



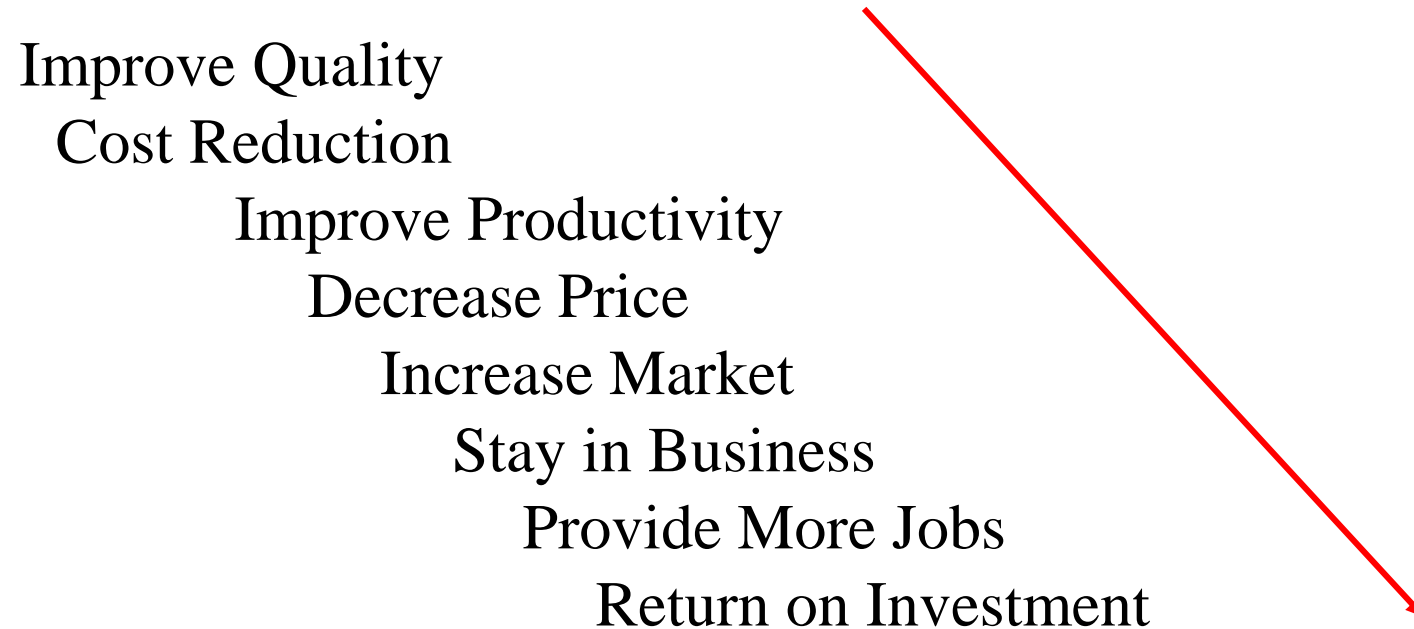
USE OF QUALITY TOOLS FOR PROCESS IMPROVEMENT

PRESENTED BY:-
MOHUA SINHABABU

OUTLINE

- OVERVIEW OF SEVEN QUALITY TOOLS
- PURPOSE AND APPLICATIONS
- BENEFITS

The Deming Chain



SIX PROBLEM SOLVING STEPS

Identify

- recognize the symptoms

Define

- Agree on the problem and set boundaries

Investigate

- Collect data

Analyze

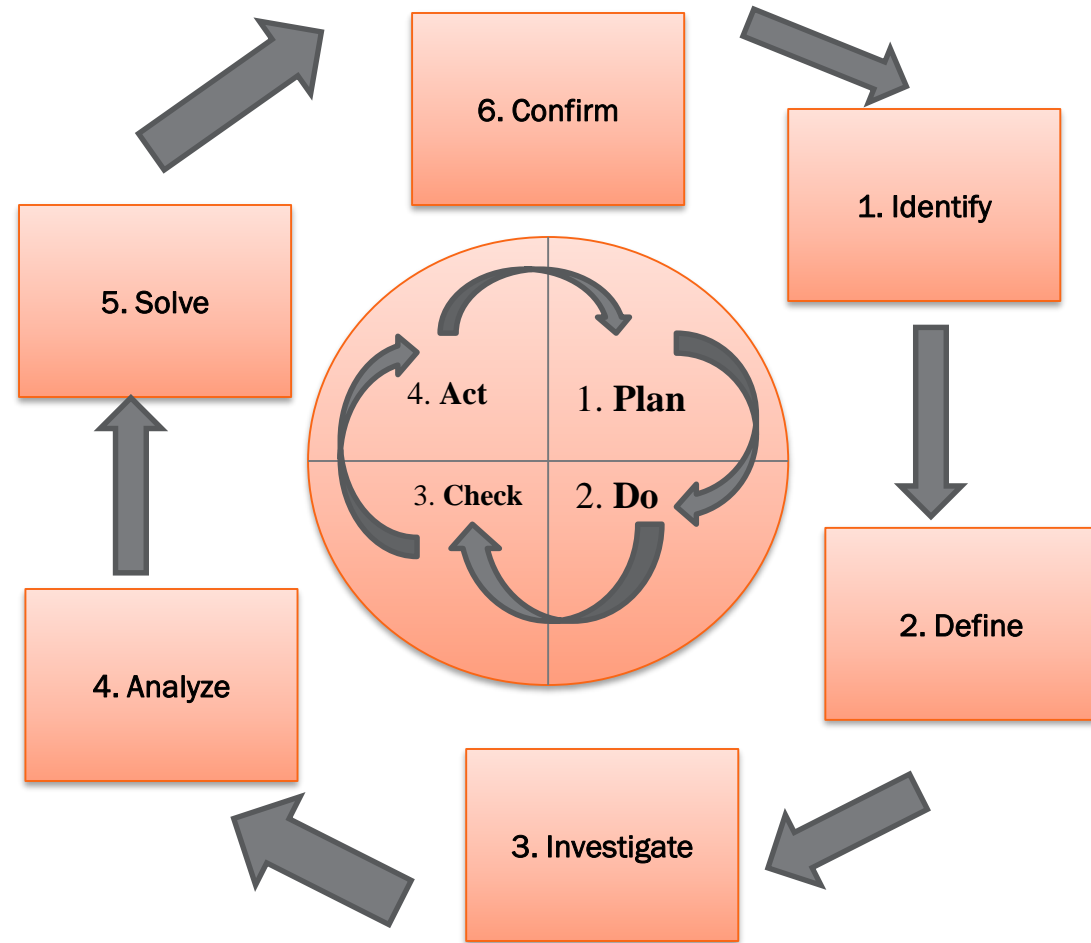
- Use quality tools to aid

Solve

- Develop the solution and implement

Confirm

- Follow up to ensure that the solution is effective



WHAT ARE THE 7 QUALITY TOOL?

A set of graphical techniques identified as being most helpful in troubleshooting issues related to quality.

