UNIT-3 BME 55

QUALITY MANAGEMENT TOOLS

PROF.D.K.SINGH

7 QUALITY TOOLS

- ✓ Check sheet
- ✓ Histogram
- ✓ Pareto chart
- ✓ Cause & effect diagram
- ✓ Control chart
- ✓ Scatter diagram
- ✓ Flow chart

CHECK SHEET

- Check sheet is a form used to collect data in real time at the location where the data is generated.
- The data it captures can be qualitative or quantitative.
- When the information is quantitative, the check sheet is sometimes called tally sheet.

CHECK SHEET..

Motor Assembly Check Sheet

Name of Data Recorder: Lester B. Rapp

Location: Rochester, New York

Data Collection Dates: 1/17 - 1/23

<table>
<tr><th rowspan="2">Defect Types/
Event Occurrence</th><th colspan="7">Dates</th><th rowspan="2">TOTAL</th></tr>
<tr><th>Sunday</th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th><th>Friday</th><th>Saturday</th></tr>
<tr><td>Supplied parts rusted</td><td></td><td>|||||||||</td><td>|||||</td><td>||||</td><td>||</td><td></td><td></td><td>20</td></tr>
<tr><td>Misaligned weld</td><td></td><td></td><td>|||</td><td></td><td></td><td>||</td><td></td><td>5</td></tr>
