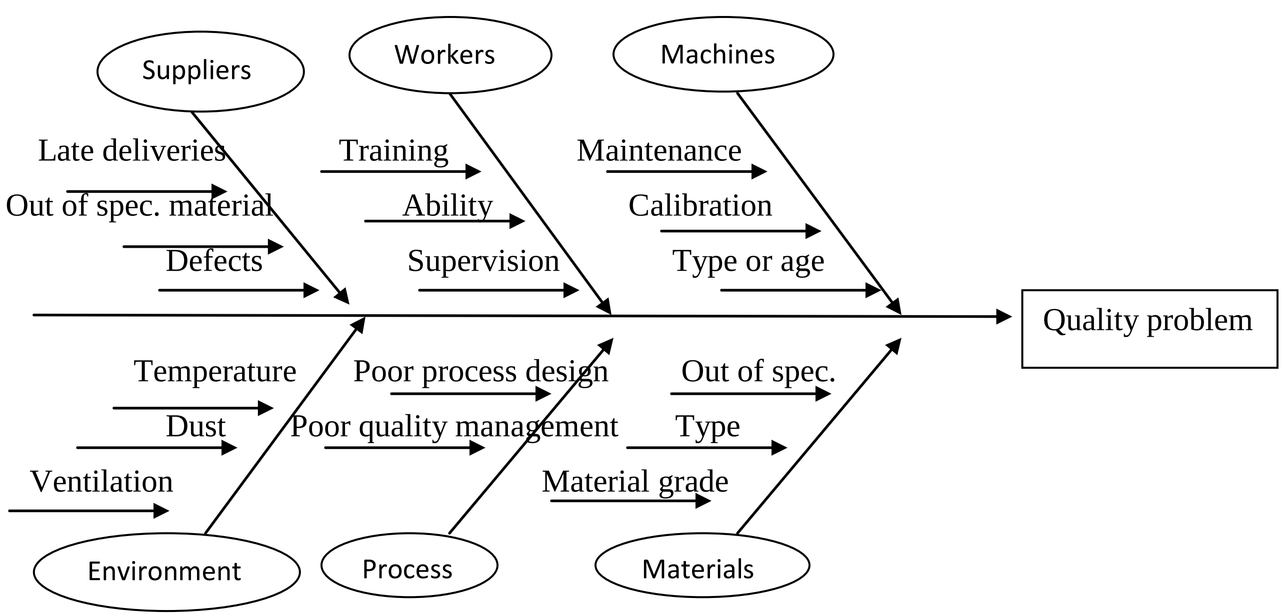
Quality tools can be used to evaluate the acceptability of product quality, to evaluate causes of quality problems, such as long transit time or poor refrigeration. There are seven different quality tools which are extremely useful in identifying and analyzing quality problems.

(a) Data sheet

Data from a table, form, query or procedure displayed in a row-and-column format is called data sheet.

(b) Cause-and-effect diagrams

The diagrams help to identify potential causes for particular quality problems. These are also known as Ishikawa diagram or fishbone, because it is drawn to resemble the skeleton of a fish. They are typically constructed through brainstorming techniques. They are often called fishbone diagrams because they look like the bones of a fish. The "head" of the fish is the quality problem. The diagram is drawn so that the "spine" of the fish connects the "head" to the possible cause of the problem. These causes could be related to the machines, workers, measurement, suppliers, materials, and many other aspects of the production process (Fig). Each of these possible causes can then have smaller "bones" that address specific issues that relate to each cause. For example, a problem with machines could be due to a need for maintenance, calibration or old equipment. Similarly, a problem with workers could be related to lack of training.



Cause-and-effect diagrams are problem-solving tools commonly used by quality control teams. Specific causes of problems can be explored through brainstorming. The development of a cause-and-effect diagram requires the team to think through all the possible causes of poor quality.

