CHAPTER 3

TQM TOOLS AND TECHNIQUES

Expected Outcomes

Construct a Pareto diagram.
Explain how to construct a cause and effect diagram.
Explain how to construct a check sheet.
Explain how to construct histogram, scatter diagram

Statistical Process Control

A methodology for monitoring a process to identify special causes of variation and signal the need to take corrective action when appropriate

Statistical Process Control

Seven Tools:

- Pareto Diagram
- Cause-Effect Diagram
- Check Sheets
- Process Flow Diagram
- Scatter Diagram
- Histogram
- Control Charts

The Pareto Principle

Vilfredo Pareto was an economist who is credited with establishing what is now widely known as the Pareto Principle or 80/20 rule.

The Pareto Diagram

- Graph that ranks data classifications in descending order from left to right
- Pareto diagrams are used to identify the most important problems
- Advantage: Provide a visual impact of those vital few characteristics that need attention
- Resources are then directed to take the necessary corrective action

Constructing a Pareto Diagram

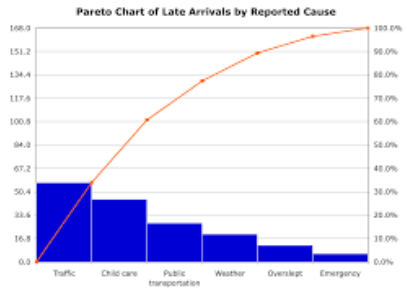
Steps:

1. Determine the method of classifying the data: by problem, cause, type of nonconformity, etc
2. Decide if dollars (best), weighted frequency, or frequency is to be used to rank the characteristics
3. Collect data for an appropriate time interval

Constructing a Pareto Diagram

Steps cont'd:

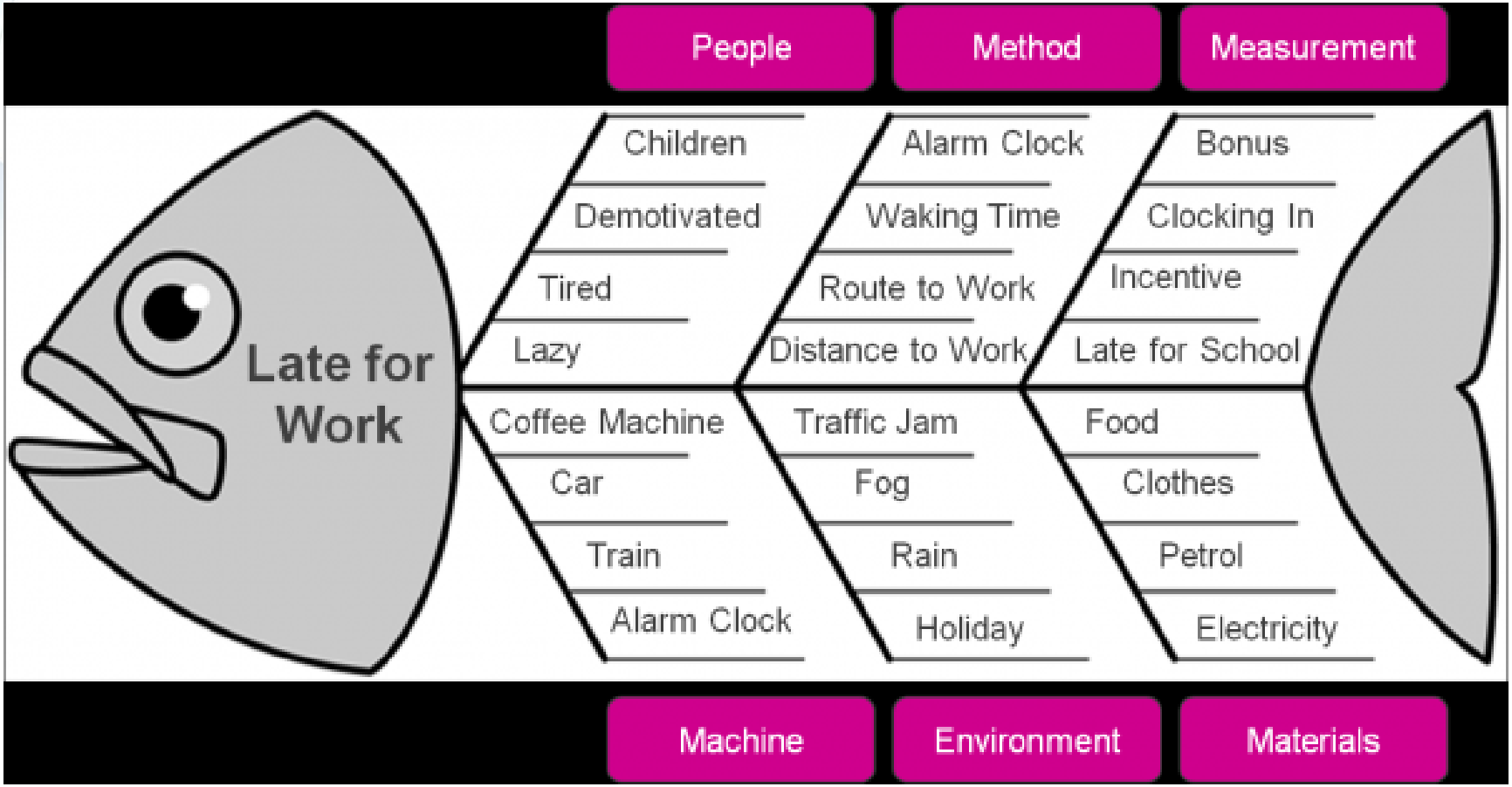
4. Summarize the data and rank order categories from largest to smallest
5. Compute the cumulative percentage if it is to be used
6. Construct the diagram and find the vital few