<tr><td>Improper test procedure</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>Wrong part issued</td><td></td><td>|</td><td></td><td>||</td><td></td><td></td><td></td><td>3</td></tr>
<tr><td>Film on parts</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>Voids in casting</td><td></td><td></td><td></td><td>||||</td><td>||</td><td></td><td></td><td>6</td></tr>
<tr><td>Incorrect dimensions</td><td></td><td></td><td></td><td></td><td></td><td>||</td><td></td><td>2</td></tr>
<tr><td>Adhesive failure</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td></tr>
<tr><td>Masking insufficient</td><td></td><td></td><td></td><td></td><td>|</td><td></td><td></td><td>1</td></tr>
<tr><td>Spray failure</td><td></td><td></td><td>|||||</td><td></td><td></td><td></td><td></td><td>5</td></tr>
<tr><td>TOTAL</td><td></td><td>10</td><td>13</td><td>10</td><td>5</td><td>4</td><td></td><td></td></tr>
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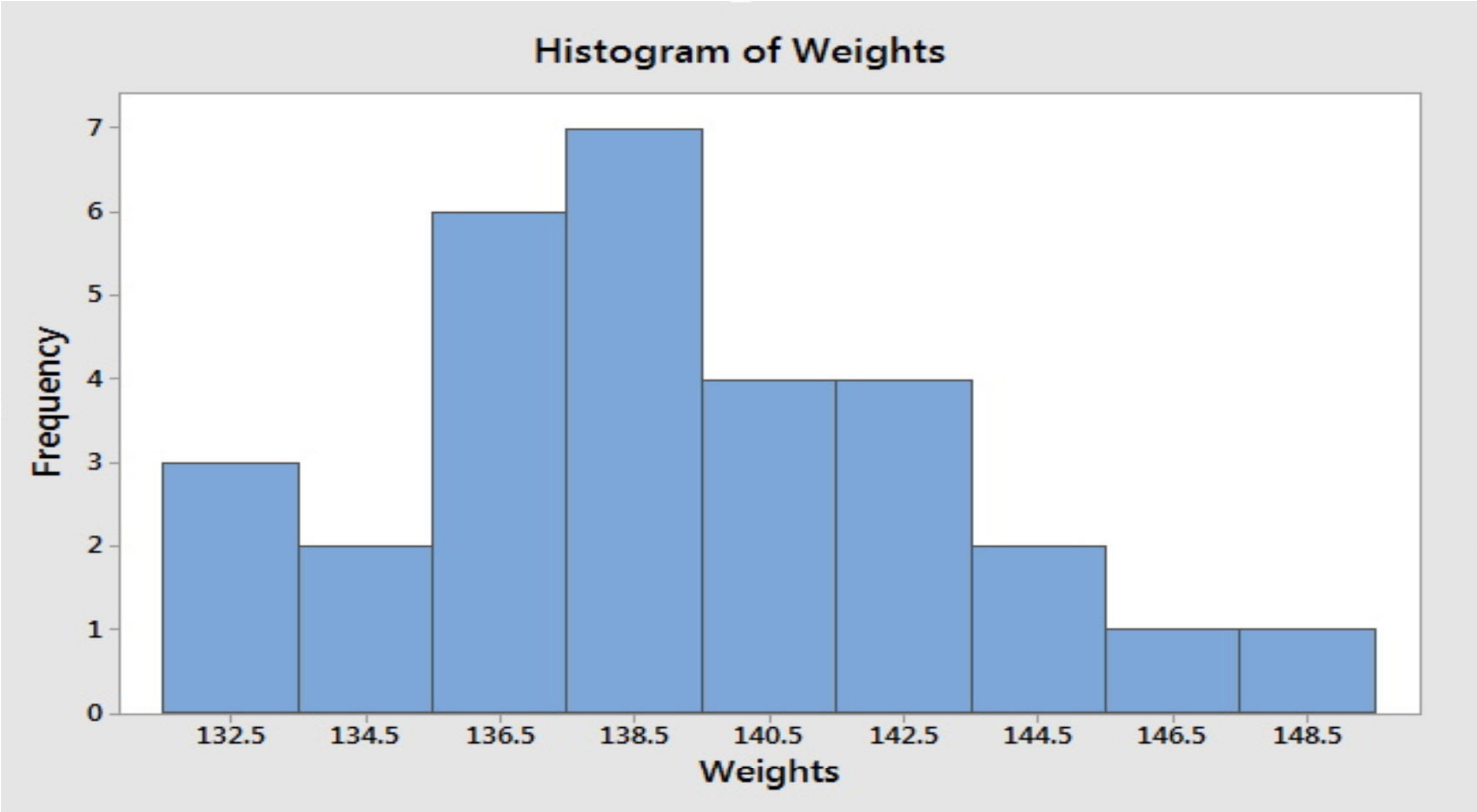
HISTOGRAMS