SEVEN QUALITY TOOLS

1. Cause and Effect Diagrams/ Fishbone Diagrams
2. Flow Charts
3. Check sheets
4. Histograms
5. Pareto Charts
6. Control Charts
7. Scatter Diagrams



QUALITY TOOL BRAINSTORMING

RULES

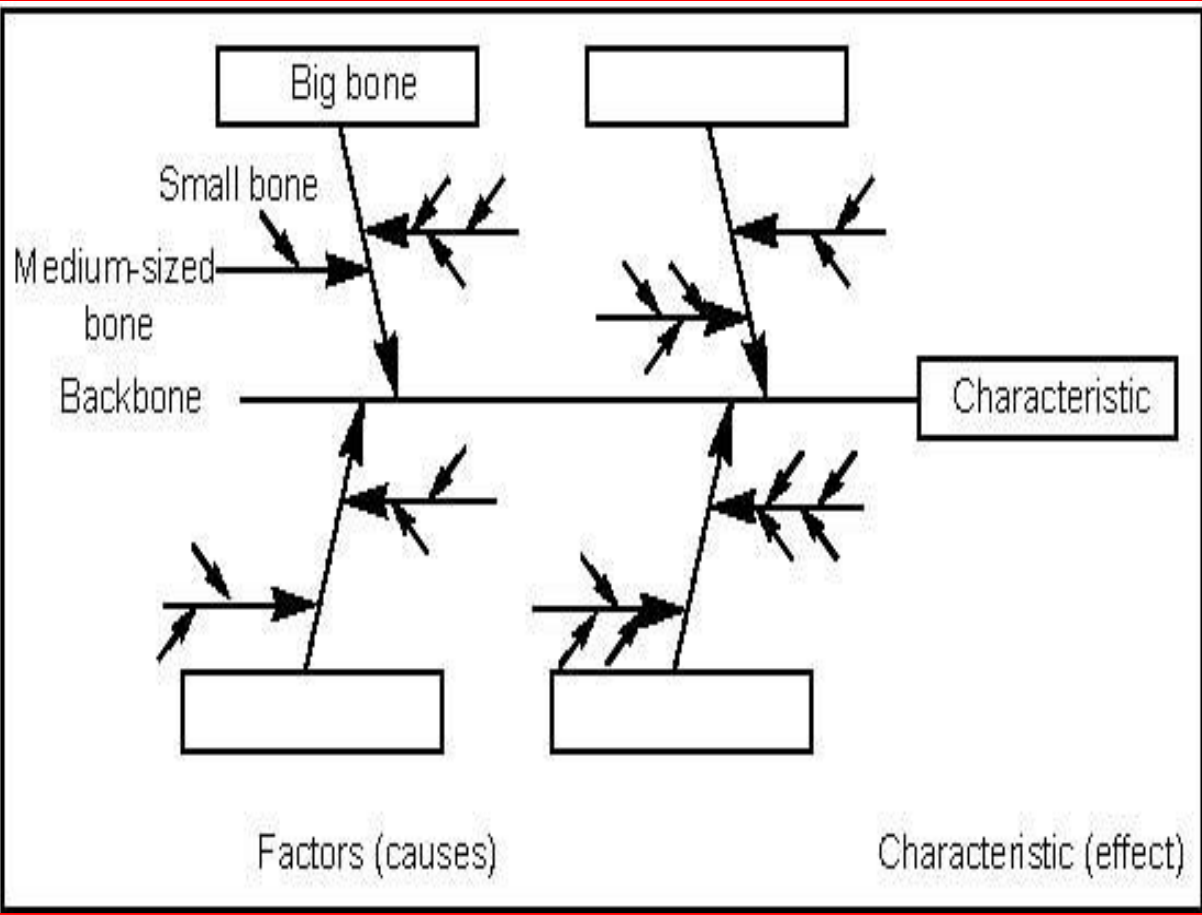
- Diverse group
- Go around room and get input from all – one idea per turn
- Continue until ideas are exhausted
- No criticism
- Group ideas that go together
- Look for answers

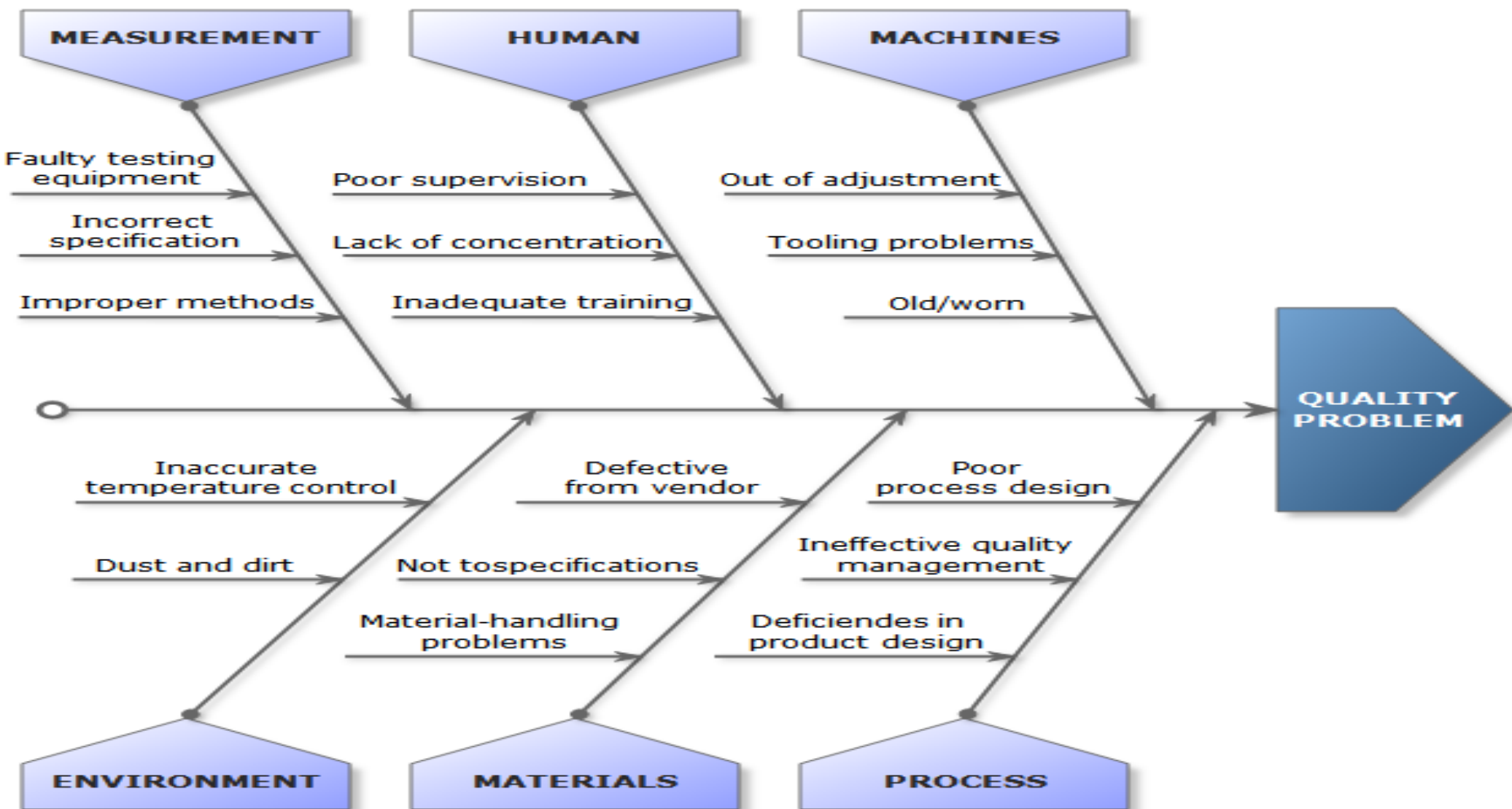
CAUSE AND EFFECT DIAGRAMS/ FISHBONE DIAGRAM

Purpose: Graphical representation of the trail leading to the root cause of a problem

How is it done?

- Decide which quality characteristic outcome or effect you want to examine (may use Pareto chart)
- Backbone –draw straight line
- Ribs – categories
- Medium size bones –secondary causes
- Small bones – root causes