Cause-and-Effect Diagram

- It was developed by Dr. Kaoru Ishikawa in 1943
- Picture composed of lines and symbols designed to represent a meaningful relationship between an effect and its causes
- Effect (characteristics that need improvement) on the right and causes on the left

Cause-and-Effect Diagram



Cause-and-Effect Diagram

- Enables a team to focus on the content of a problem, not on the history of the problem or differing personal interests of team members
- Creates a snapshot of collective knowledge and consensus of a team; builds support for solutions
- Focuses the team on causes, not symptoms
- Used to investigate either a “bad” effect and to take action to correct the causes or a “good” effect and to learn those causes responsible

Cause-and-Effect Diagram

Steps in the construction of a Cause-and-Effect Diagram:

- Identify the effect or quality problem
- Determine the major causes
- Determine all the minor causes. Request a brainstorming session
- Once the diagram is complete, evaluate it to determine the most likely causes
- Develop solutions

Check Sheets

- The main purpose is to ensure that the data are collected carefully and accurately by operating personnel for process control and problem solving

Motor Assembly Check Sheet

Name of Data Recorder: Lester B. Rapp

Location: Rochester, New York

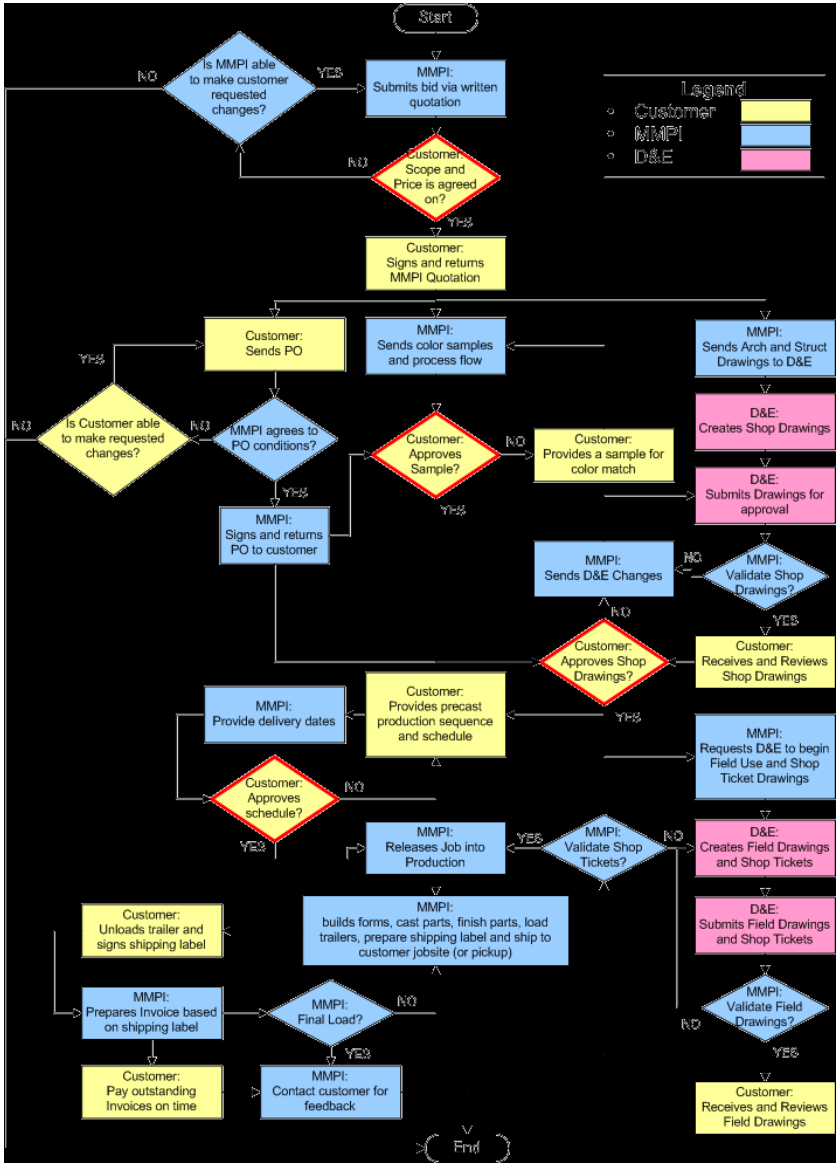
Data Collection Dates: 1/17 - 1/23

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

Process Flow Diagram

- It is a schematic diagram that shows the flow of the product or service as it moves through the various processing stations or operations
- Makes it easy to visualize the entire system, identify potential trouble spots, and locate activities
- Compares and contrasts actual versus ideal flow of a process

Process Flow Diagram

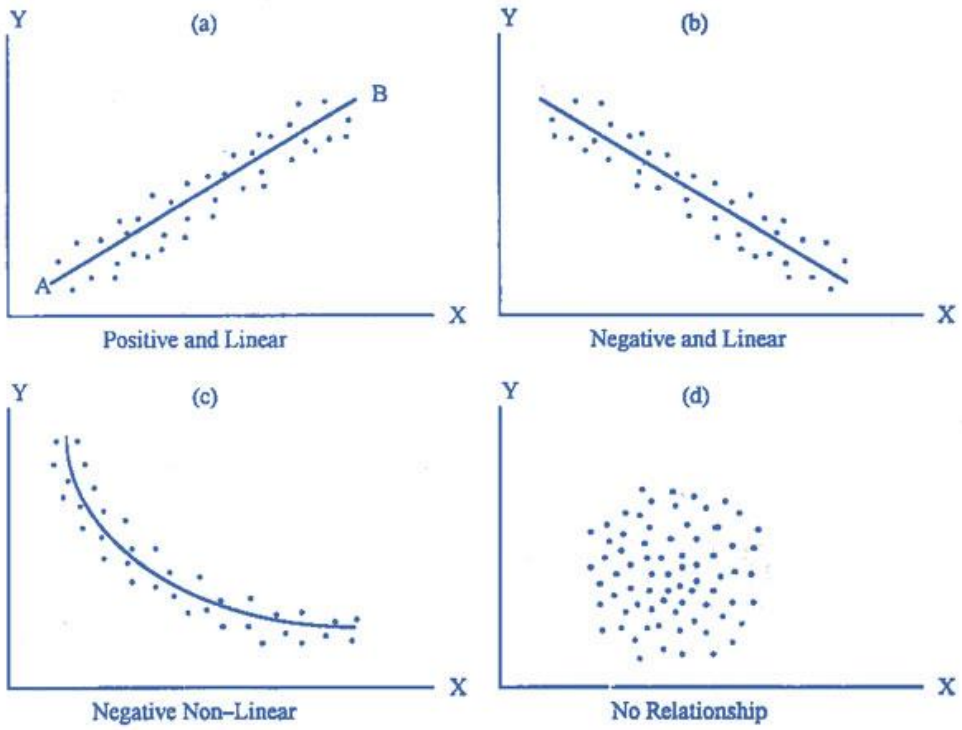


Process Flow Diagram

- Allows a team to reach agreement on process steps and identify activities that may impact performance
- Improvements to the process can be accomplished by eliminating steps, combining steps, or making frequently occurring steps more efficient

