



# UNIT-2

## Project Improvement Tools

### Learning Outcomes

**By the end of this unit the learner will be able to:**

- ✓ Describe the seven quality tools to solve process problems.
- ✓ Describe the various quality management tools

## Unit 2

### Project Improvement Tools

Tools aid in data collection and interpretation, and provide the basis for decision making in Six Sigma. There are no agreed upon standard tools used in Six Sigma projects.

*In this session, we will describe seven tools that are often referred to as the seven basic quality tools - Cause Effect Diagrams, Histograms, Flowcharts, Scatter Diagrams, Pareto, Check Sheets, and Control Charts.*

#### Check Sheets and Flowcharts

**Check Sheets.** A check sheet is a simple tool that is used to identify problems. The format is easy to understand and they are easy and quick to fill out - important when your main job is producing product, not filling out forms.

Whether it is the number of rejected parts in a manufacturing company or the number of incorrect sales agreements in a real estate company, mistake identification is hugely important.

The following is an example of a typical check sheet.

#### Check Sheet (Engineering Drawings)

Defects/Mistakes	Days					Total
	Monday	Tuesday	Wednesday	Thursday	Friday	
Incorrect Dimension	II	III	0	0	I	6
Part #s Missing	I	II	III	II	III	11
Parts Unidentified	0	II	0	III	II	7
Title Block Errors	III	I	I	I	0	6
<b>Total</b>	6	8	4	6	6	

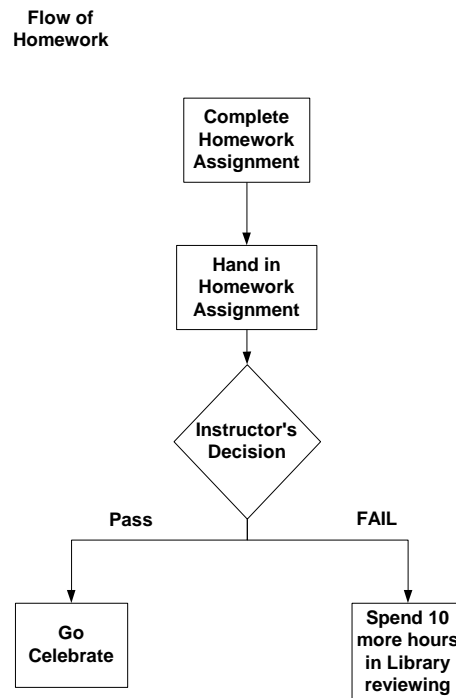
**Flowcharts.** A flowchart is a way to visually represent a process. It can also be used to identify critical points in a process - where mistakes, bottlenecks or other problem may arise. Each shape has a particular meaning. The basic shapes used are:

- Diamond – decision point in the process
- Rectangle – a procedure
- Lines and arrows – the flow of the steps in the process

There are a few steps to creating a simple flowchart:

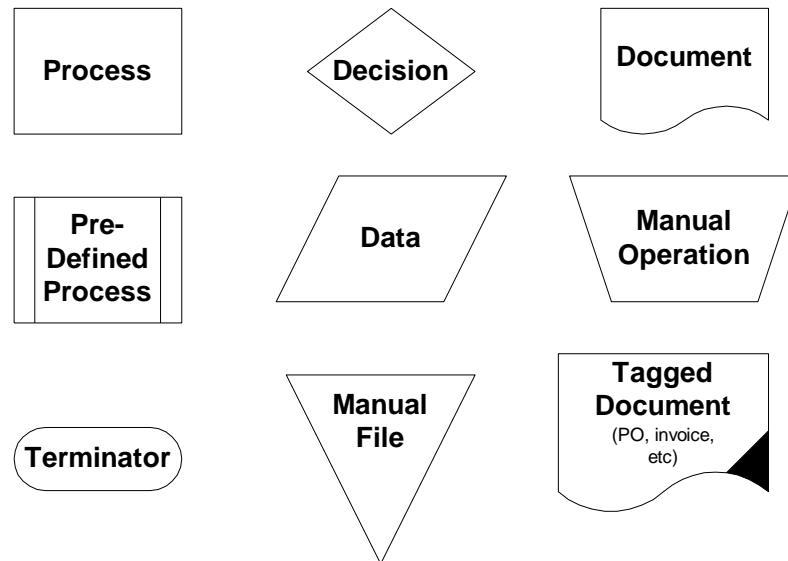
- List the steps in a process
- Determine if the step is a procedure or decision
- Draw accordingly

