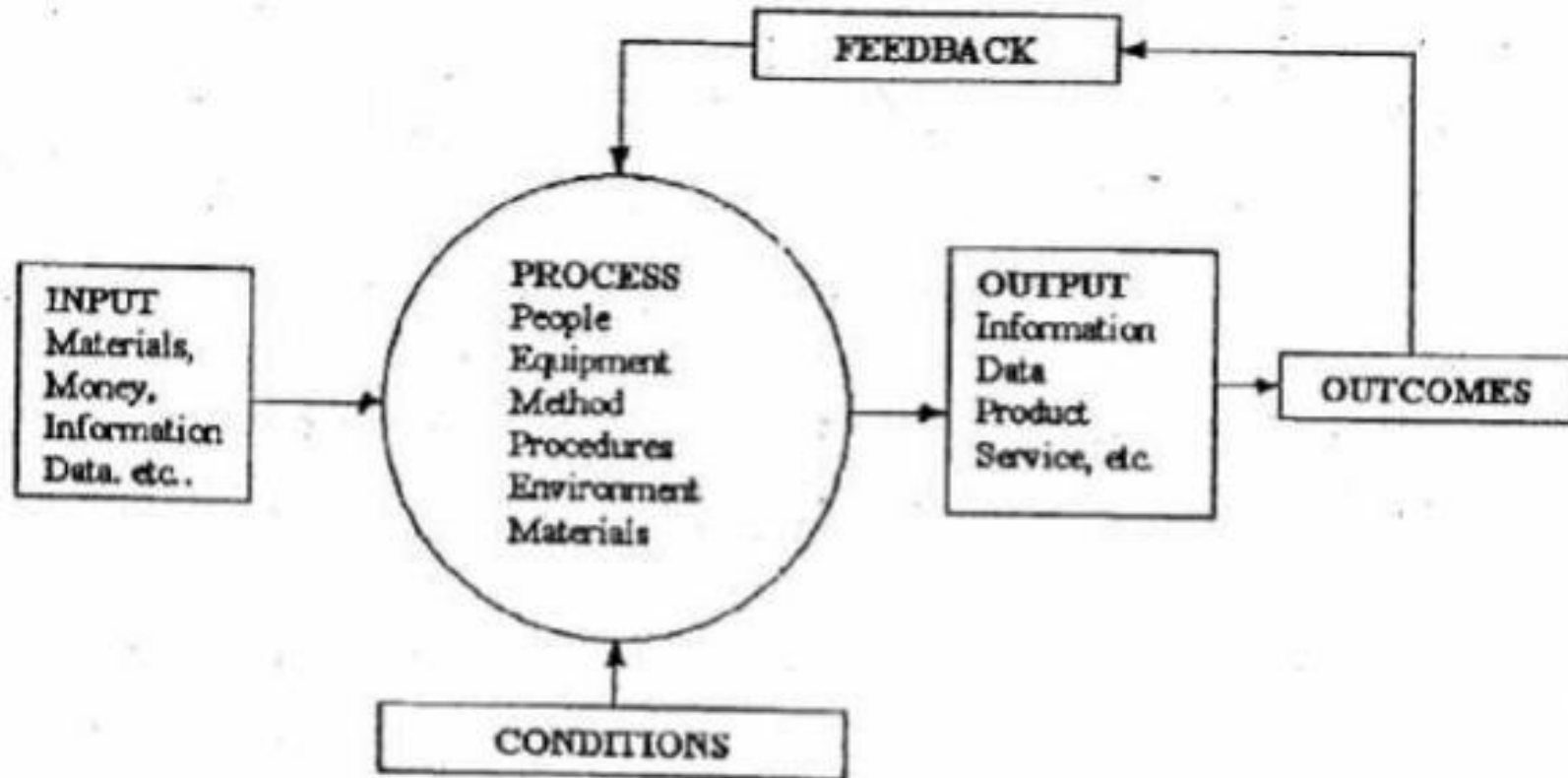




# **CONTINUOUS PROCESS IMPROVEMENT**

# Continuous Process Improvement



# IMPROVEMENT

## 5 Ways to Improve

- Reduce resource input
- Reduce errors
- Meet or exceed expectations of customers
- Make the process Safer
- Make the process more satisfying for the people doing it

# JURAN Trilogy

## JURAN TRILOGY

One of the best approaches developed by Dr. Joseph Juran.  
It has 3 components:

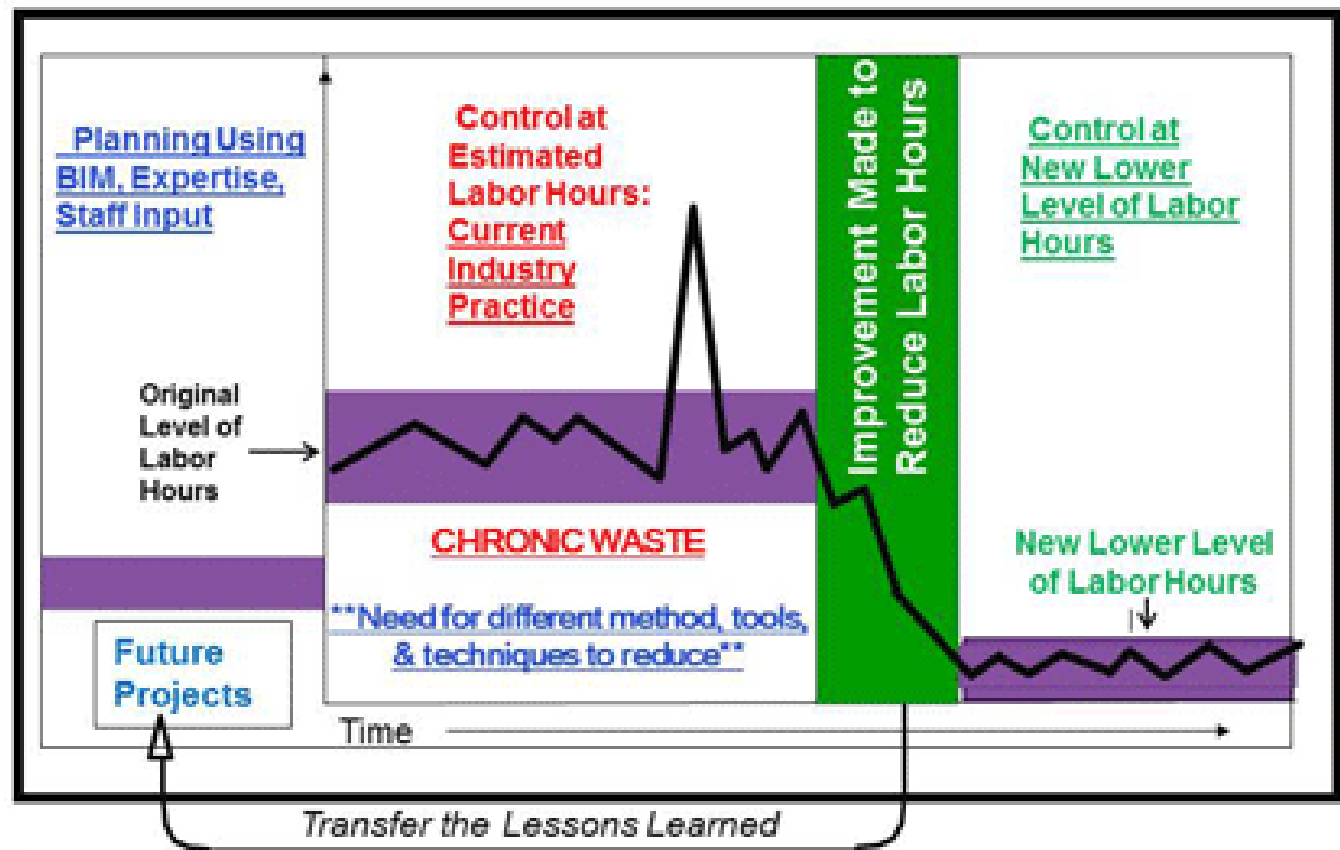
1. Quality Planning
2. Quality Control &
3. Quality Improvement