(c) Flowchart

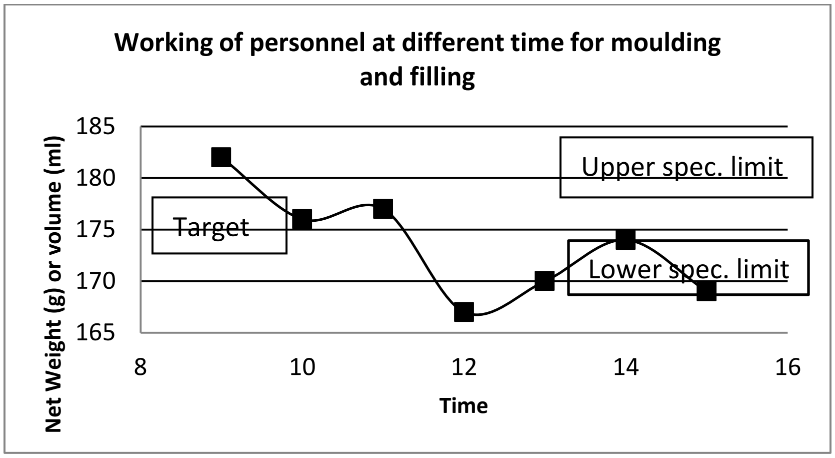
A schematic diagram of the sequence of steps involved in an operation or process is called flow chart. Flowcharts provide an excellent form of documentation for a process operation and are useful to examine how various steps in an operation work together. In the flowchart, each process is written inside the blocks and each block is connected with an arrow to show where that process leads. By seeing the steps involved in an operation or process, everyone develops a clear picture of how the operation works and where problems could arise.

(d) Checklist

A tool used to ensure that all important steps or actions in an operation have been taken. A checklist contains items that are important or relevant to an issue to situation.

(e) Control charts

These are very important quality control tools. Charts used to evaluate whether a process is operating within expectations relative to some measured value such as weight, width, or volume of a product. For example, we could measure the weight of a bread or the volume of a bottle of a drink. When the production process is operating within expectations, we say that it is "in control." To evaluate whether or not a process is in control, we regularly measure the variable of interest and plot it on a control chart. The chart has a line down the center representing the average value of the variable we are measuring. Above and below the center line are two lines, called the upper control limit (UCL) and the lower control limit (LCL). As long as the observed values fall within the upper and lower control limits, the process is in control and there is no problem with quality. A point that plots outside of the control limits is interpreted as evidence that the process is out of control. Therefore, investigation and corrective action are required in such a case to find and eliminate the causes responsible for this behavior. For example, in the production of bread or filling of bottles of a drink, the main purpose is to find efficiency of personnel at different time for moulding (in bread making) or filling (in drinks), the target is 175 (g) or (mL). The UCL and LCL are 180 (g) or (mL) or 170 (g) or (mL) respectively. The measurement has been taken at various times during production. As long as the values remained between upper and lower limits, the efficiency of personnel is ok. But if the values were beyond those prescribed limits, then we can say that the personnel at that time are or were not efficient.

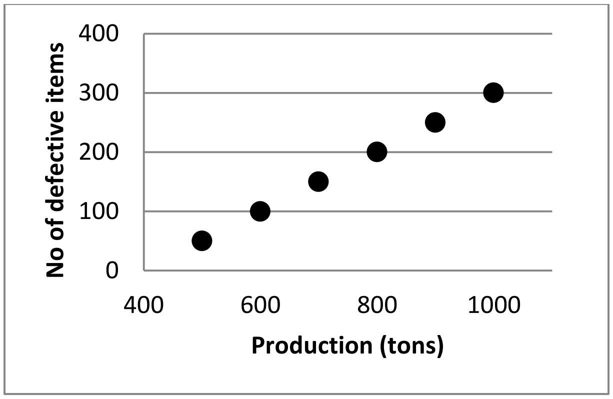


The control charts contain the following fundamental characteristics:

1. They contain upper and lower control limits within which all observations will lie if the process is under control.
2. They contain a center line which is usually considered the target value for the process.
3. They generally show numbers along the vertical axis to define the values of the control limits and observations.

(f) Scatter diagrams

These are the graphs that show how two variables are related to one another i.e. what happens to one variable when the other variable is changed. They are particularly useful in detecting the amount of correlation, or the degree of linear relationship, between two variables. For example, increased production speed and number of defects could be correlated positively; as production speed increases, so does the number of defects (Fig. 1). Two variables could also be correlated negatively, so that an increase in one of the variables is associated with a decrease in the other. For example, increased worker training might be associated with a decrease in the number of defects observed (Fig. 2). The greater the degree of correlation, the more linear are the observations in the scatter diagram. On the other hand, the more scattered the observations in the diagram, the less correlation exists between the variables. This may be the case when one is observing the relationship between two variables such as oven temperature and number of defects (observed in pizza or cake baking), since temperatures below and above the ideal could lead to defects.