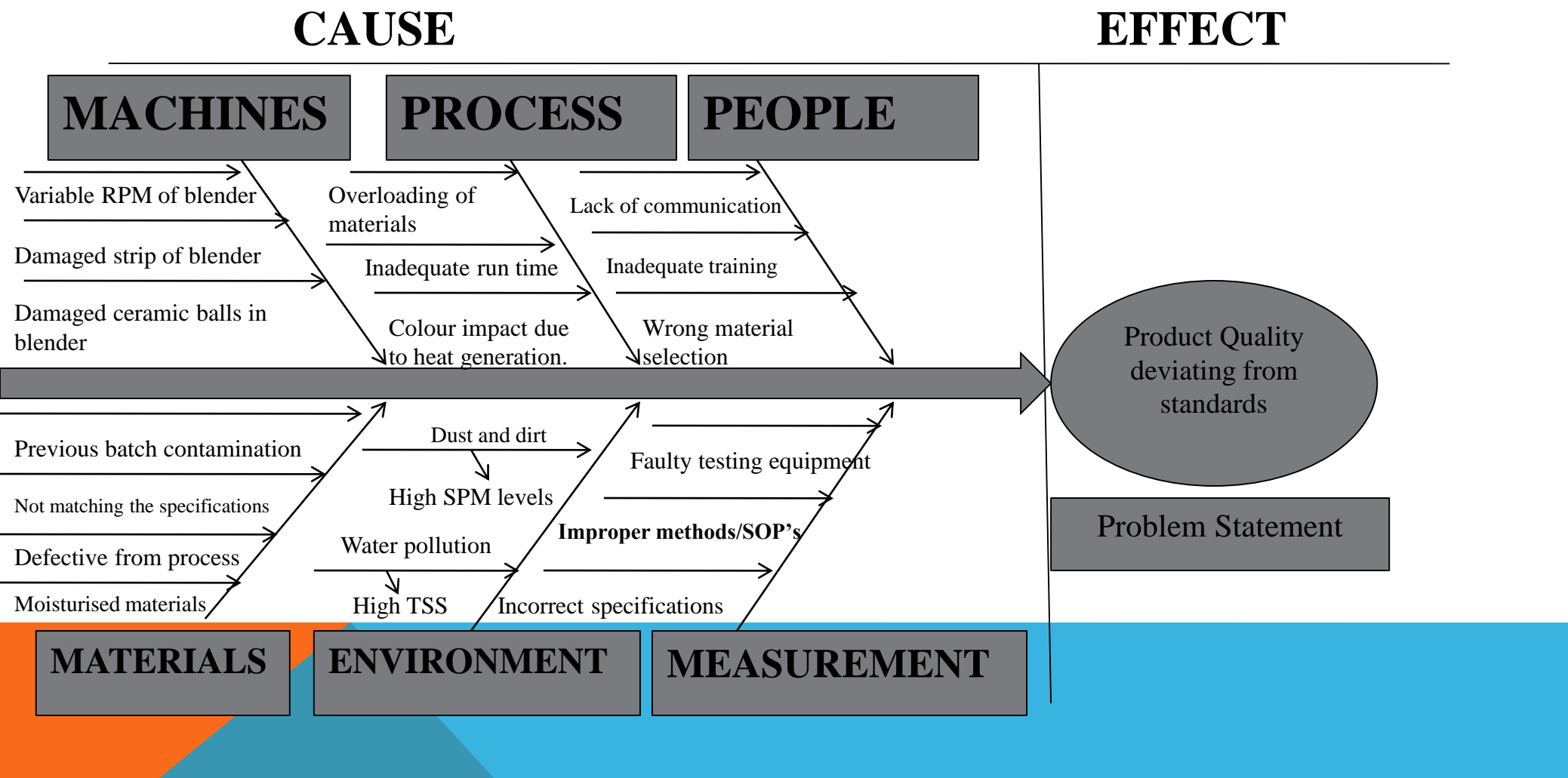




BENEFITS OF FISHBONE DIAGRAM:-

- Breaks problems down into bite-size pieces to find root cause
- Fosters team work
- Common understanding of factors causing the problem
- Road map to verify picture of the process
- Follows brainstorming relationship

FISHBONE DIAGRAM FOR PIGMENT BLENDING DEVIATING FROM STANDARD



FLOW CHARTS

PURPOSE:

Visual illustration of the sequence of operations required to complete a task

- Schematic drawing of the process to measure or improve.
- Starting point for process improvement
- Potential weakness in the process are made visual.
- Picture of process as it should be.

BENEFITS:

- Identify process improvements
- Understand the process
- Shows duplicated effort and other non-value-added steps
- Clarify working relationships between people and organizations
- Target specific steps in the process for improvement.

FLOW CHARTS

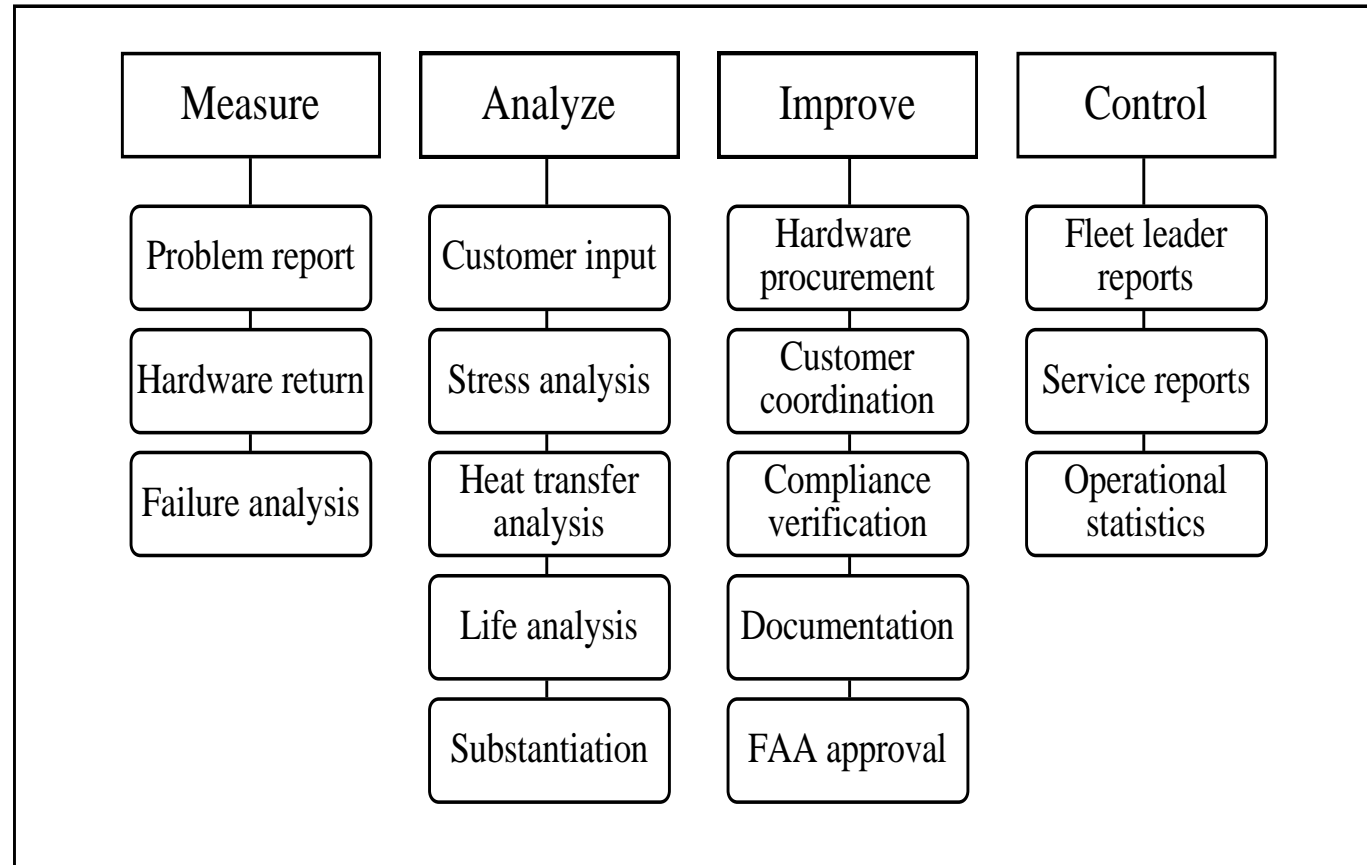
TOP DOWN

Benefits

- Simplest of all flowcharts
- Used for planning new processes or examining existing one
- Keep people focused on the whole process

How is it done?