- A histogram is a bar graph that shows frequency data.
- It is used to graphically summarize and display the distribution and variation of a process data set.
- It provides the easiest way to evaluate the distribution of data.

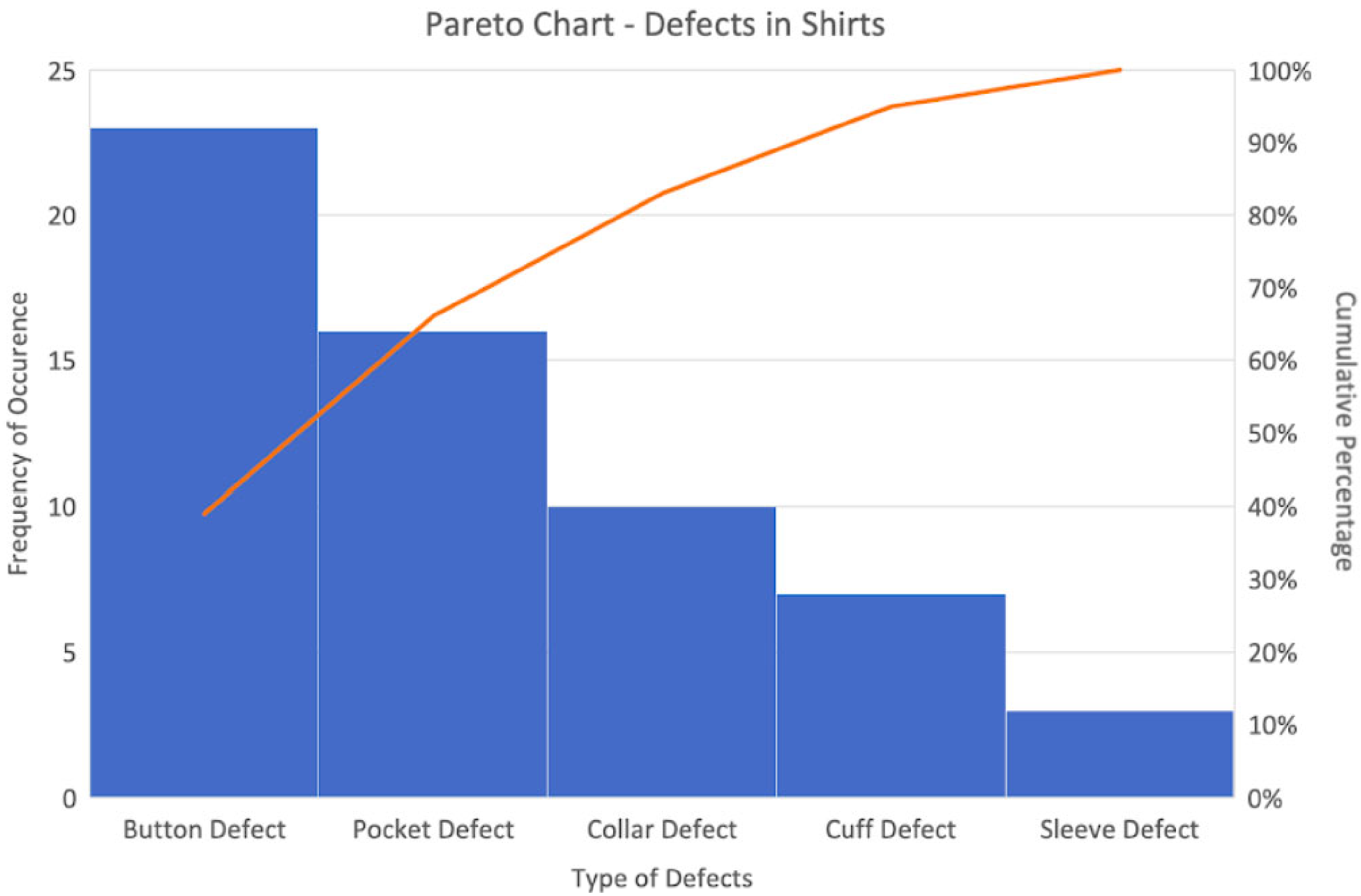
HISTOGRAMS..