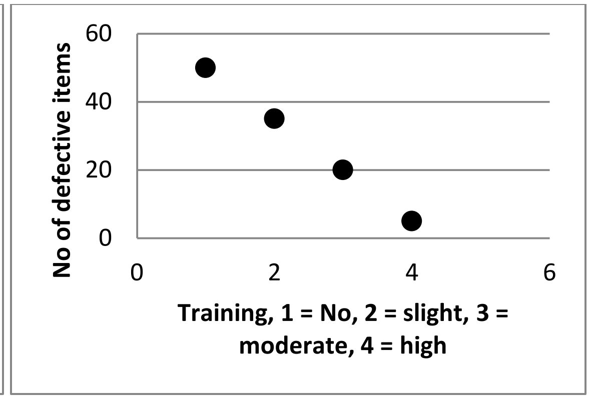
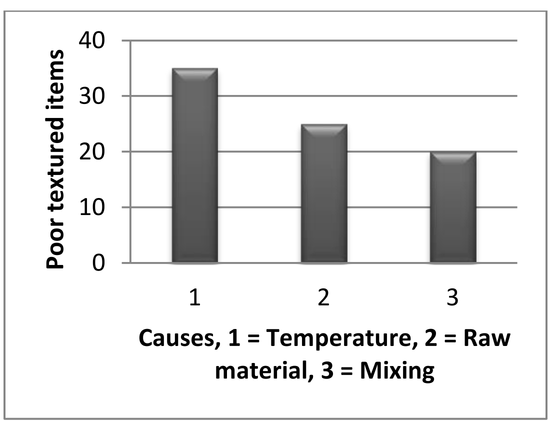


Fig. 1. Positive relationship between number of defects and production speed

Fig. 2. Negative relationship between number of defects and training

(g) Pareto charts

The technique was named after Vilfredo Pareto, a nineteenth-century Italian sociologist. One way to use Pareto analysis is to develop a chart that ranks the causes of poor quality in decreasing order based on the percentage of defects each has caused. For example, a tally can be made of the number of defects that result from different causes, such as operator error, defective parts, or inaccurate machine calibrations. Percentages of defects can be computed from the tally and placed in a chart. This technique used to identify quality problems based on their degree of importance.

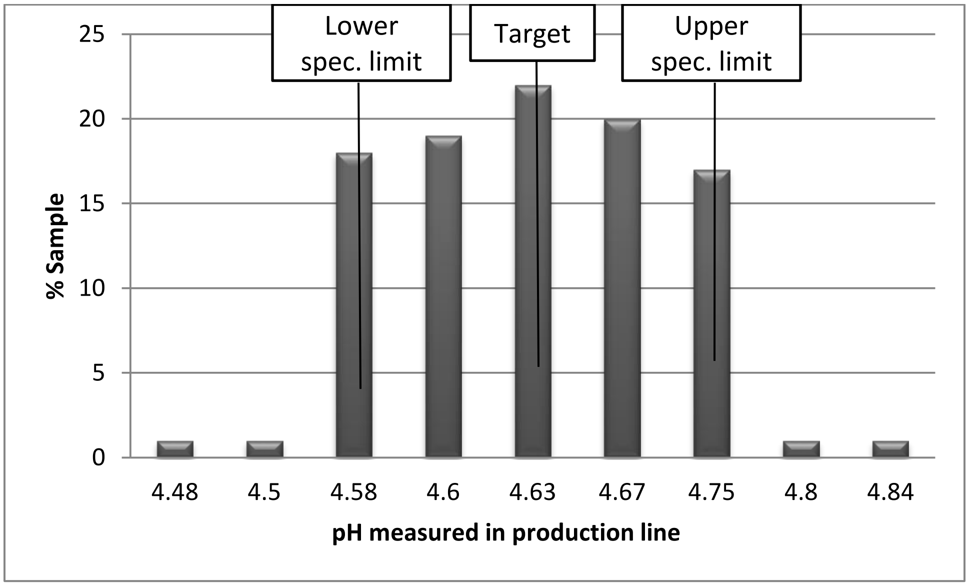


The pareto chart is valuable in answering questions such as:

1. What are the largest issues facing a team or business?
2. What efforts should be focused on to achieve the greatest improvements?