An example:



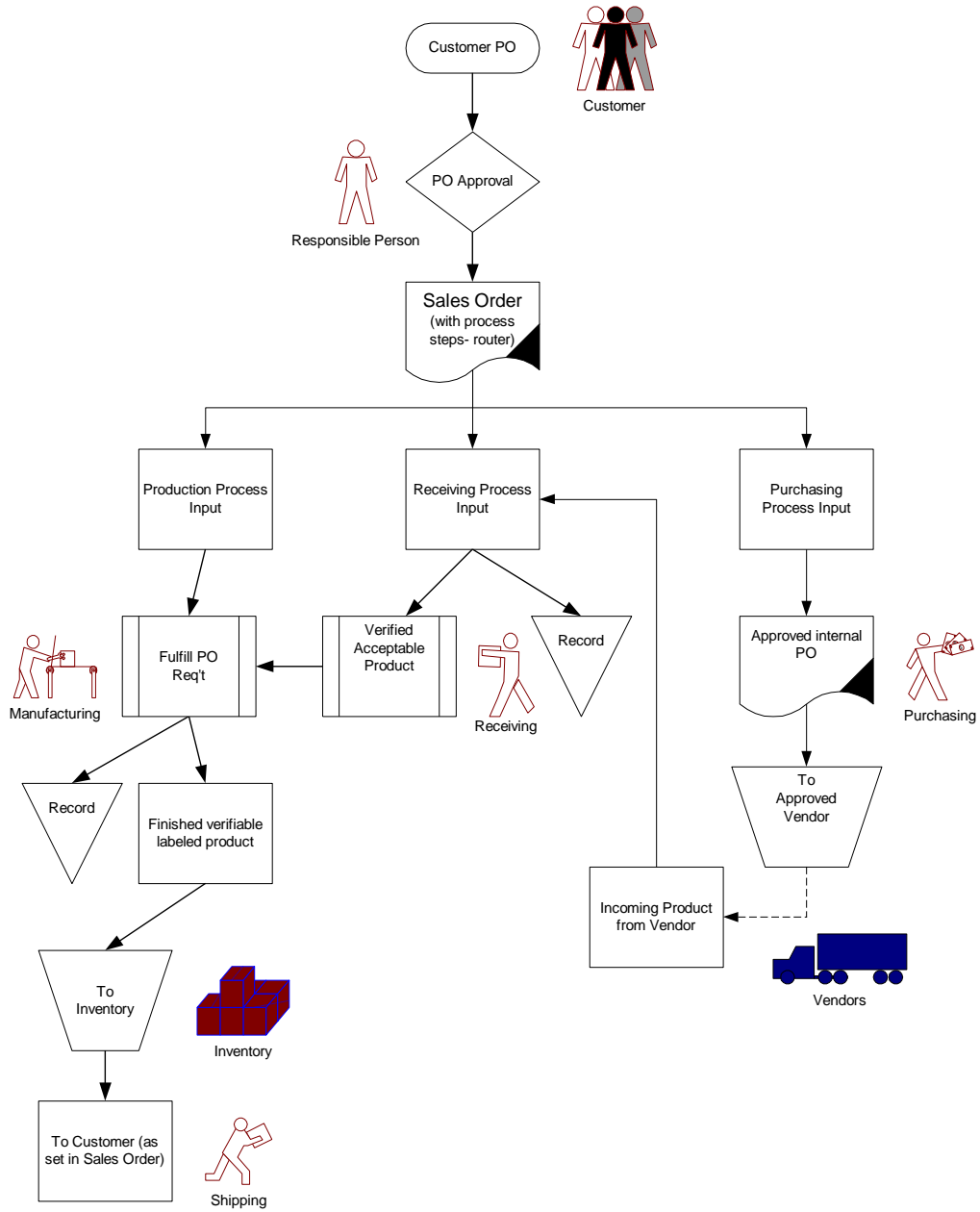
Here one might be able to point to the completing of homework as the critical point to control (since the instructor's decision is likely out of your control)

Flowcharts can also be more complex looking but still give basic information about a process. The following symbols are seen in industry applications:



The following is an example of what you might see in industry:

**Process Approach: Sales, Purchasing, Receiving and Production**



Use the space below to consider examples of these improvement tools within your own experience.