# JURAN Trilogy

## HOW LASTING PROJECT IMPROVEMENTS ARE MADE

### THE JURAN TRILOGY®



# Improvement Strategies

- Repair
- Refinement
- Renovation
- Reinvention

# Improvement Strategies:

## ***Repair***

- Anything Broken must be fixed
- *Two levels of application*
  1. If a customer receives damaged product: FIX IT (Temporary solution)
  2. Eliminate the root cause of the problem (long term solution)



# Improvement Strategies:

## ***Refine***

- Continually improve the process that is not broken
- Incremental improvements in products, processes, services
- A strategy for both individuals & teams
- Doing things just a bit *quicker*, *better*, *easier* or *with less waste*
- Benefit: Little resistance from employees
- Drawback: Gradual change might not be recognized or rewarded by management





## Improvement Strategies: ***Renovate***

- Major break through improvements
- Output may appear to be the same
- Innovation & technology  
advancements are key factors in this  
approach
- More expensive

# Improvement Strategies:

## ***Reinvent***

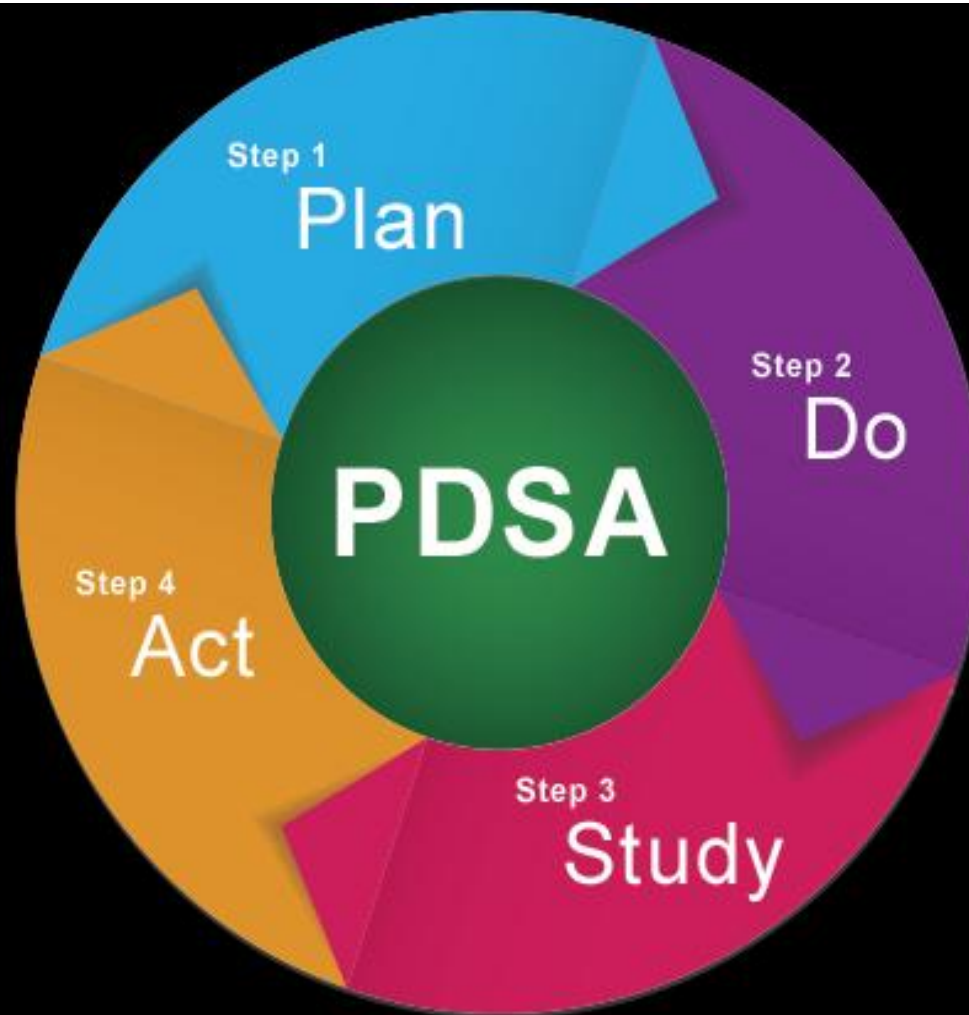
- Most demanding strategy
- Thinking process: *Current approach will never satisfy customer requirements*
- A new output (product, service or activity) might be developed
- Start with the imagination that previous system does not exist
- Benefit: Potential competitive advantage

Drawbacks: Potential resistance from

# Types of Problems in Continuous Process Improvement

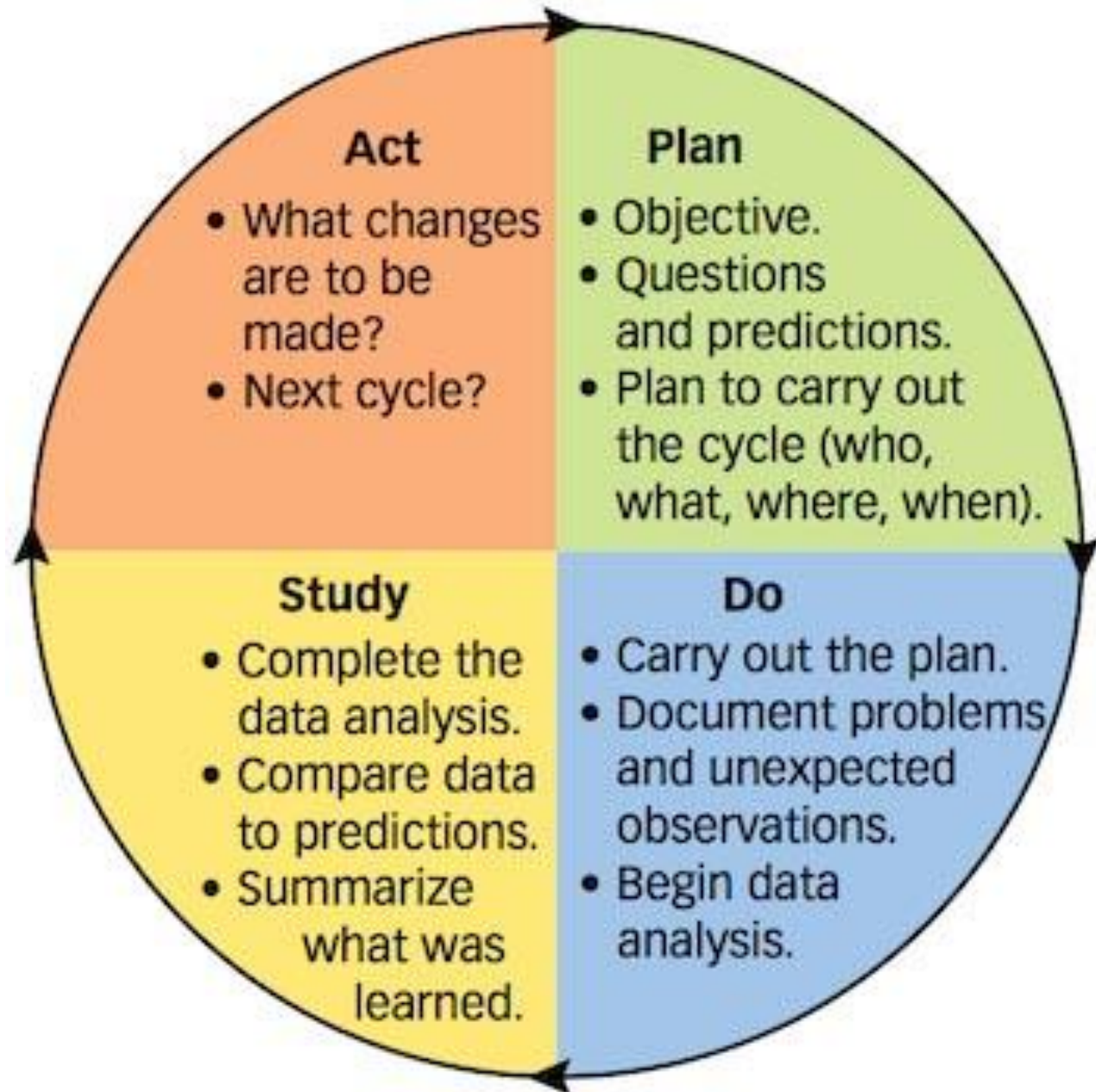
- Compliance
- Unstructured
- Efficiency
- Process Design
- Product Design