Scatter Diagram

The simplest way to determine if a cause and-effect relationship exists between two variables



Scatter Diagram

- Supplies the data to confirm a hypothesis that two variables are related
- Provides both a visual and statistical means to test the strength of a relationship
- Provides a good follow-up to cause and effect diagrams

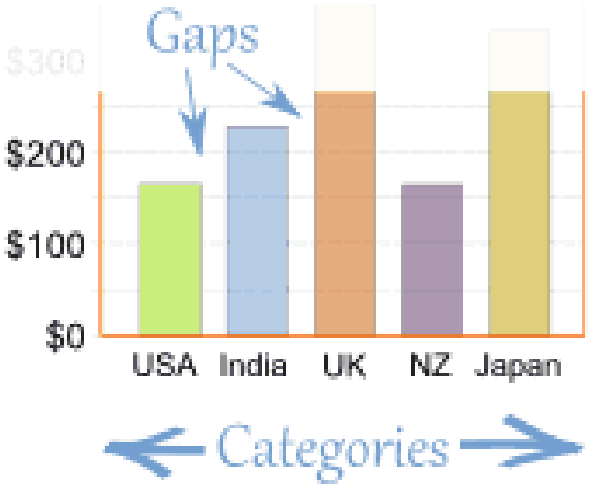
Scatter Diagram

Steps:

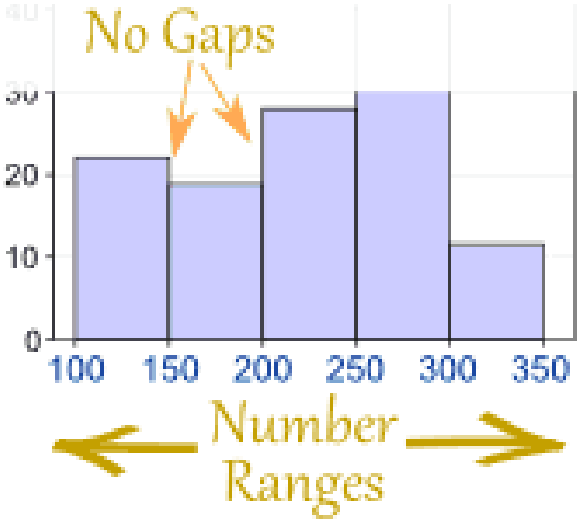
- Data are collected as ordered pairs (x, y)
- The horizontal and vertical scales are constructed with the higher values on the right for the x-axis and on the top for the y-axis
- Plot the data
- Once the diagram is complete, the relationship or correlation between the two variables can be evaluated

Histogram

Graphically shows the process capability and, if desired, the relationship to the specifications and the nominal



Bar Graph



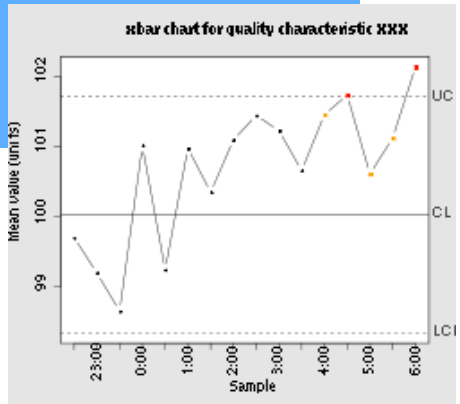
Histogram

Histogram

- Displays large amounts of data that are difficult to interpret in tabular form
- Shows centering, variation, and shape
- Illustrates the underlying distribution of the data
- Provides useful information for predicting future performance

Control Charts

- Focuses attention on detecting and monitoring process variation over time
- Distinguishes special from common causes of variation
- Serves as a tool for on-going control
- Provides a common language for discussion process performance



TQM Tools

- Design of Experiments (DOE)
  - Used to determine those variables in a process that are critical and their target values