Histogram of Weights
Frequency
0
1
2
3
4
5
6
7
132.5
134.5
136.5
138.5
140.5
142.5
144.5
146.5
148.5
Weights

PARETO CHARTS

- The Pareto chart can be used to display categories of problems graphically so they can be properly prioritized.
- A Pareto chart or diagram indicates which problem to tackle first by showing the proportion of the total problem that each of the smaller problem comprise.
- This is based on the Pareto Principle: 20% of the source cause 80% of the problem.

PARETO CHARTS..



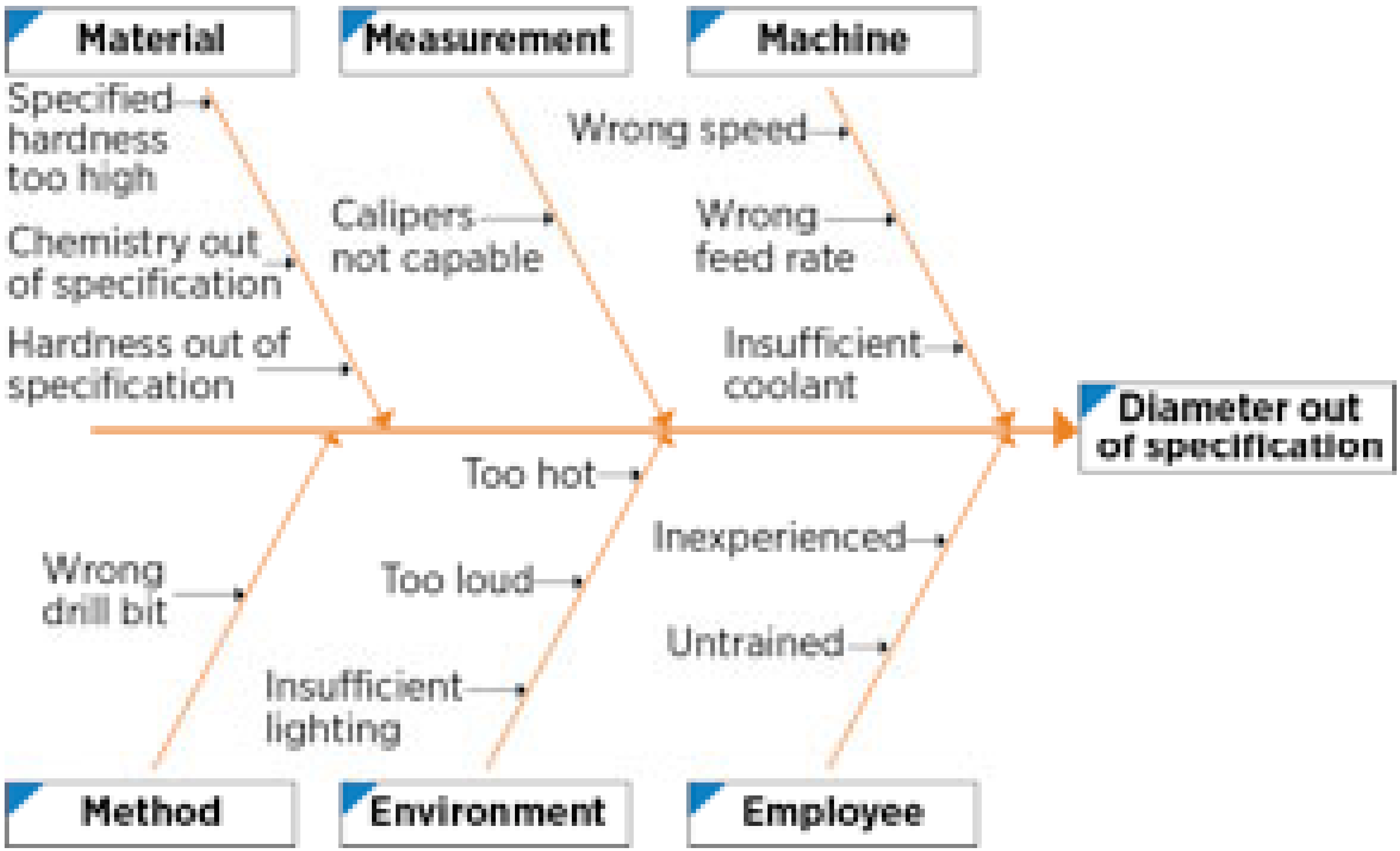
CAUSE & EFFECT DIAGRAMS

- These are also called Fishbone diagram or Ishikawa diagram.
- They are called fishbone diagrams since they resemble one with the long spine and various connecting branches.
- Helps determine the root causes of a problem or quality characteristic using a structured approach.
- Encourages group participation and utilizes group knowledge of the process

CAUSE & EFFECT DIAGRAMS..

- Uses an orderly, easy-to-read format to diagram cause and effect relationships.
- Indicates possible causes of variation in a process.
- Increases knowledge of the process by helping everyone to learn more about the factors at work and how they relate.