# PDSA-cycle

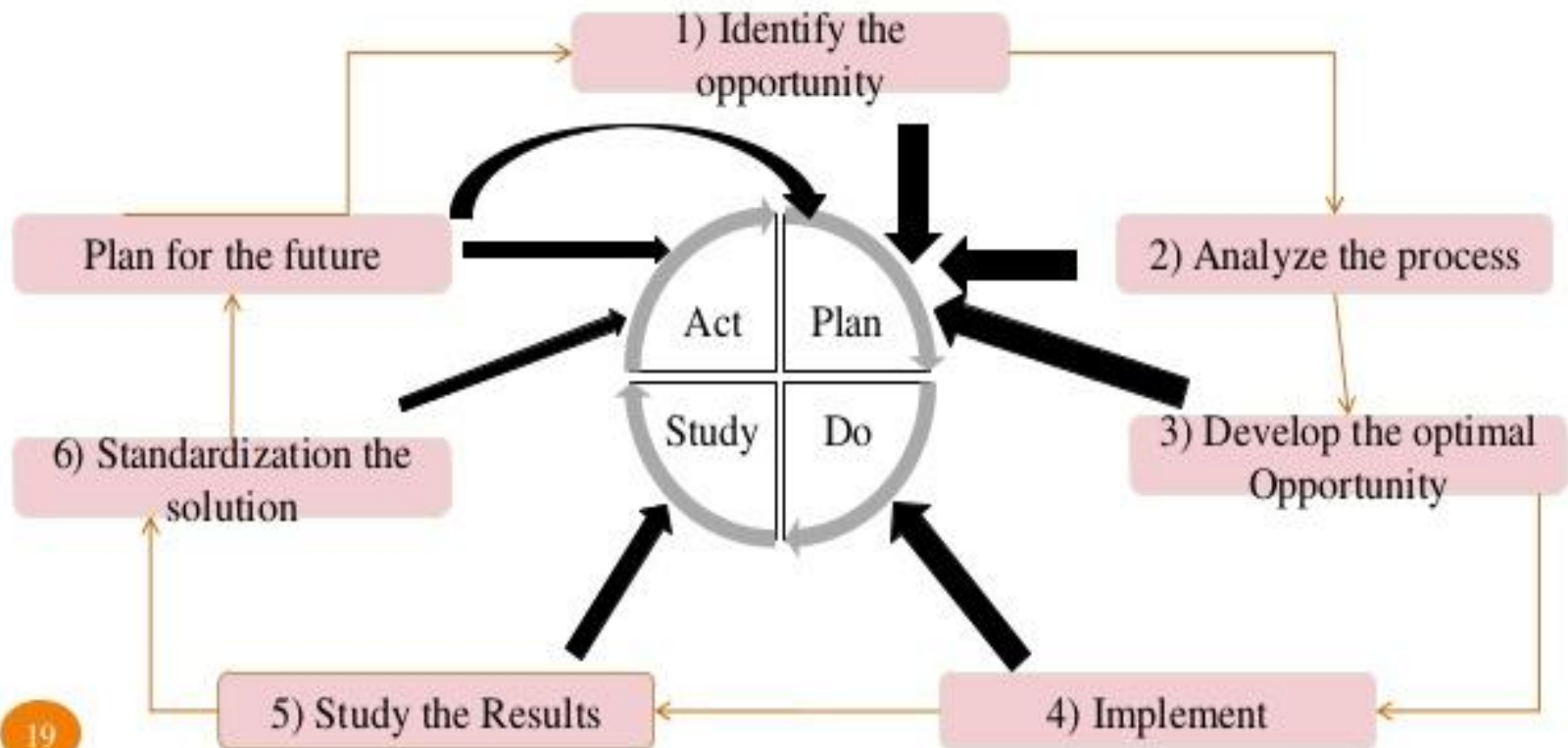




# PDSA-cycle



# Problem-Solving Method



KAIZEN

改善

Kai = Change

Zen = Good



CHANGE

+



BETTER

=



**CONTINUOUS  
IMPROVEMENT**

Everybody!  
Everyday!  
Everywhere!



# KAIZEN

Basically kaizen is small incremental changes made for improving productivity and minimizing waste

Kaizen has three main principles:

- Consider the process and the results
- The need to look at the entire process of the job at hand and to evaluate the job as to the best way to get the job done
- Kaizen must be approached in such a way that no one is blamed and that the best process is put into place.

# KAIZEN

## PHASES IN KAIZEN

### **Kaizen Event Steps Outline**

Kaizen means "change for the good." The target of Kaizen is cost reduction by eliminating waste.

- Step #0** - Event Preparation — Select event area, team, and create team package
- Step #1** - Define the Scope and Goals of the Event
- Step #2** - Train the Team. Review the World Class Tool(s) and Techniques that Support the Team's Goal
- Step #3** - Walk the Event Area, Observe Physical Layout, Review Videos if Available. This step starts the idea creation process
- Step #4** - Collect Data on Event Area (Scrap, Production, Time Studies, Videos, Etc.) — Develop/obtain the baseline performance measurements
- Step #5** - Brainstorm Ideas — Thinking "outside the box" and piggybacking important here
- Step #6** - Use Multi-Voting to Prioritize Top 8-10 Ideas that will be Worked on Immediately
- Step #7** - Form Sub-Teams to Go Out and Try/Implement Ideas

# 5 'S' in KAIZEN

5S is a method for organizing a workplace, especially a shared workplace (like a shop floor or an office space), and keeping it organized.



## 5S&quote steps

Sorting - keeping only essential items

Simplifying -eliminates extra motion

Sweeping - keep the workplace clean

Standardizing - standardized work practices

Sustaining - maintaining and reviewing standards



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# KAIZEN

## BENEFITS OF KAIZEN

- Kaizen Reduces Waste- like inventory waste, time waste, workers motion
- Kaizen Improves space utilization, product quality
- Results in higher employee moral and job satisfaction, and lower turn-over.

**Case Study:** Toyota is well-known as one of the leaders in using Kaizen. In 1999 at one U.S. plant, 7,000 Toyota employees submitted over 75,000 suggestions, of which 99% were implemented.

# SIX SIGMA

# 6σ

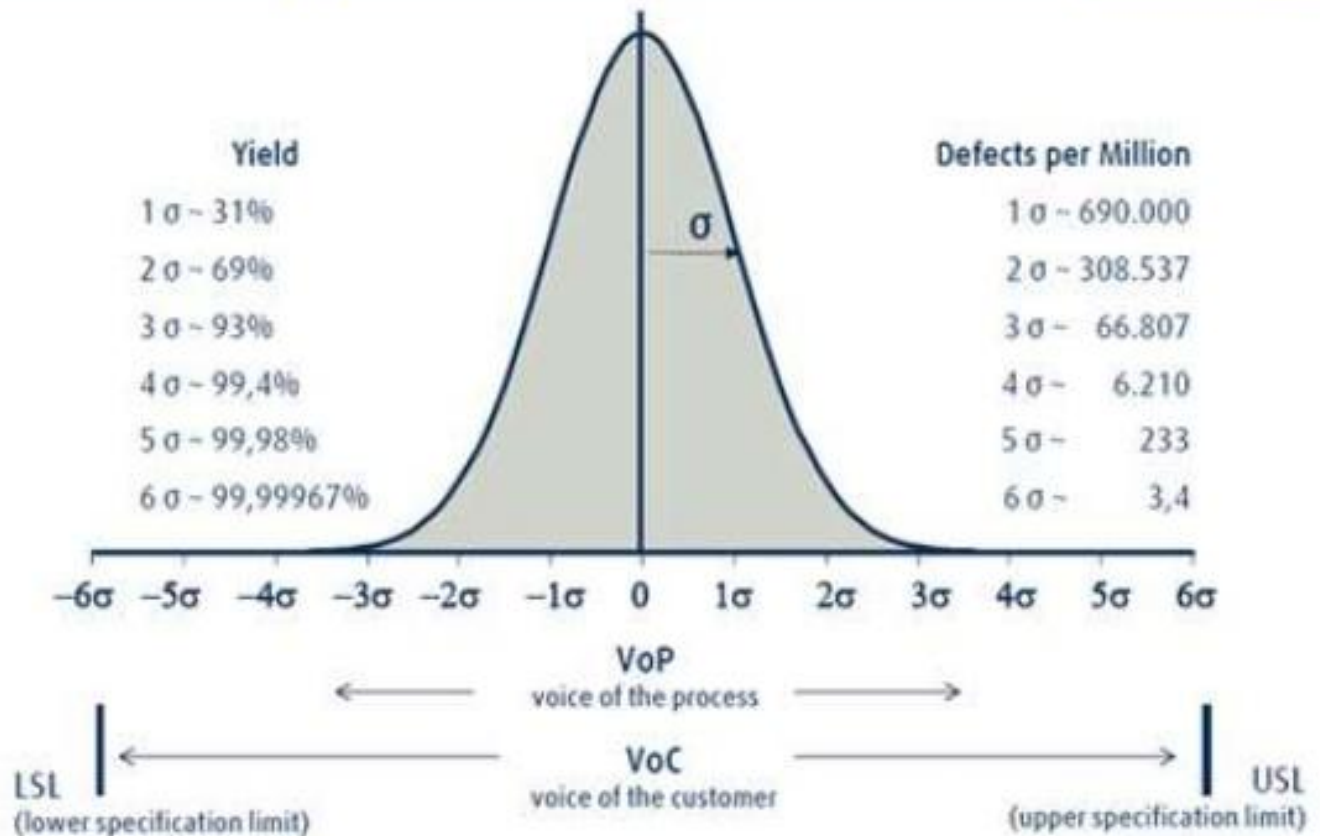
*"Delivering Tomorrow's Performance Today"*