- List major steps
- Write them across top of the chart
- List sub-steps under each in order they occur



FLOW CHARTS

LINEAR

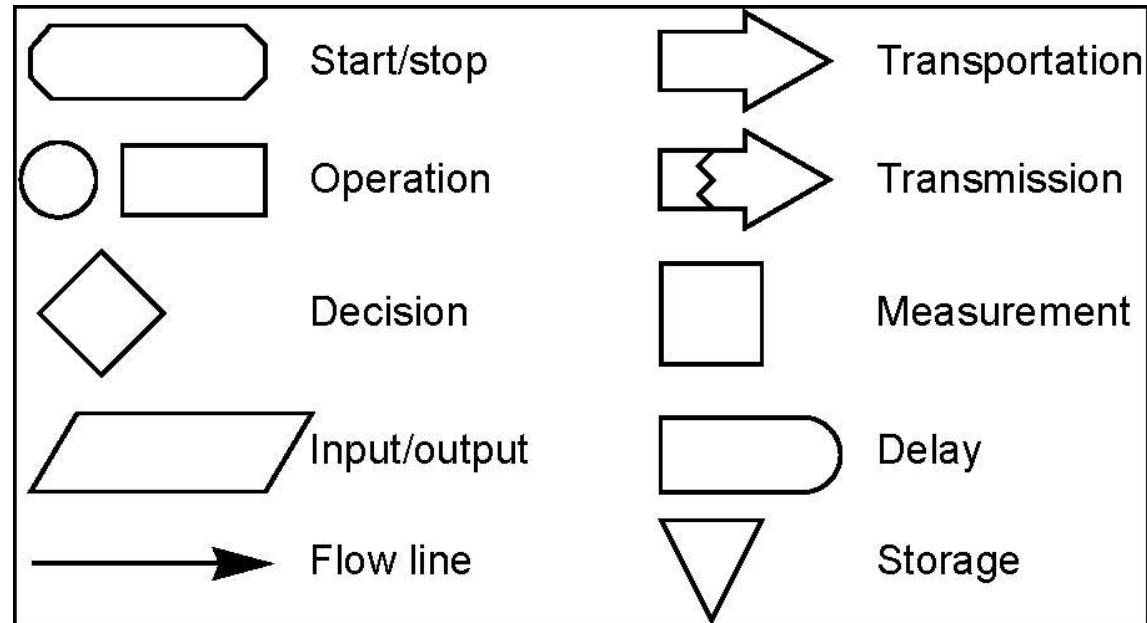
BENEFITS:-

- Show what actually happens at each step in the process
- Show what happens when non-standard events occur
- Graphically display processes to identify redundancies and other wasted effort

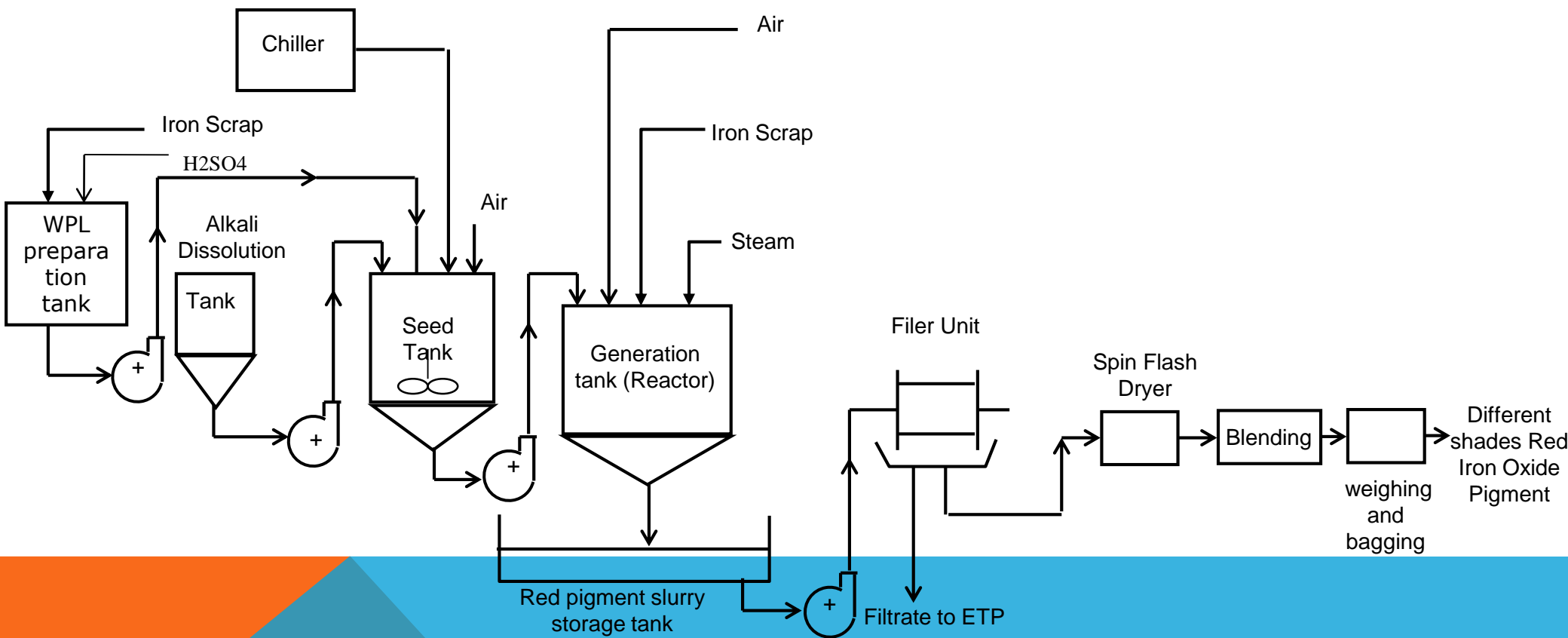
HOW IS IT DONE?

- Write the process step inside each symbol
- Connect the Symbols with arrows showing the direction of flow

PROCESS TOOLBOX



FLOW CHART FOR PIGMENT MANUFACTURING



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CHECKSHEETS

Purpose:

- Tool for collecting and organizing measured or counted data
- Data collected can be used as input data for other quality tools

Benefits:

- Collect data in a systematic and organized manner
- To determine source of problem
- To facilitate classification of data (stratification)

Example - Check Sheet

Reasons for late work orders	Name: (if applicable)					
Location: North County	Dates: 3 ~ 7 June, 2009					
	3/06	4/06	5/06	6/06	7/06	Total
Rainy weather		II		I		3
Forgot to schedule	I	IIII	IIII	III	III III	20
Crews on higher priority work	III I	IIII	III III	IIII	III III	30
Materials not available	I	I		I		3
Customer facility not ready	I		I	II		4
Total	9	11	13	11	16	60



TYPES OF CHECK SHEET

▪ DEFECTIVE CAUSE CHECK SHEET:

- used to identify causes of a problem or a defect.
- More than one variable or attribute 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.

Operators	Time	Machine 1	Machine 2
Operator A	Morning	X	X
	Afternoon	XX	XXXXXX
Operator B	Morning	X	XX
	Afternoon	XX	XXXXXXXXXXXX

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.

FORMAT NO. :

RAW MATERIAL			
#	Requirements As per Technical Data sheet & Purchase order	As per Standards	Requirements - Descriptions
SAMPLING			
INPROCESS INSPECTION			
FINAL INSPECTION			
ADDITIONAL REQUIREMENTS			

MANAGER QUALITY CONTROL : _____

MANAGER QUALITY ASSURANCE : _____

GENERAL MANAGER - QUALITY (Q.A./Q.C) : _____

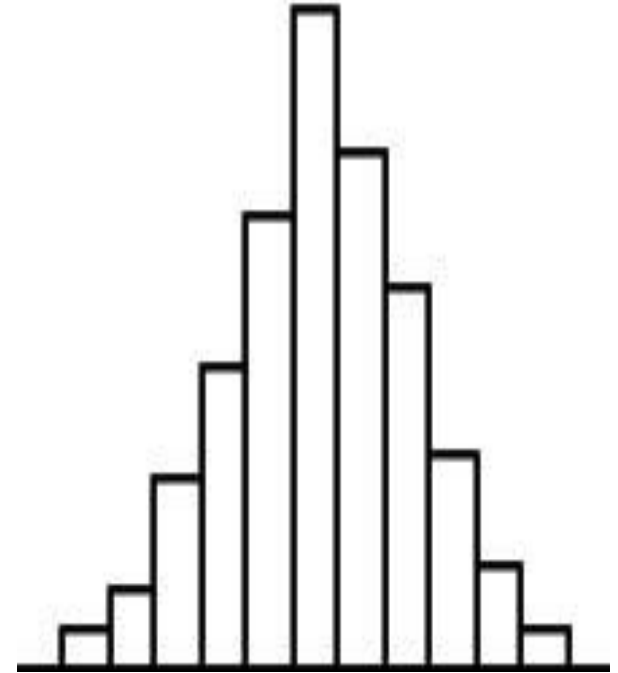
HISTOGRAMS

PURPOSE:

To determine the spread or variation of a set of data points in a graphical form

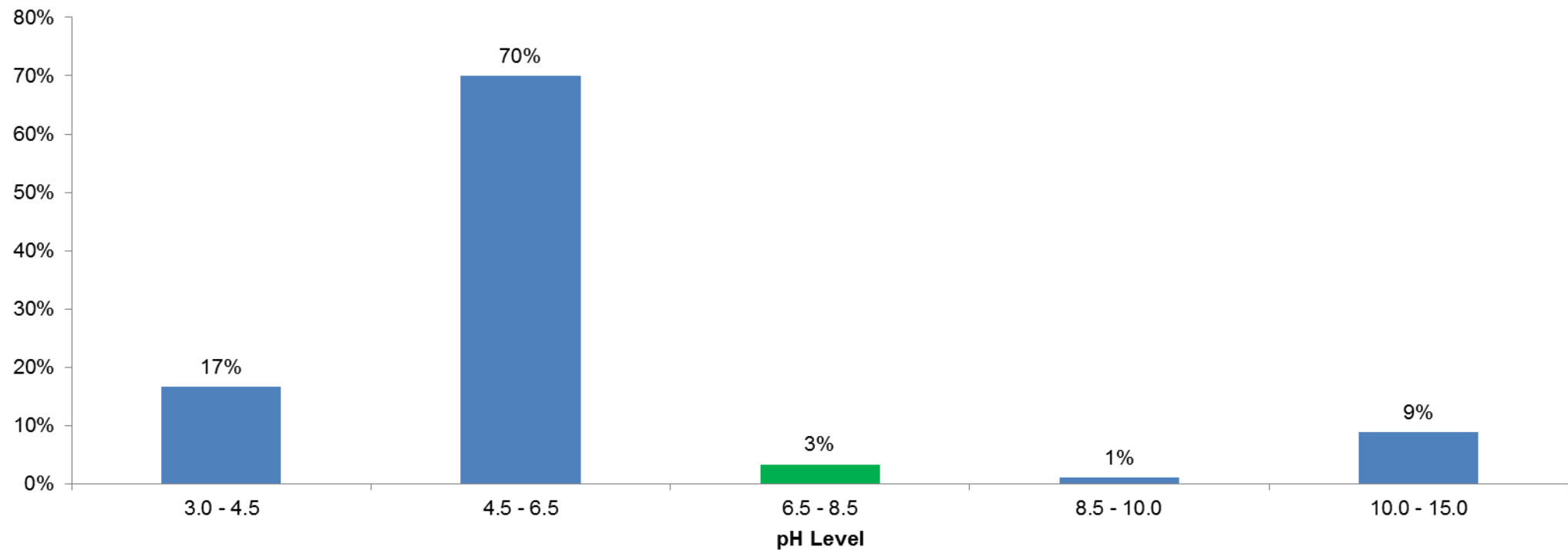
HOW IS IT DONE?

- Collect data, 50-100 data point
- Determine the range of the data
- Calculate the size of the class interval
- Divide data points into classes
- Determine the class boundary
- Count no. of data points in each class
- Draw the histogram

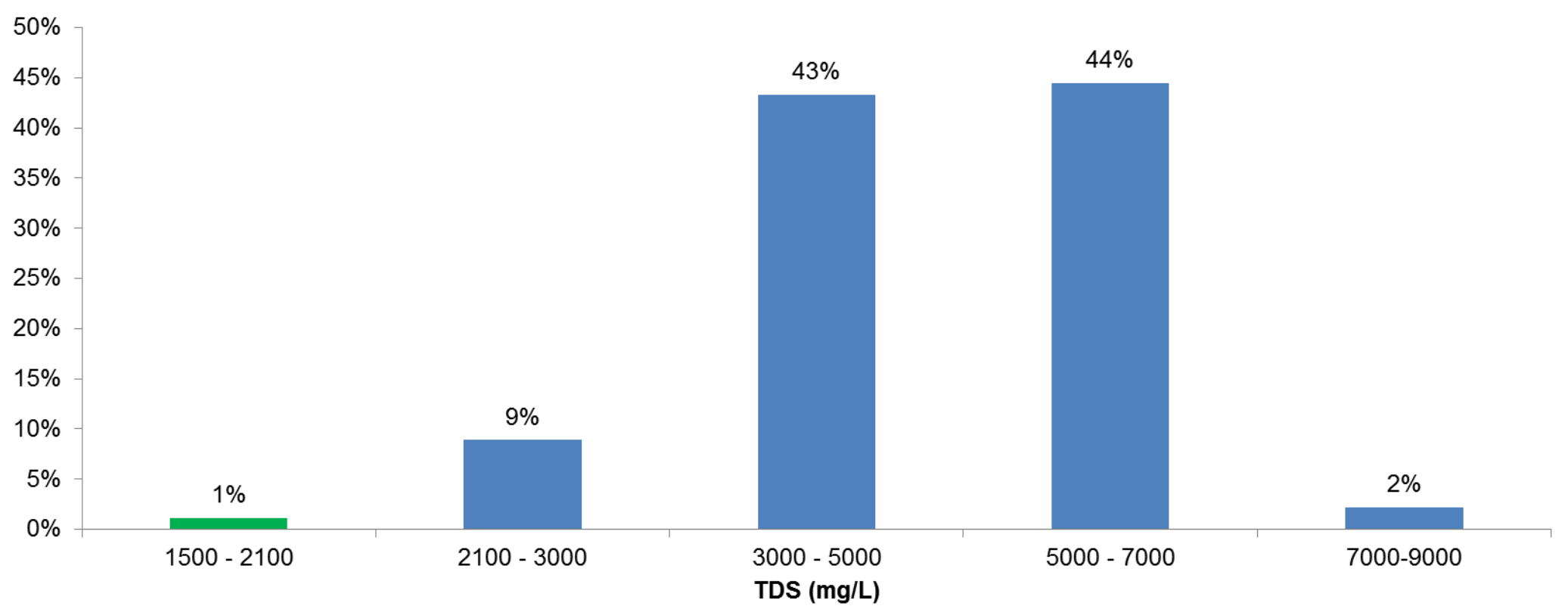


pH IN TATA PIGMENTS EFFLUENT - FY 17

pH values of 90 samples from 1st Apr to 20 Jun'16



TDS (MG/L) IN TATA PIGMENTS EFFLUENT - FY 17



HISTOGRAMS

BENEFITS:

- Allows you to understand at a glance the variation that exists in a process
- The shape of the histogram will show process behavior
- Often, it will tell you to dig deeper for otherwise unseen causes of variation.
- The shape and size of the dispersion will help identify otherwise hidden sources of variation
- Used to determine the capability of a process
- Starting point for the improvement process

PARETO CHARTS

PURPOSE:

Prioritize problems.

HOW IS IT DONE?