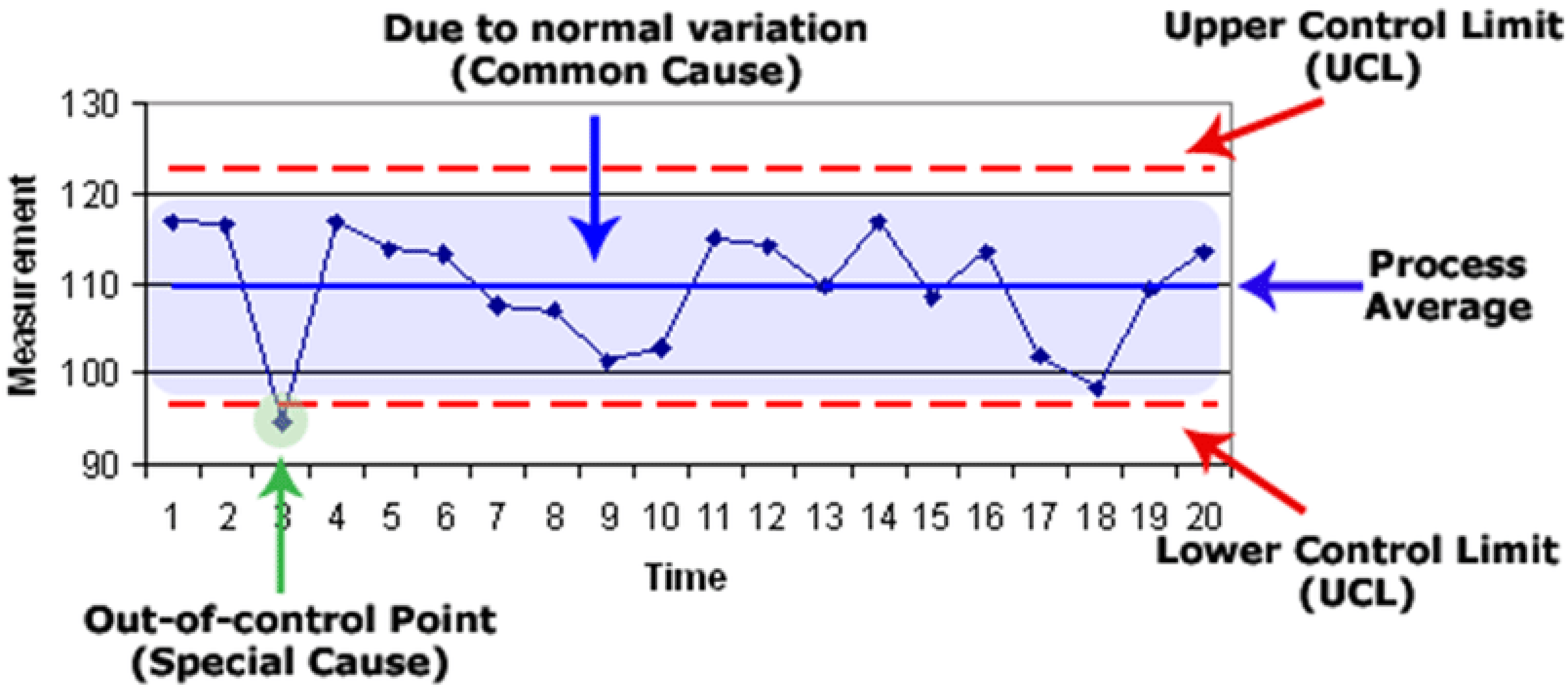
CAUSE & EFFECT DIAGRAMS..

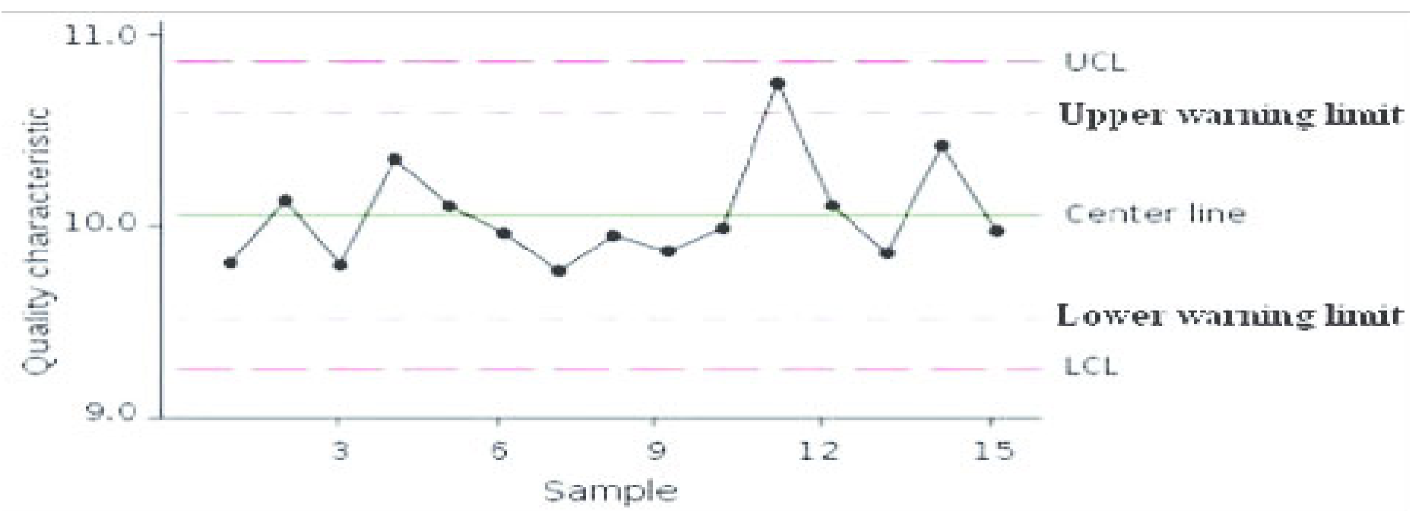


CONTROL CHART

- The control chart is a graph used to study how a process changes over time.
- A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit.
- These lines are determined from historical data. By comparing current data to these lines, you can draw conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation).