- *A term (Greek) used in statistics to represent standard deviation from mean value, an indicator of the degree of variation in a set of a process.*
- *Sigma measures how far a given process deviates from perfection. Higher sigma capability, better performance*

# SIX SIGMA

## Sigma Levels

Screenshot\_2015-03-09-18:13:38.png



The customer is satisfied (in 99,99967% of deliveries a.o.)



# SIX SIGMA

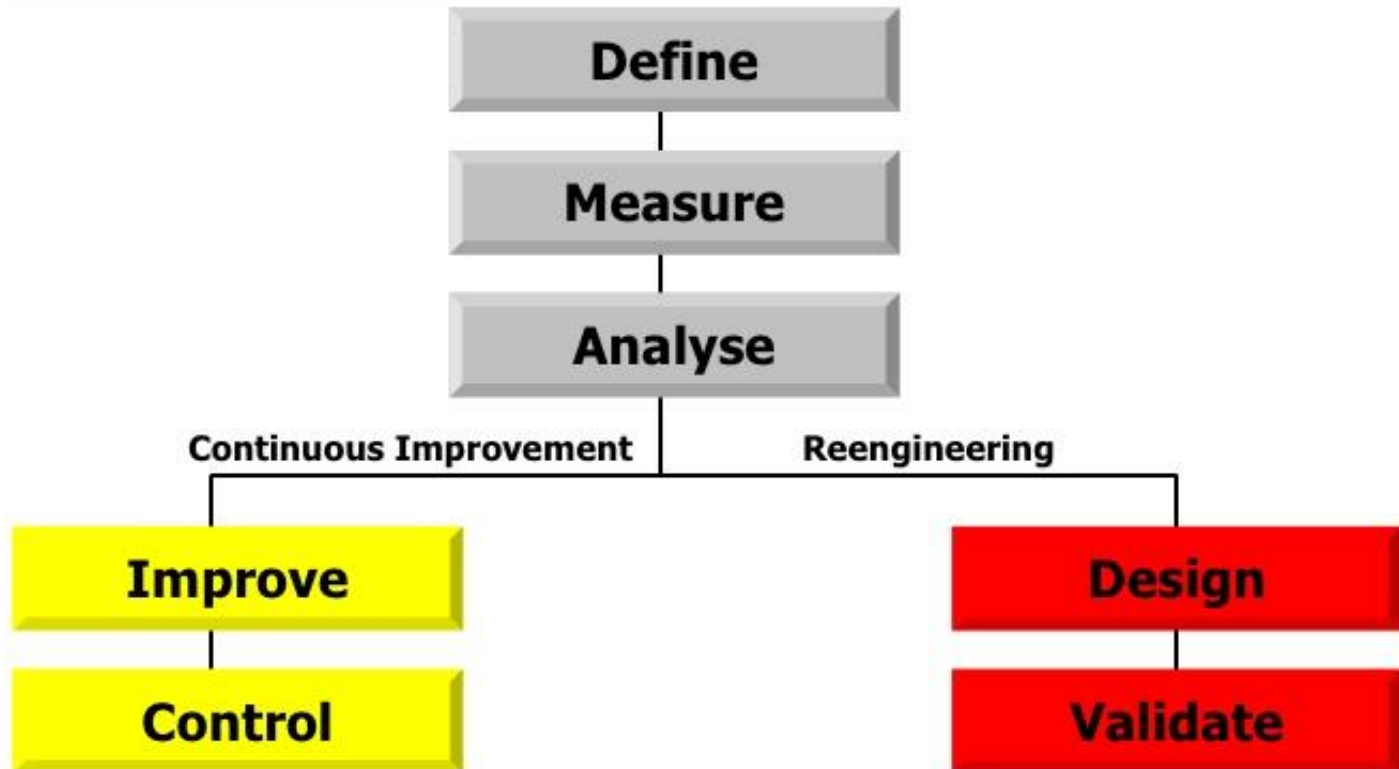
## WHY SIX SIGMA ?

- Six Sigma emerged as a natural evolution in business to increase profit by eliminating defects
- The Current business environment now demands and rewards innovation more than ever before due to:
  - Customer Expectations
  - Technological Change
  - Global Competition
  - Market Fragmentation



# SIX SIGMA METHODOLOGIES

## DMAIC vs. DMADV



# SIX SIGMA METHODOLOGIES

## Six Sigma Methodologies

### DMAIC

An improvement system for existing processes falling below specification and looking for incremental improvement

Define  
Measure  
Analyse  
Improve  
Control

### DMADV

An improvement system used to develop new processes or products at Six Sigma quality levels

Define  
Measure  
Analyse  
Design  
Verify

Both DMAIC & DMADV are inspired by Deming's Plan-Do-Check-Act Cycle

# DMAIC vs DMADV

DMAIC	DMADV
The emphasis of DMAIC is more on correcting an existing process and reducing existing variation	DMADV is more about creating a process (Standardize) with an optimized design or "Doing it Right first time"
DMAIC is "Correction"	DMADV is "Prevention"
DMAIC uses more of Statistical tool and numerical/quantitative analysis to arrive at the solution	DMADV uses Qualitative tools: QFD (Quality Function Deployment), KANO Model etc
Six Sigma focuses on one or two CTQ, looks at processes, and aims to improve the CTQ performance	DFSS focuses on every single CTQ that matters, looks at products and services as well as the processes by which they are delivered, and aims to bring a large scale improvement
DMAIC projects often take short duration to fix a customer problem & process improvements	DMADV projects are often much larger and take longer, and are often based on a long term business need for new products /service

# Process improvement tools

## Seven QC Tools

With correct implementation of the Seven TQM Tools  
**95%** of quality related problems can be solved.

1. Flow charts
2. Check sheets
3. Histograms
4. Pareto diagrams
5. Cause-and-effect diagrams
6. Scatter diagrams
7. Control charts

# 1. Check Sheets

- **Check Sheets** are simple documents that are used for collecting data in real-time.
- A Check Sheet is typically a blank form that is designed for the quick, easy and efficient recording of the desired information, which can be either quantitative or qualitative.
- When the information is quantitative, the check sheet is called a **Tally Sheet**.