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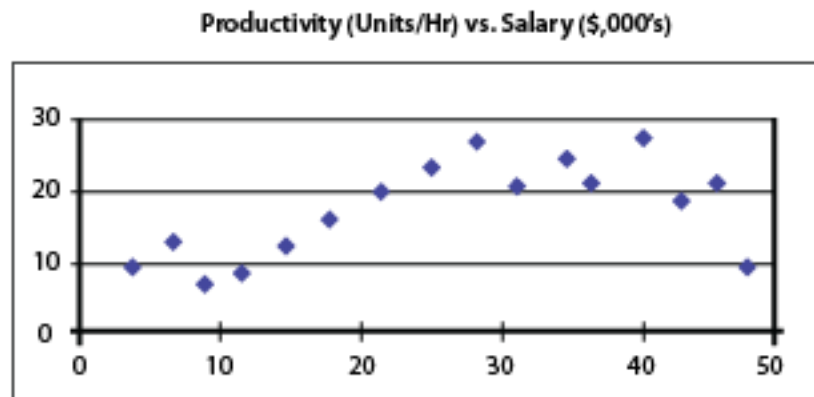
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## Scatter Diagrams and Histograms

**Scatter Diagrams.** A scatter diagram can be used to decide if there is a relationship between two things (called variables). For example, is the height of children related to the height of their parents? In industry, a scatter diagram is a quick and easy check to find what a problem may be related to. For example, is the number of defective parts produced related to the speed of parts production? If it is it might be good to slow the production rate to a speed that causes an acceptable number of defects. The following is an example of a scatter diagram.

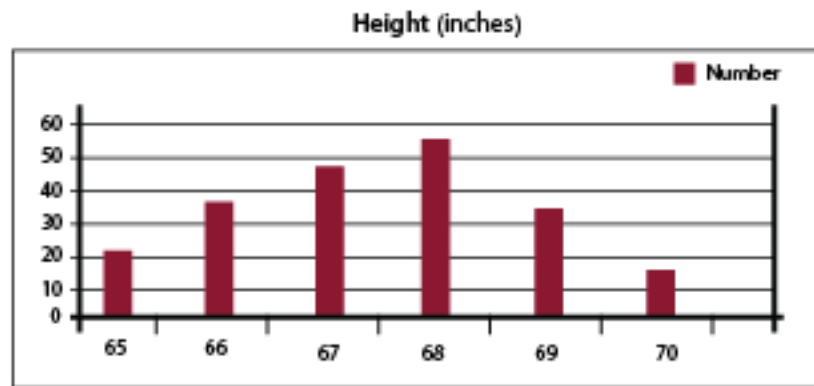


If the trend is an upward one (like the example) it shows a positive relationship. This means that as one variable increases so does the other. The other possibilities are as a variable increases the other decreases (an example might be as you add more people to your production line the number of defective parts decreases) or as one decreases the other decreases (an example might be as the temperature food is kept at decreases the number of food borne pathogens also decreases).

Another important thing to know about scatter diagrams is that the more densely packed the points are the better the relationship. If the points are widely scattered there may be a weak or non-existent relationship.

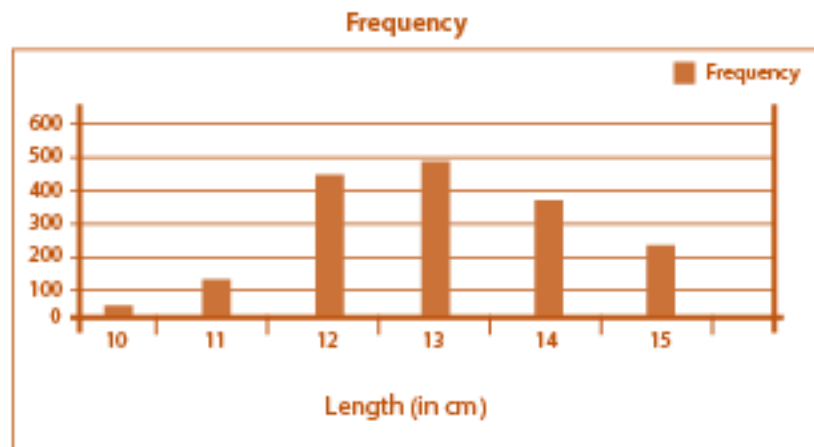
**Histograms.** A histogram (also called bar chart) is used to graphically represent a number of values to look at their distribution. Its main function is to see if the distribution looks 'normal', what the range of values are and if there are any values that are unusual.