(h) Histogram

A chart that shows the frequency distribution of observed values of a variable. It estimates how many items are being produced which do not meet specifications. This gives an idea of batch performance. When you add target, upper and lower limit lines, you can examine how process performs. We can see from the plot what type of distribution a particular variable displays, such as whether it has a normal distribution or not.



A histogram can help answers questions such as:

1. What is the most common system response?
2. What distribution (symmetric, skewed) do the data have?
3. Do the data contain outliers?

(i) Bar chart

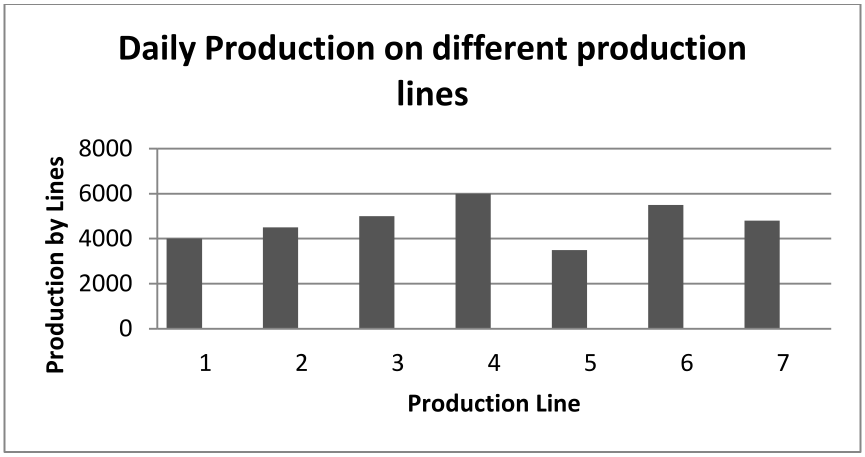
A bar chart is used to graphically summarize and display the differences between groups of data.

A bar chart can be constructed by segmenting the range of the data into groups. For example, if the data range from machine to machine, the data will consist of a group from machine 1, a second group of data from machine 2, a third group of data from machine 3, and so on.

The vertical axis of the bar chart is labeled frequency and the horizontal axis is labeled with the group names of the response variables.

A bar chart answers the questions:

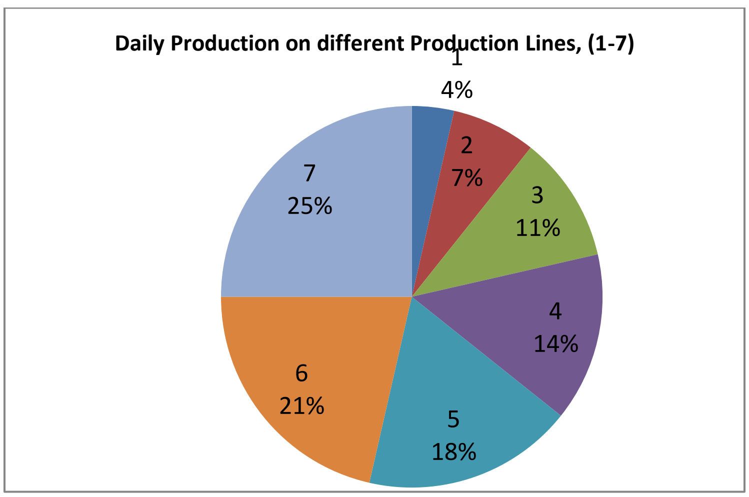
1. What are the differences in system response between groups?
2. Does the data contain outliers?



(j) Pie chart

Pie charts are used to display the sizes of parts that make up some whole (percentage of a whole at a set point in time). To create a pie chart, it is necessary to supply a value and a name for each segment (each slice) and the title of the graph.

The pie chart shows the % production of tomato sauce by each production line. The information provided allows for comparisons of production efficiency and can contribute to the detection of malfunctioning conditions and their subsequent correction.