# Check Sheets

No of Defects Generated in the Factory - December 2011							
Operator	Time	Machine 01	Machine 02	Machine 03	Machine 04	Total	
A	Morning	///	////	/	//	10	24
	Evening	////	////	/	////	14	
B	Morning	/	//		/	4	10
	Evening	//	//	/	/	6	
C	Morning		/		/	2	5
	Evening	/	/		/	3	
D	Morning	//	///	//	/	8	19
	Evening	///	///	///	//	11	
Total		16	21	8	13	58	

# Check Sheets

Telephone Interruptions

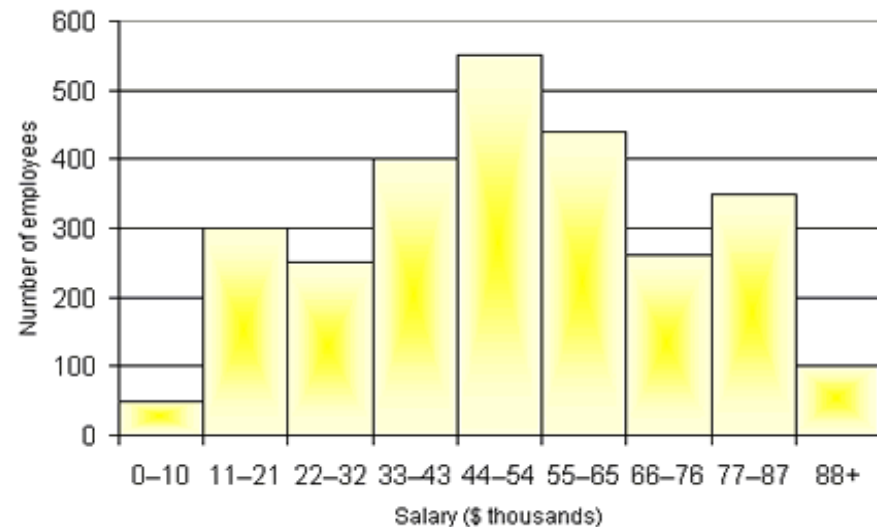
Reason	Day					
	Mon	Tues	Wed	Thurs	Fri	Total
Wrong number	+++			+++	+++	20
Info request						10
Boss	+++		+++			19
Total	12	6	10	8	13	49



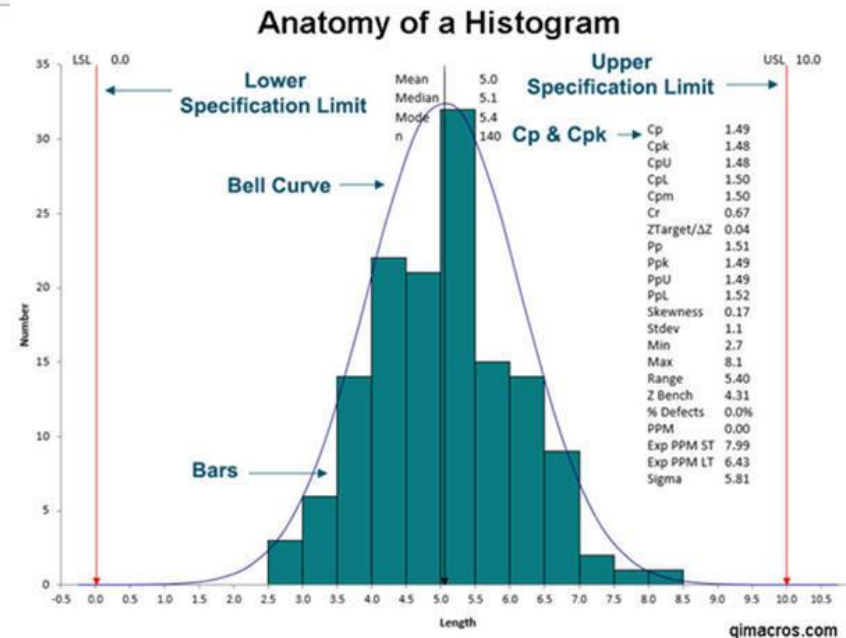
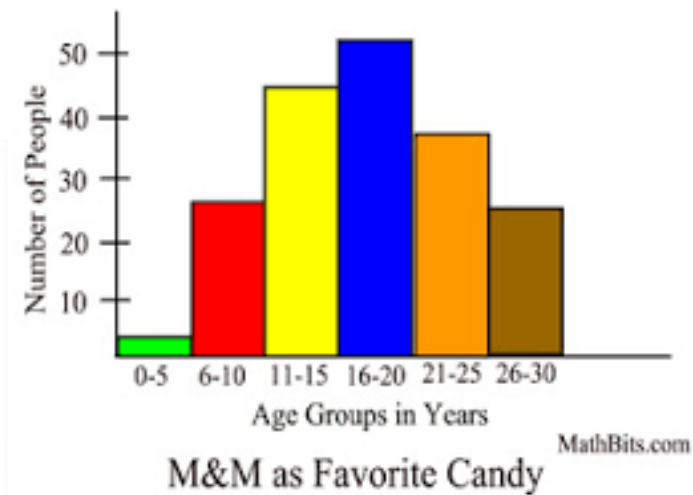
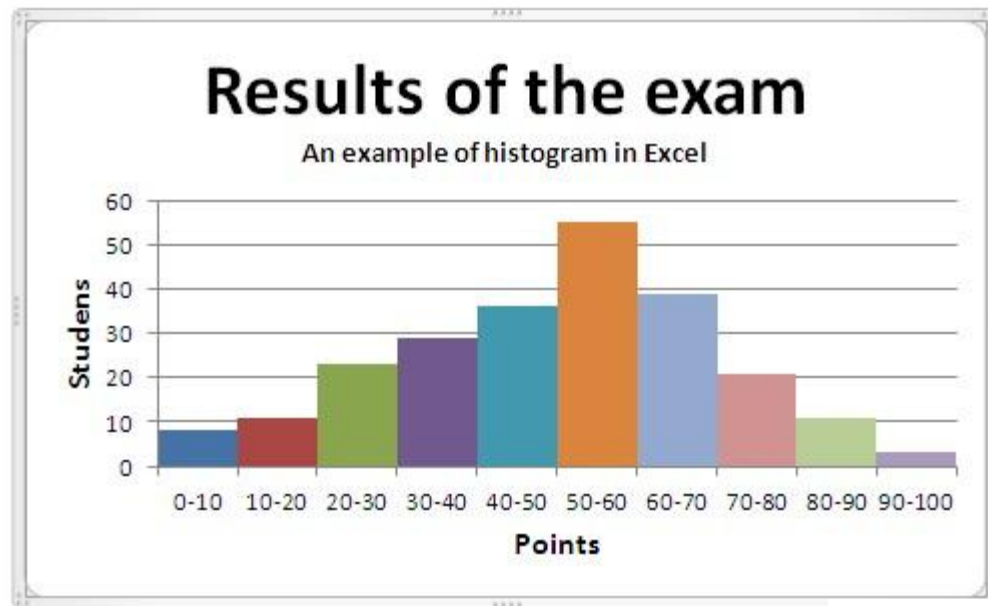
## 2. Histograms

A **histogram** divides up the range of possible values in a data set into classes or groups.

For each group, a rectangle is constructed with a base length equal to the range of values in that specific group, and an area proportional to the number of observations falling into that group.