CONTROL CHART





CONTROL CHART..

- **When to use a Control Chart:**

- When controlling ongoing processes by finding and correcting problems as they occur.
- When predicting the expected range of outcomes from a process.
- When determining whether a process is stable (in statistical control).
- When analyzing patterns of process variation from special causes (non-routine events)or common causes (built into the process).
- When determining whether your quality improvement project should aim to prevent specific problems or to make fundamental changes to the process.

CONTROL CHART..

➢ **Control Chart Basic Procedure:**

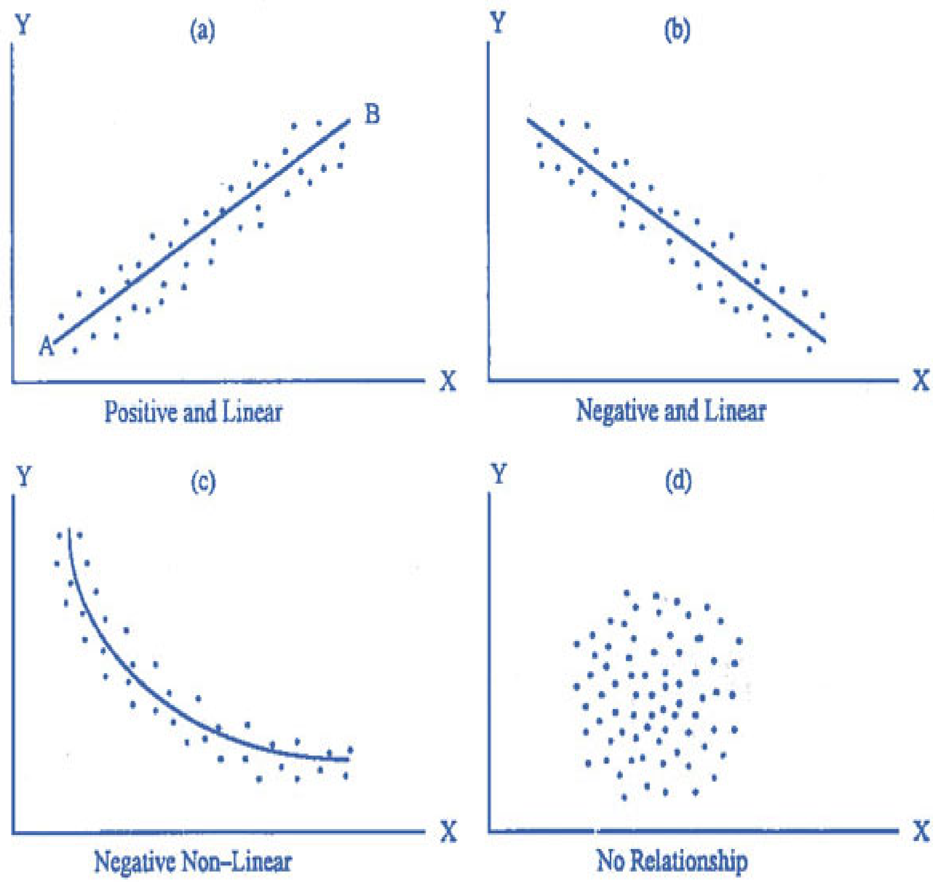
1. Choose the appropriate control chart for your data.
2. Determine the appropriate time period for collecting and plotting data.
3. Collect data, construct your chart and analyze the data.
4. Look for "out-of-control signals" on the control chart. When one is identified, mark it on the chart and investigate the cause.
5. Continue to plot data as they are generated. As each new data point is plotted, check for new out-of-control signals.

SCATTER DIAGRAM

- 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.

SCATTER DIAGRAM

- **Procedure: 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 & lowest value for both variables.
- Draw the horizontal (x) and vertical axes (y) 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.