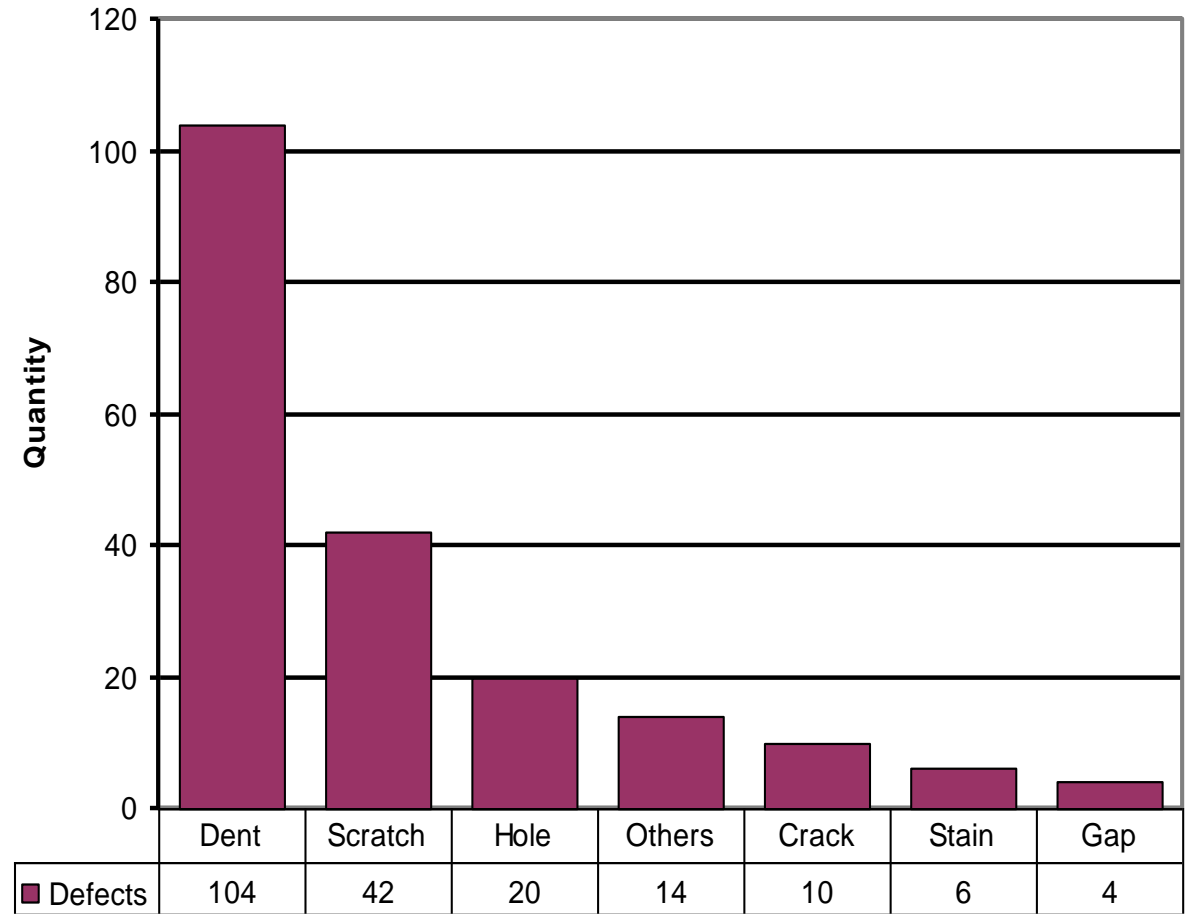
- Create a preliminary list of problem classifications.
- Tally the occurrences in each problem classification.
- Arrange each classification in order from highest to lowest
- Construct the bar chart

Type of Defect	Tally	Total
Crack	II II	10
Scratch	II II II II II II	42
Stain	II I	6
Dent	II II II II II III	104
Gap	IIII	4
Hole	II II II II	20
Others	II II III	14
Total		200

Example of a data tally sheet

BENEFITS:

- Pareto analysis helps graphically display results so the significant few problems emerge from the general background.
- It tells you what to work on first.

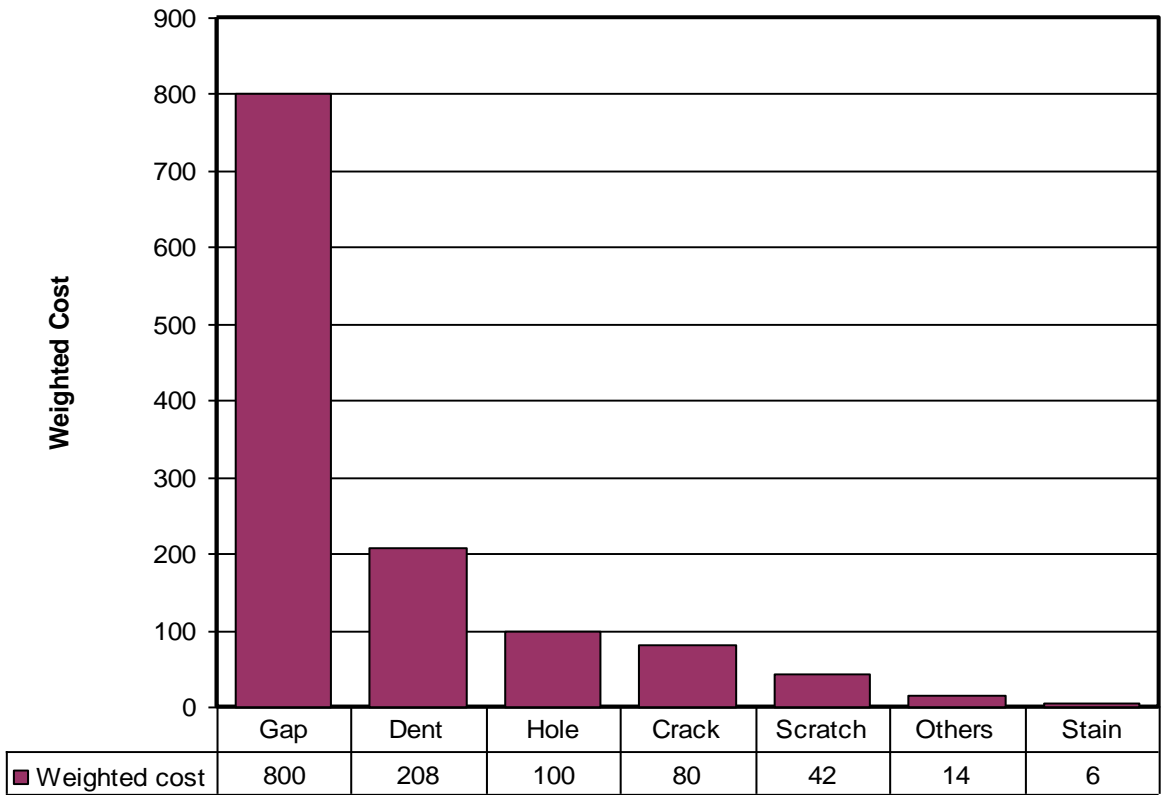


PARETO CHARTS

❖ Weighted Pareto charts use the quantity of defects multiplied by their cost to determine the order.

Defect	Total	Cost	Weighted cost
Gap	4	200	800
Dent	104	2	208
Hole	20	5	100
Crack	10	8	80
Scratch	42	1	42
Others	14	1	14
Stain	6	1	6

WEIGHTED PARETO



CONTROL CHARTS

PURPOSE:

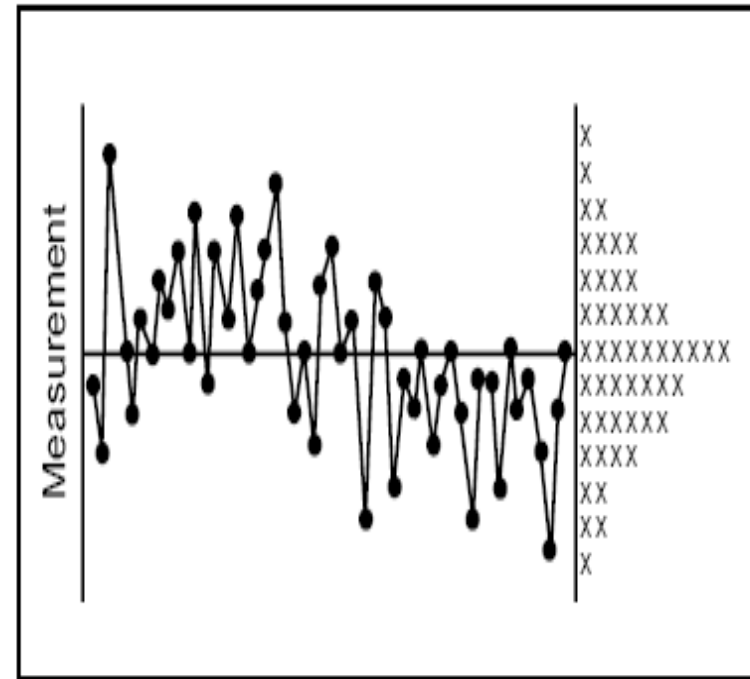
The primary purpose of a control chart is to predict expected product outcome.