The idea of 'normal' is critical here. In a normal distribution just as many values occur above as below the average. An example may help. If you were to measure the height of personnel at your company your distribution may look like this:



The average height is 72 inches and there are 95 personnel taller and 99 personnel shorter. This would be a normal distribution. The range would be 69 inches (shortest) to 75 inches (tallest). There are no unusual heights.

A typical histogram seen in industry might be:



Use the space below to consider examples of these improvement tools within your own experience.

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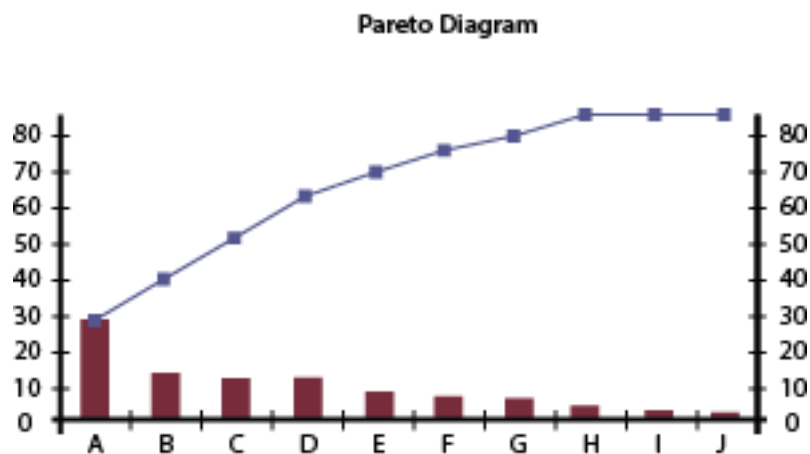
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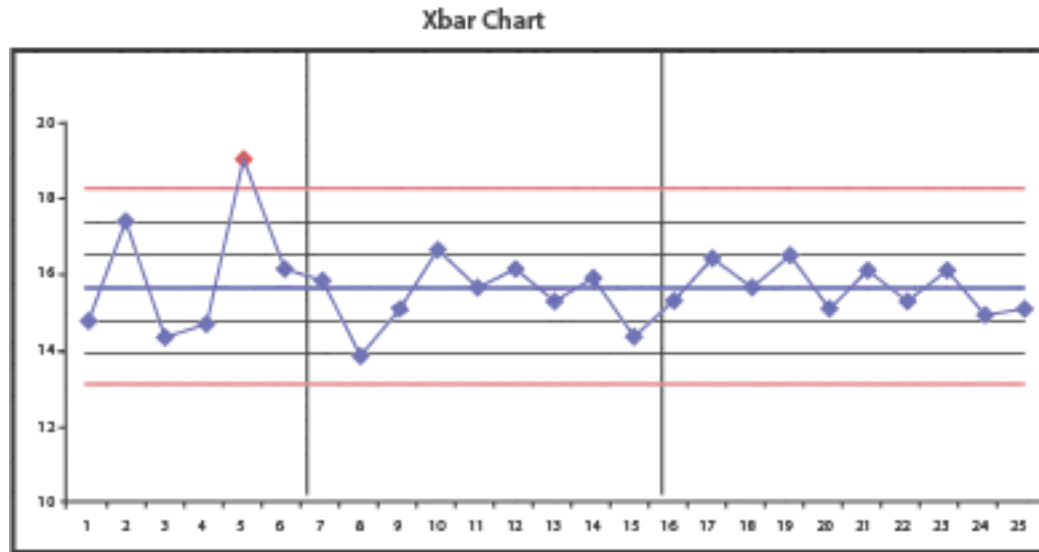
## Pareto Analysis, Control Charts and Cause-and-Effect Diagrams

**Pareto Analysis.** Named for Vilfredo Pareto, Pareto Analysis is used to represent events (problems, complaints, defects, etc.) in order of importance. Vilfredo was an Italian economist and one of the things he noticed was that 20% of Italians owned 80% of wealth in Italy. Juran took this further in his observation that 80% of the defects in manufacturing are caused by 20% of the problems (his 'vital few' theory). This led to the presentation of data seen in the Pareto chart.