FLOW CHART

A Flow chart

- Is a type of diagram that represents an algorithm, workflow or process, showing the steps as boxes of various kinds, and their order by connecting them with arrows.
- Flow charts are used in analysing ,designing, documenting or managing a process or program in various fields.

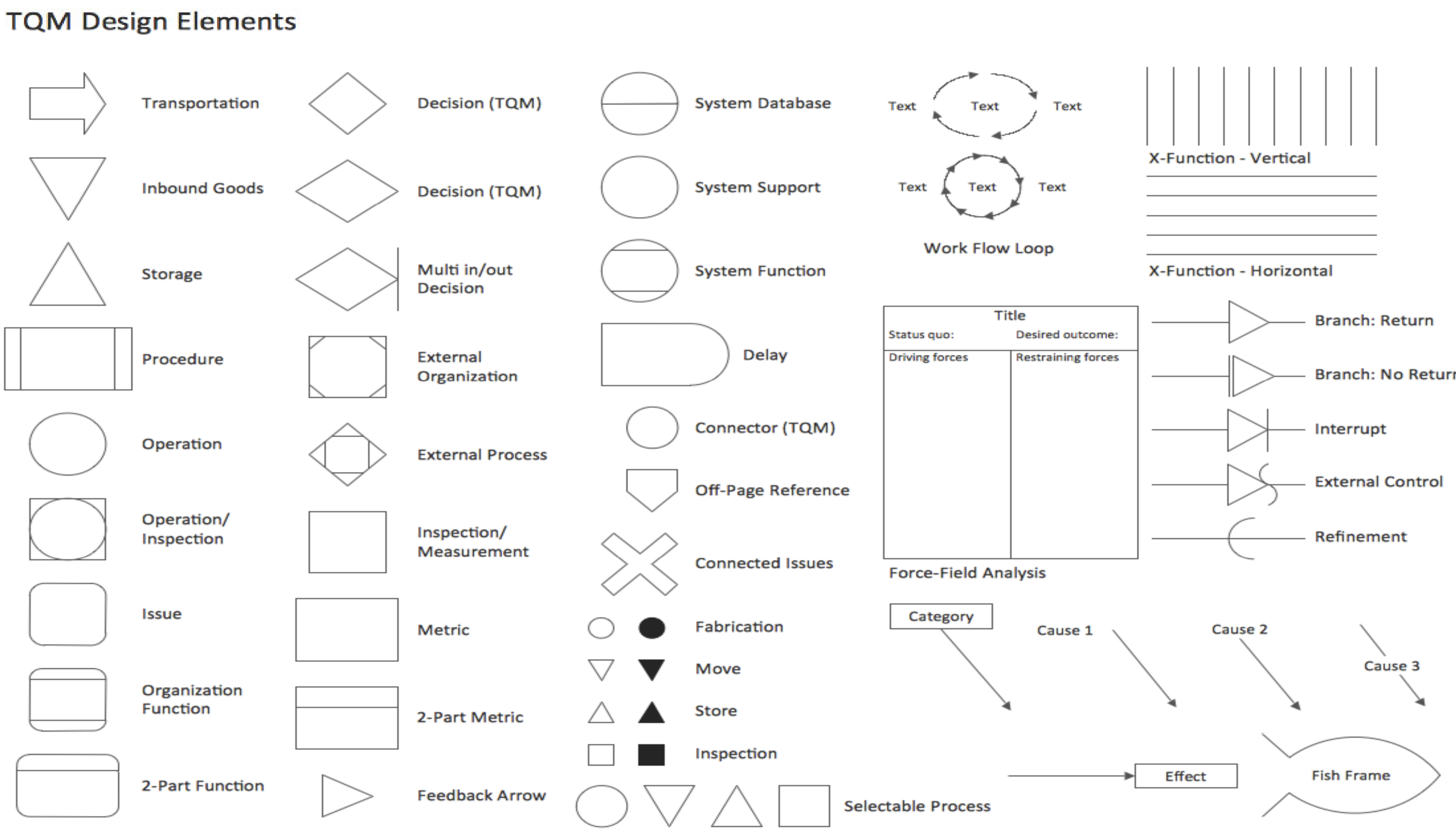
Overview

I. *Flow chart are used in designing and documenting complex processes or programs.*