BENEFITS:

- Predict process out of control and out of specification limits
- Distinguish between specific, identifiable causes of variation
- Can be used for statistical process control

What does it look like?

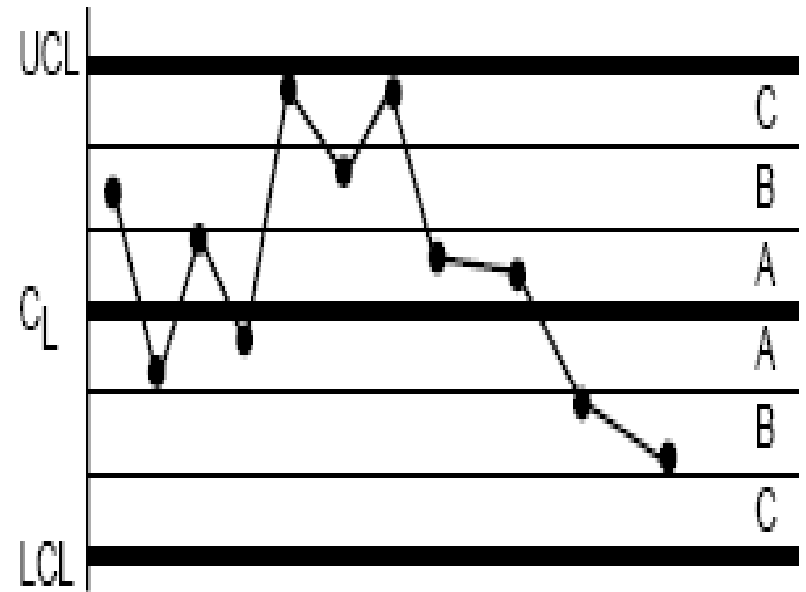
- Adding the element of time will help clarify your understanding of the causes of variation in the processes.
- A run chart is a line graph of data points organized in time sequence and centered on the median data value.



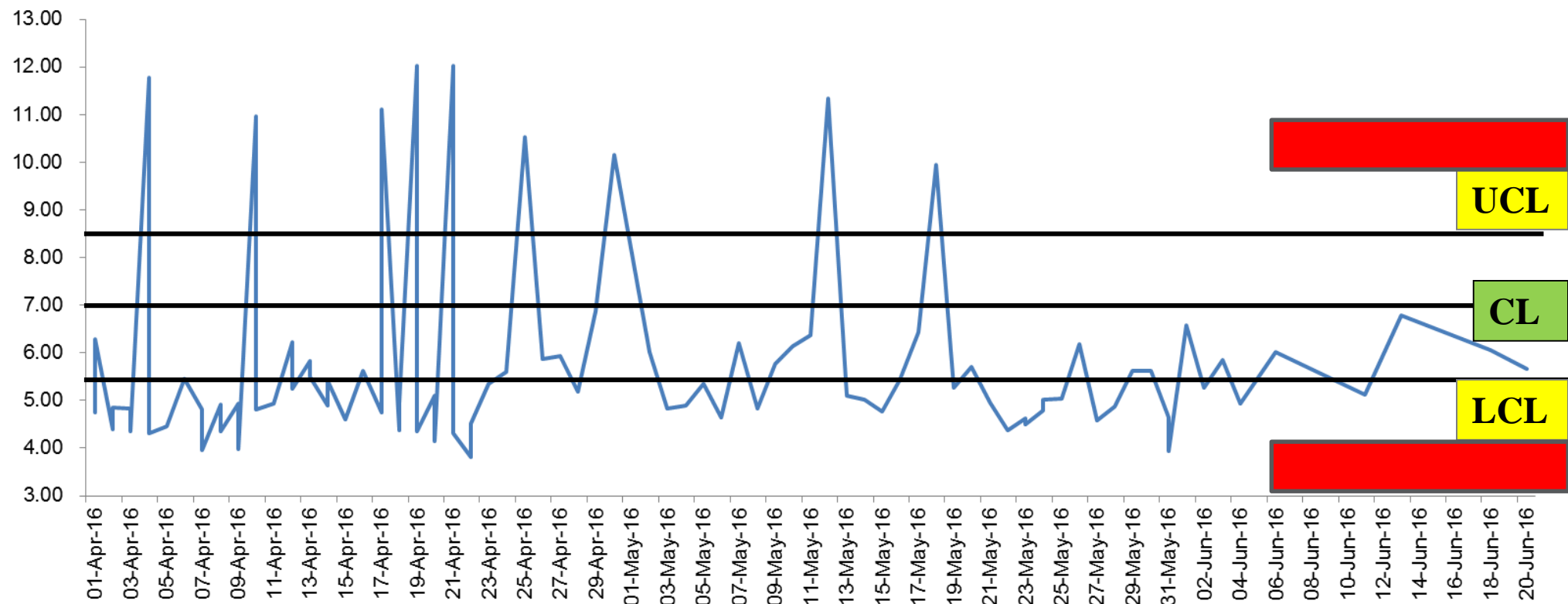
Unusual variation can hide in a frequency plot

CONTROL CHARTS

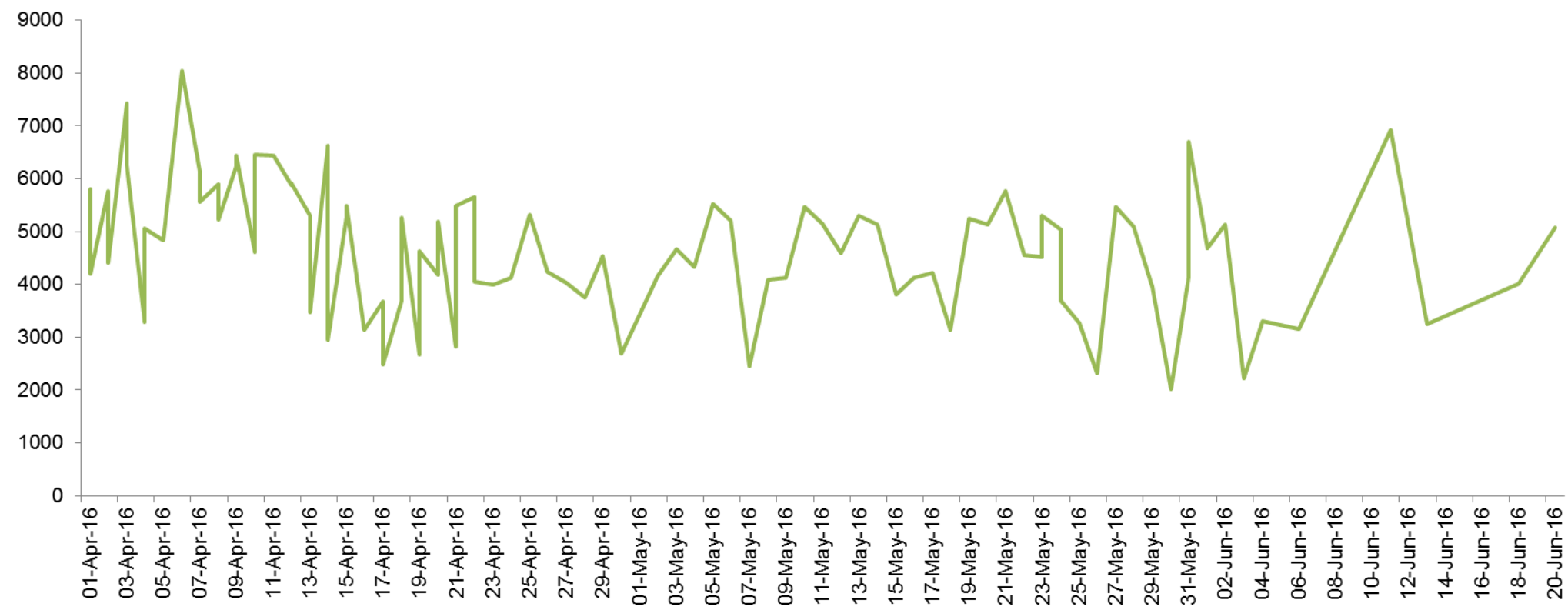
- Next, look at the upper and lower control limits. If your process is in control, 99.73% of all the data points will be inside those lines.
- The upper and lower control limits represent three standard deviations on either side of the mean.
- Divide the distance between the centerline and the upper control limit into three equal zones representing three standard deviations.