# Histograms

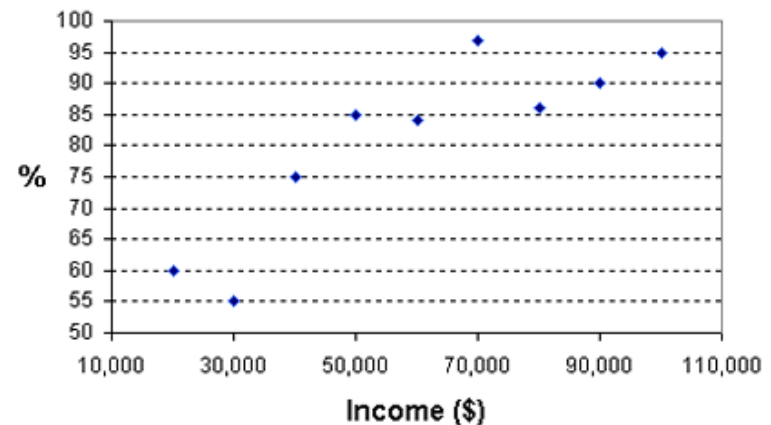


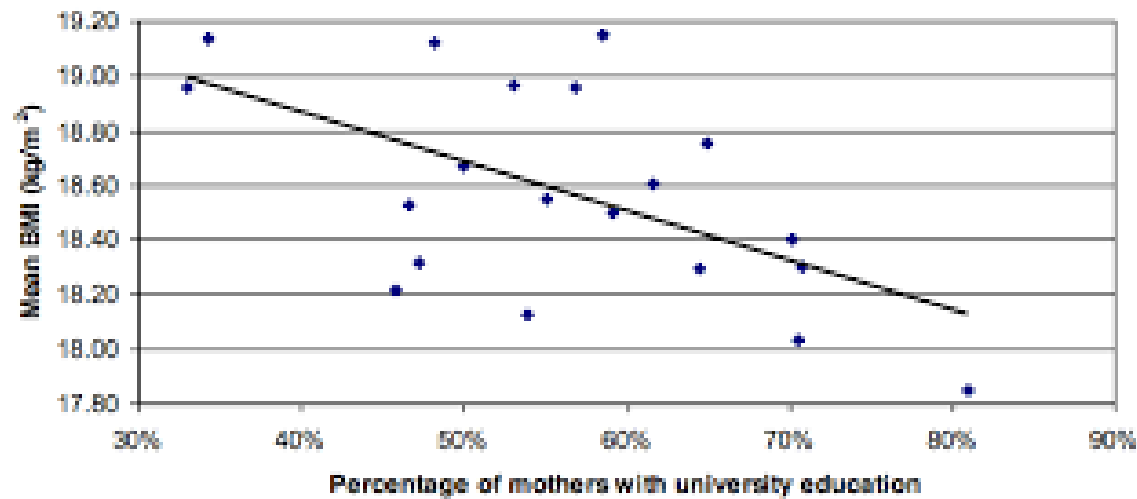
# 3. Scatter Diagrams

**Scatter Diagrams** are used to present measurements of two or more related variables. A Scatter Diagram does not specify dependent or independent variables.

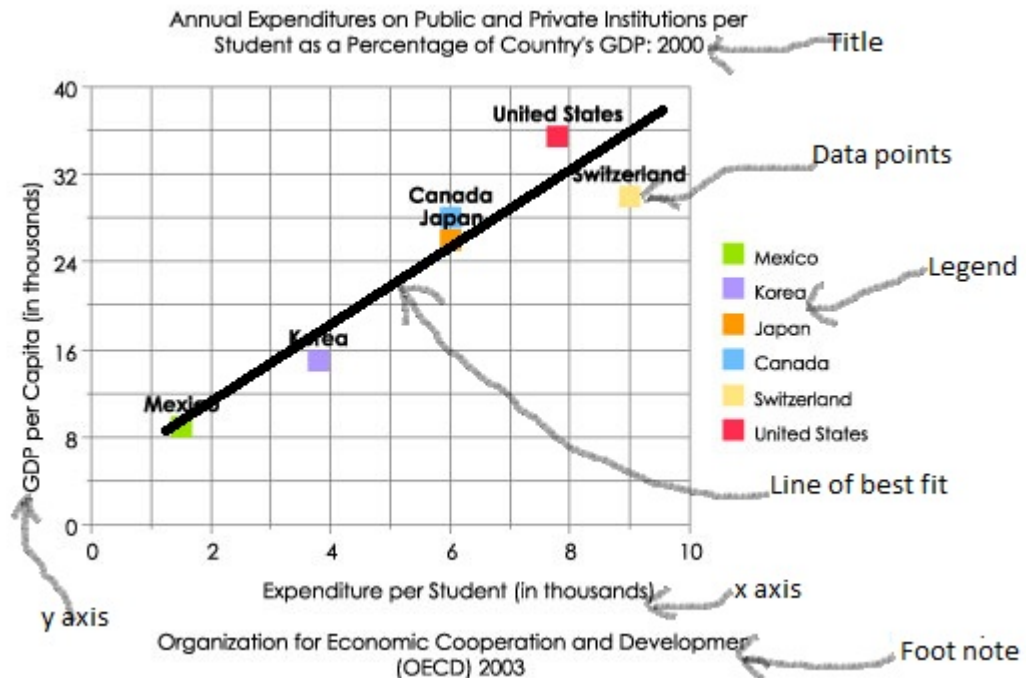
Either type of variable can be plotted on either axis.

Scatter Diagrams represent the association (not causation) between two variables.





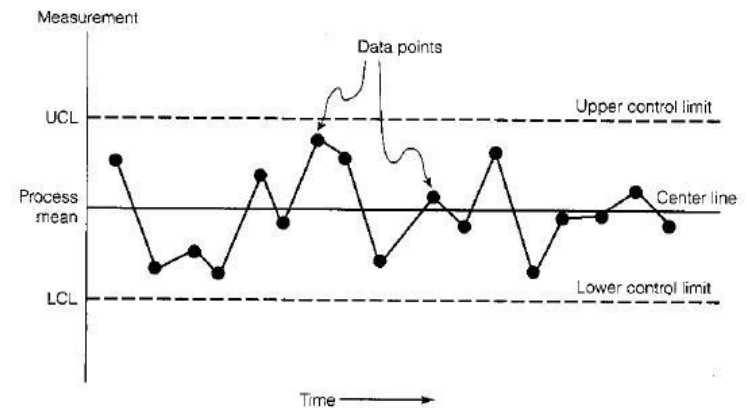
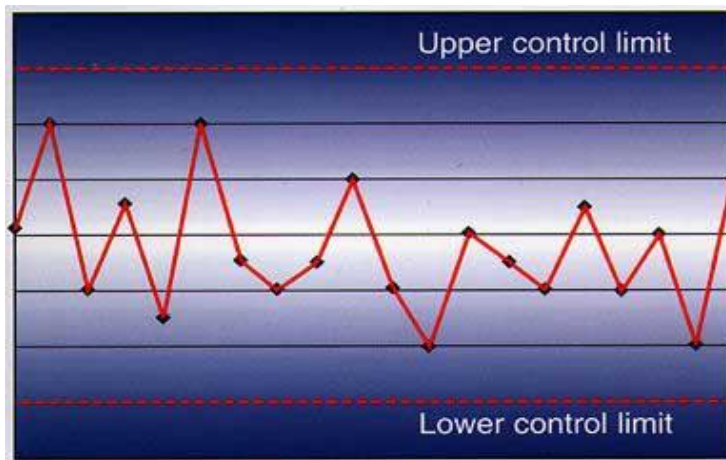
# Scatter Diagrams



# 4. Control Charts

A control chart consists of the following:

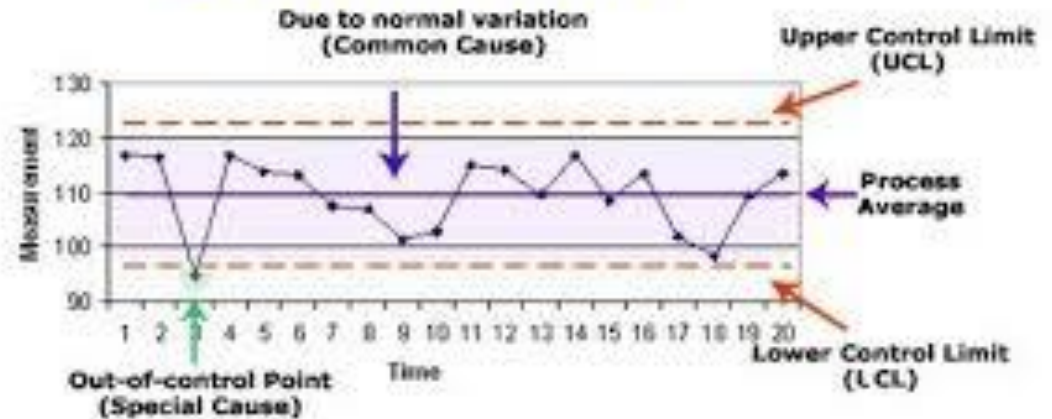
A Centre Line (CL) drawn at the process mean value.



Lower and Upper Control Limits that indicate the threshold at which the process output is considered statistically unlikely.