Like the histogram, frequencies of events can be plotted, however they are arranged from highest to lowest. This gives an easy way to see the problems that are having the greatest effect on your operation (those 20% - the vital few). To add clarity, the Pareto chart also includes a line that shows the cumulative percent of problems factor by factor. In this way the data is easily used in deciding opportunities for improvement. An example:



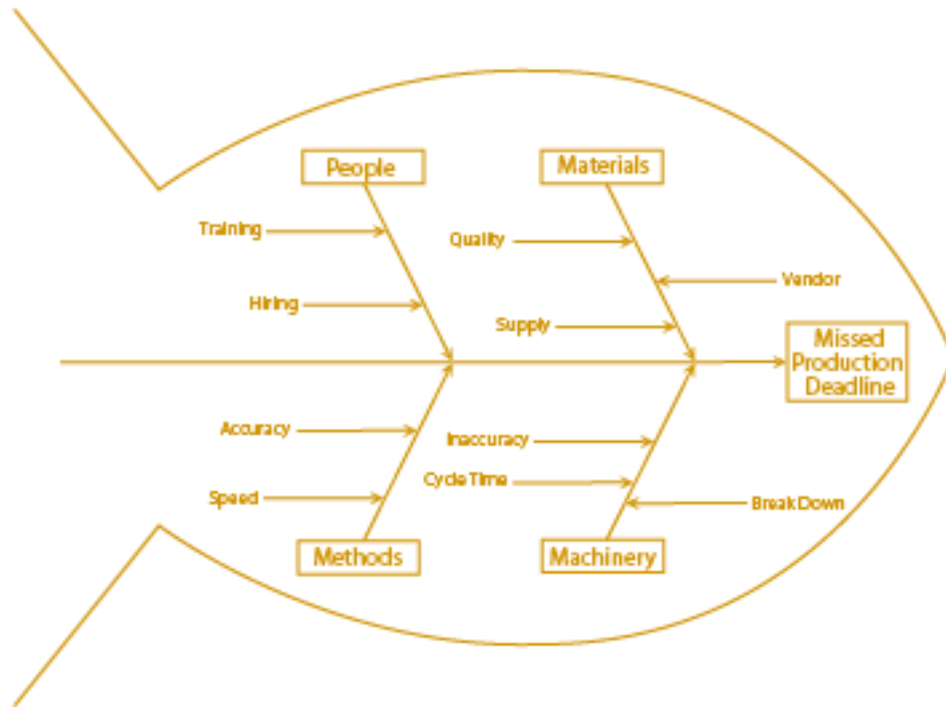
**Control Charts.** Control charts are used for time-related process performance. This is probably the most used tool in industry. It is a simple line chart taken over time (something like an EKG heart monitor). The chart also has the Upper Control Limit (UCL) and Lower Control Limit (LCL) identified. Anything between the UCL and LCL is acceptable, but values falling outside this range are unacceptable.



Control charts can also indicate when a problem occurred and give insight into what caused the problem.

**Cause-and-Effect Diagrams.** A cause-and-effect diagram was developed by Kaoru Ishikawa to help solve problems with several possible sources. Because of its shape it is sometimes called a fishbone diagram. An example may help here.

Example of a Cause and Effect Fishbone Diagram for Missed Production Deadline



Typically, the people involved in a process will have a brainstorming session to identify the categories of factors that might be leading to the problem. In the case of a missed production deadline the factors might be people (training and hiring), materials (quality, supply, and vendor), methods (accuracy and speed) or machinery (inaccuracy, cycle time, and break down).

This may be enough to identify where the problem could be occurring. If not, root cause analysis can be conducted. This may be through setting up a checklist for defects or control charts for key processes. It may also mean reviewing training records or hiring practices. The task should be made easier because of the initial cause-and-effect analysis.

**Use the space below to consider examples of these improvement tools within your own experience.**

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