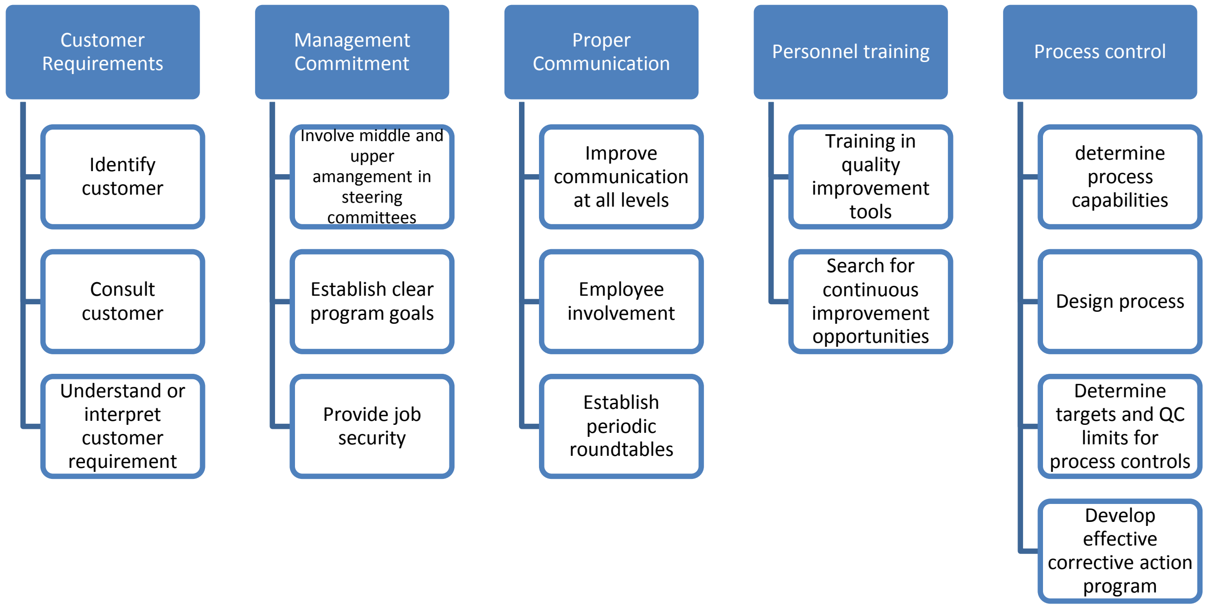


Management and planning tools

(a) Affinity diagram

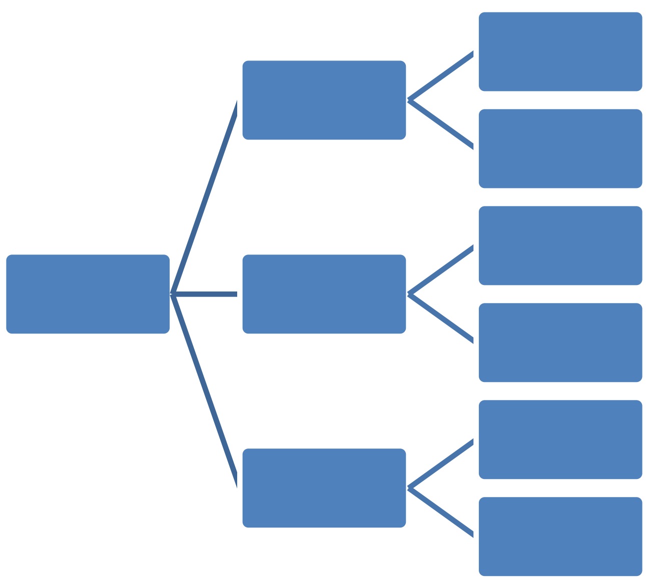
An affinity diagram also known as the KJ method after its creator Kawakita Jiro. It is used to gather and organize ideas, opinions, issues etc from a raw list – usually generated through brainstorming – into groups of related thoughts that make sense and can be dealt with more easily.

This approach makes it possible to break an operation down into categories to focus the analytical efforts on one area at a time and in this way similar items are grouped together.



(b) Tree diagram

The tree diagram, systematic diagram or dendrogram is a technique for mapping out a full range of paths and tasks that need to be done in order to achieve a primary goal and related sub-goals. It provides a better understanding of the true scope of a project and helps to figure out the tasks that must be undertaken to achieve a given objective. When read from left to right it progresses logically from general to specific, answering the question, "how accomplished?" If read from right to left, it answers the question "Why".



Activity Network Diagram

Gantt chart

The Gantt chart was developed as a production control tool in 1917 by Henry L, Gantt, an American engineer and social scientist. The Gantt chart shows planned work and finished work in relation to time. It is constructed with a horizontal axis representing the total time span of the project and a vertical axis representing the tasks that make up the project. Each task in a list has a bar corresponding to it. The length of the bar is used to indicate the expected or actual duration of the task.