# Control Charts

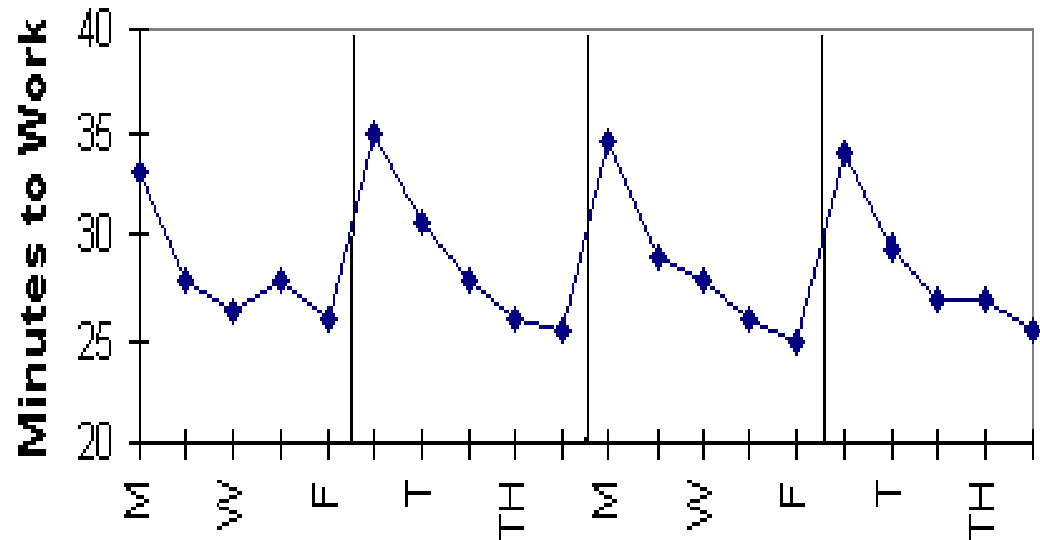
## Control Chart



# 5. Run Charts

**Run Charts** are similar in some regards to Control Charts, but do not show the control limits of the process.

They are therefore simpler to produce, but do not allow for the full range of analytic techniques supported by Control Charts.



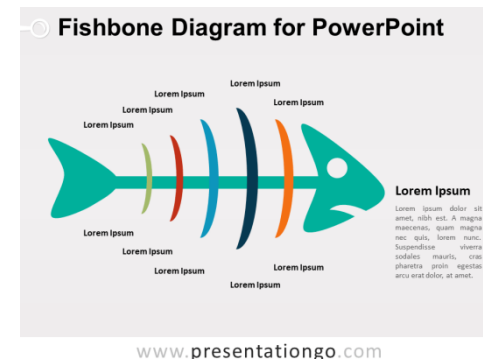
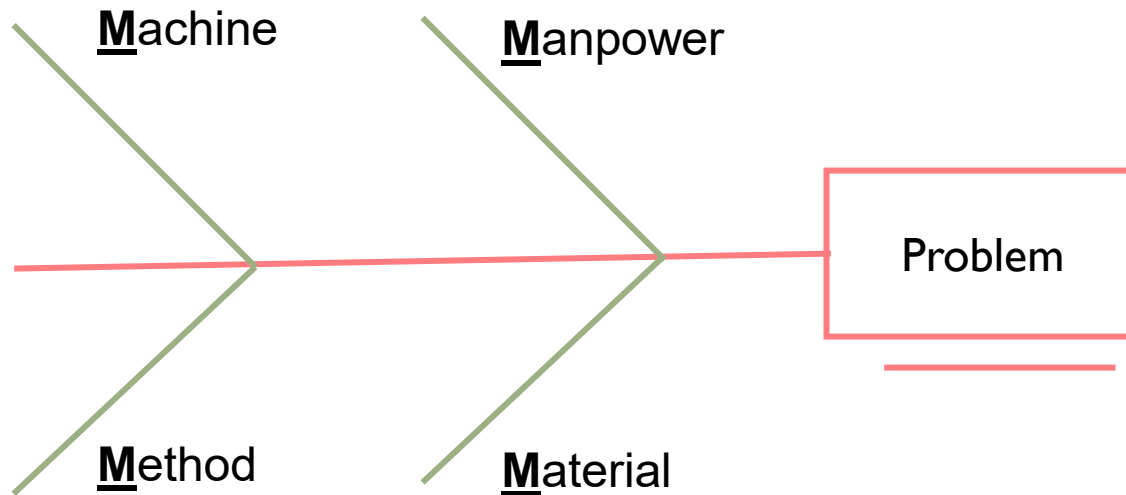
- Run chart: Measurement against progression of time.
- Control chart: Add Upper Control Limit and Lower Control Limit to the run chart.



# 6. Ishikawa Diagram

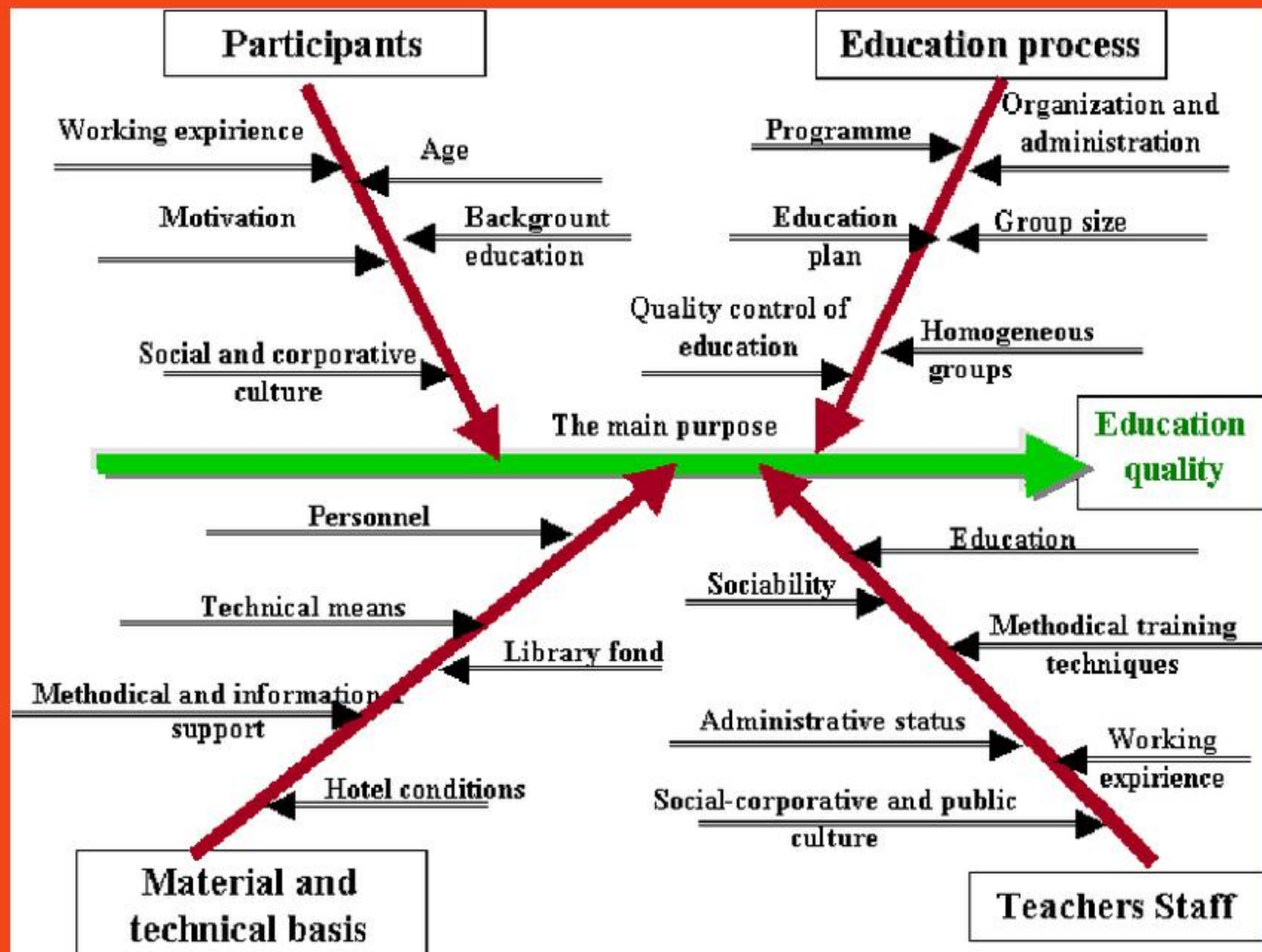
Also called *fishbone diagrams* (because of their shape) or Ishikawa diagrams.

Helps in identifying root causes of the quality failure. (Helps in the *diagnostic journey*.)