pH values of 90 samples were from 1st Apr to 20 Jun'16



TDS (MG/L) IN TATA PIGMENTS EFFLUENT



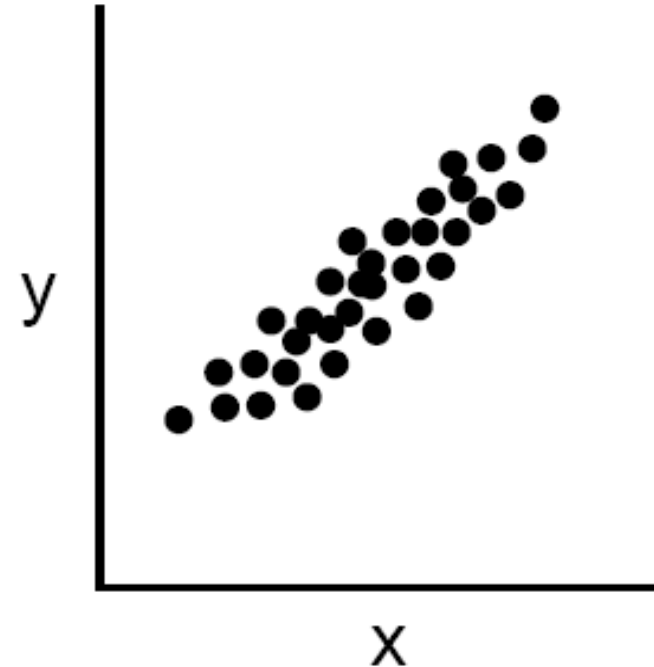
SCATTER DIAGRAMS

PURPOSE:

To identify the correlations that might exist between a quality characteristic and a factor that might be driving it

A scatter diagram shows the correlation between two variables in a process.

- These variables could be a Critical To Quality (CTQ) characteristic and a factor affecting it.
- Dots representing data points are scattered on the diagram.
- The extent to which the dots cluster together in a line across the diagram shows the strength with which the two factors are related.



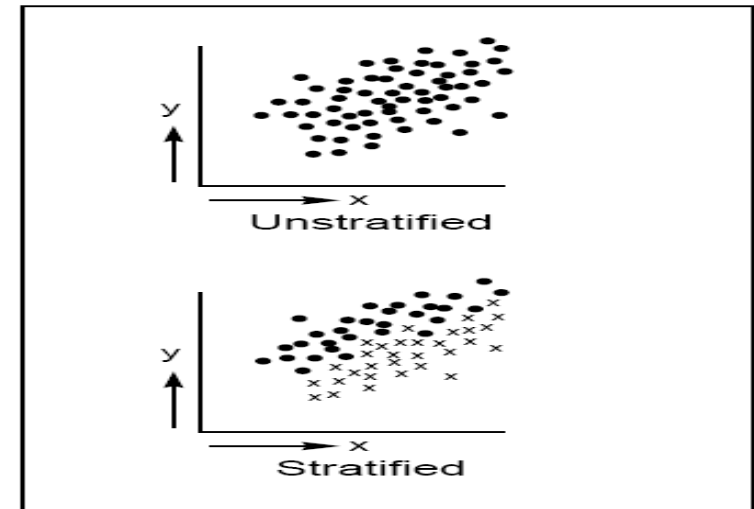
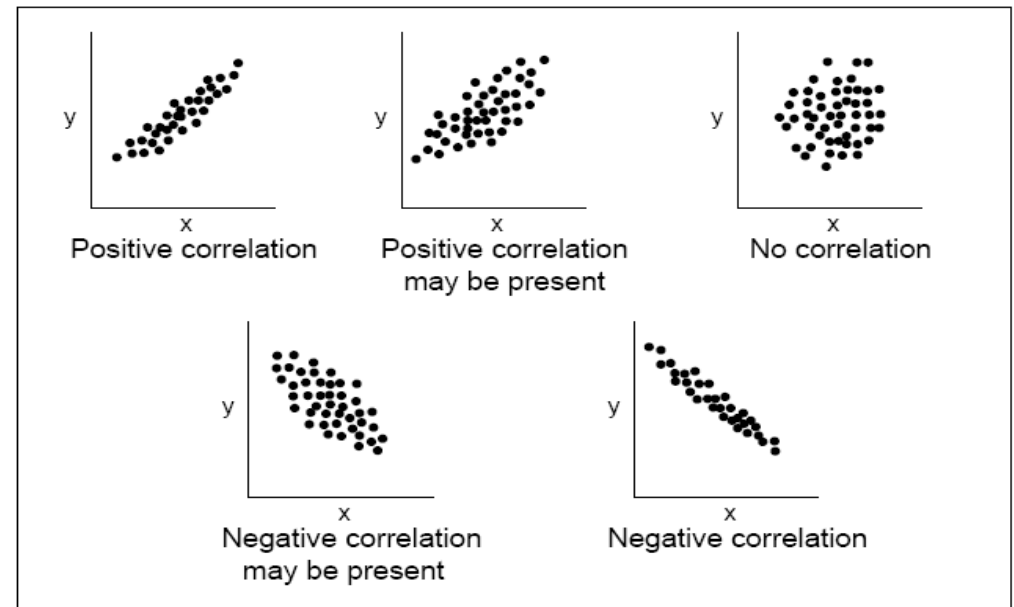
SCATTER DIAGRAMS

How is it done?:

- Decide which paired factors you want to examine. Both factors must be measurable on some incremental linear scale.
- Collect 30 to 100 paired data points.
- Find the highest and lowest value for both variables.
- Draw the vertical (y) and horizontal (x) axes of a graph.
- Plot the data
- Title the diagram

The shape that the cluster of dots takes will tell you something about the relationship between the two variables that you tested.

- If the variables are correlated, when one changes the other probably also changes.
- Dots that look like they are trying to form a line are strongly correlated.
- Sometimes the scatter plot may show little correlation when all the data are considered at once.
 - ✓ Stratifying the data, that is, breaking it into two or more groups based on some difference such as the equipment used, the time of day, some variation in materials or differences in the people involved, may show surprising results



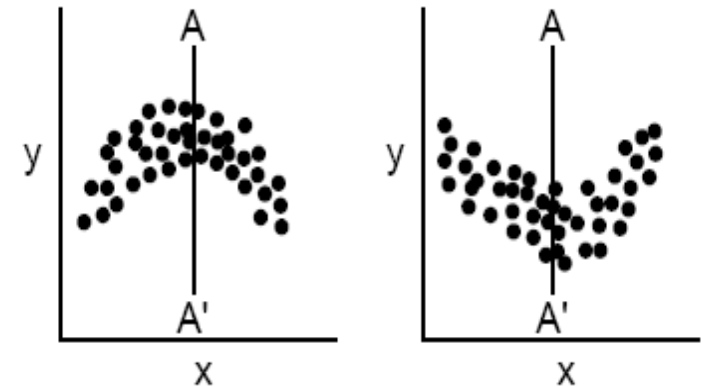
Unstratified and stratified scatter diagrams

SCATTER DIAGRAMS

- You may occasionally get scatter diagrams that look boomerang- or banana-shaped.
 - To analyze the strength of the correlation, divide the scatter plot into two sections.
 - Treat each half separately in your analysis

BENEFITS:

- Helps identify and test probable causes.
- By knowing which elements of your process are related and how they are related, you will know what to control or what to vary to affect a quality characteristic.



Scatter diagram with peaks and troughs

An illustration showing three people interacting with computers. On the left, a person with blonde hair sits at a purple desk with a desktop monitor. In the center, a person with dark hair sits on a green armchair with a laptop. On the right, a person with long brown hair sits on a green bench with a laptop. Above them is a large, stylized blue and white thought bubble containing the text 'Questions ? Comments ?'. Dotted lines connect each person's computer to the thought bubble.

**Questions ?
Comments ?**

THANK YOU

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