Ishikawa Diagram is also called Cause-and-Effect Diagram. Often are four generic heading used: **4 M's!**

# Ishikawa Diagram



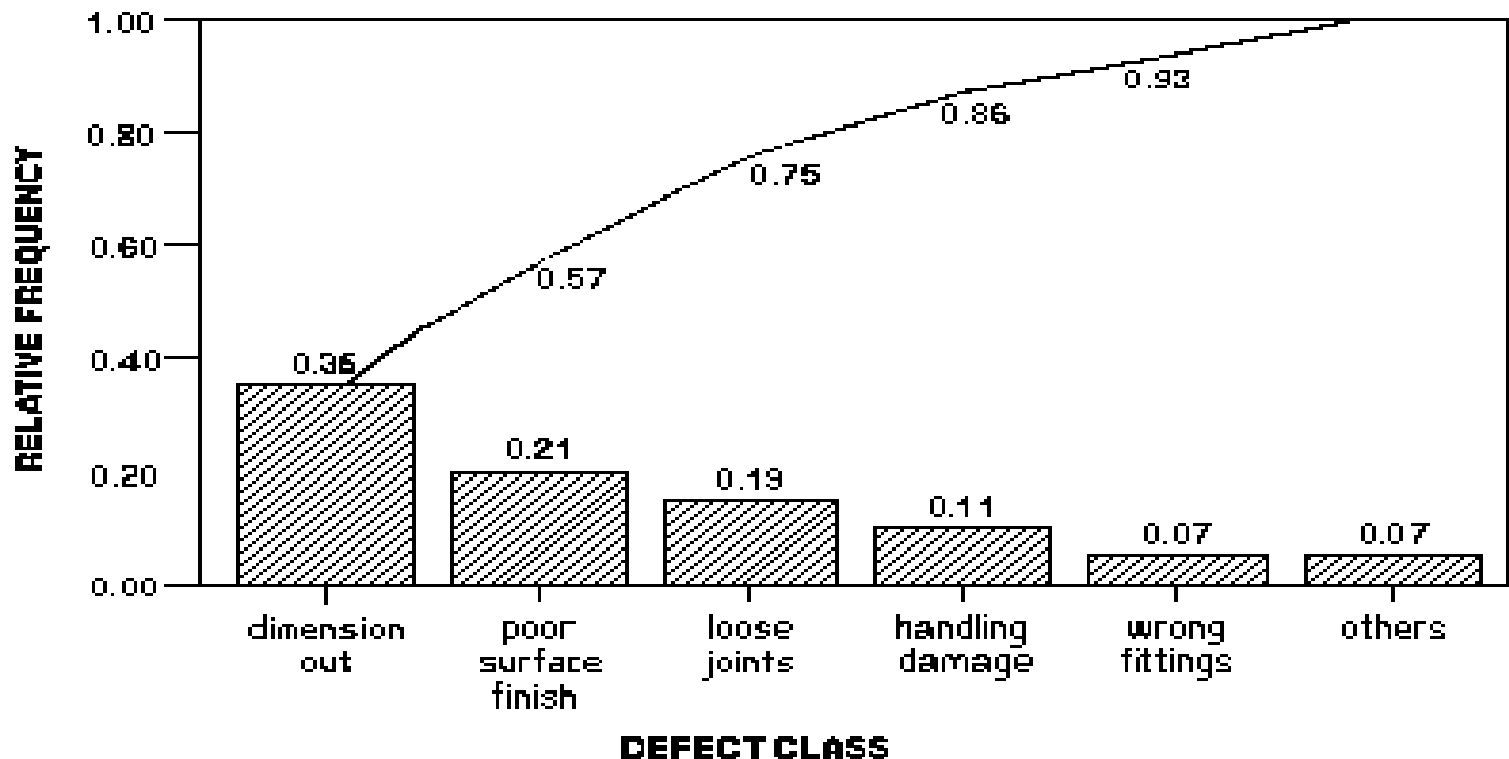
## 7. Pareto Diagram

The purpose of the Pareto Diagram is to highlight the most important set of factors among a typically large amount of causes for a problem.

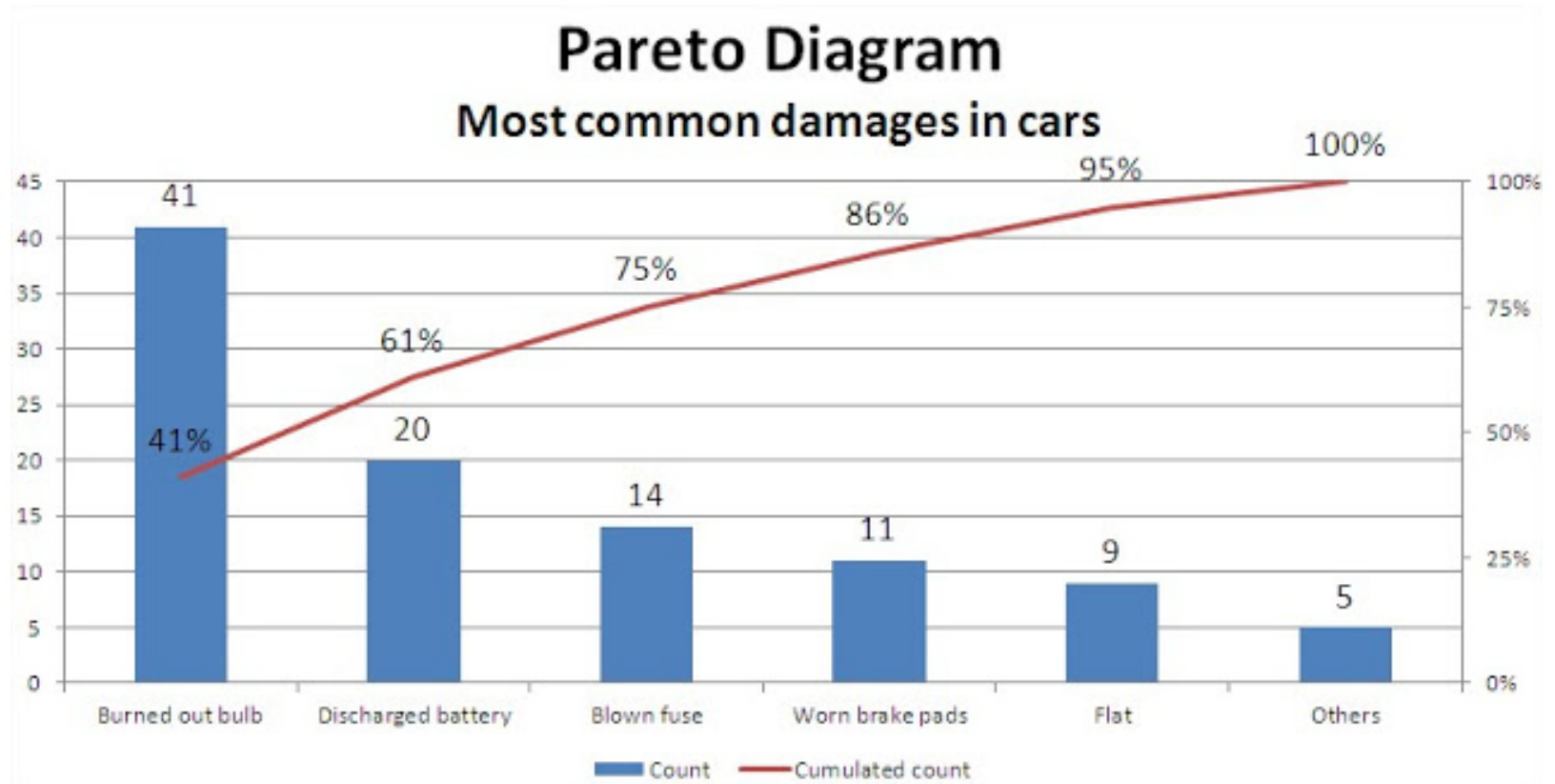
In order to develop the Pareto Diagram for a specific process, the knowledge of Frequency, Relative Frequency, Cumulative Frequency and Percentage Frequency is needed.

# Pareto Diagram

It can be noted that the 3 defects of out-of-dimension, poor surface finish and loose joints account for 75% of the rejections.



# Pareto Diagram



# Pareto Diagram