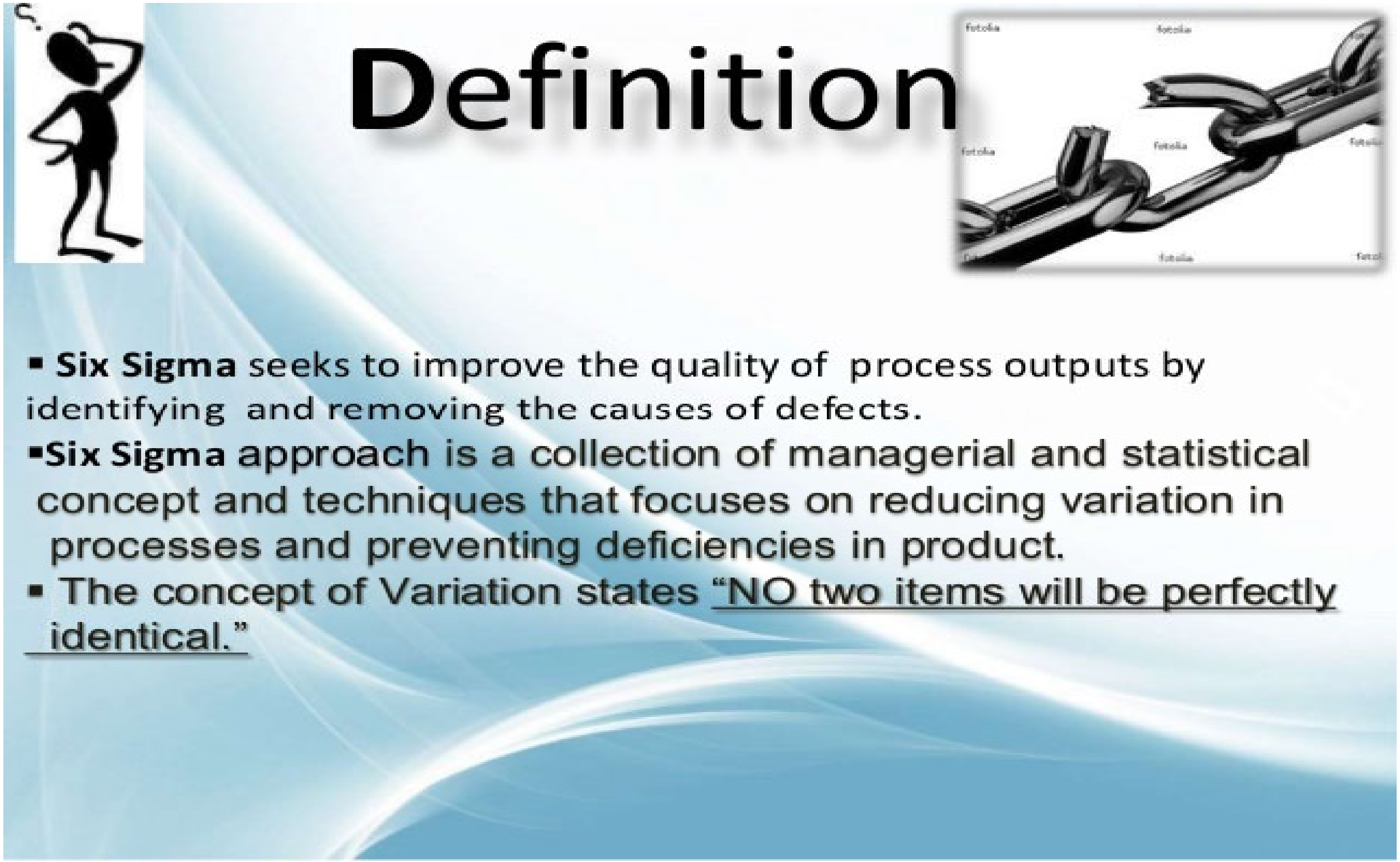
II. *Like other types of diagrams , they help visualize what is going on and thereby help the people to understand a process , and perhaps also find flaws, bottlenecks , and other less-obvious features within it.*

III. *There are many different types of flowcharts , and each type has its own repertoire of boxes and notational conventions.*

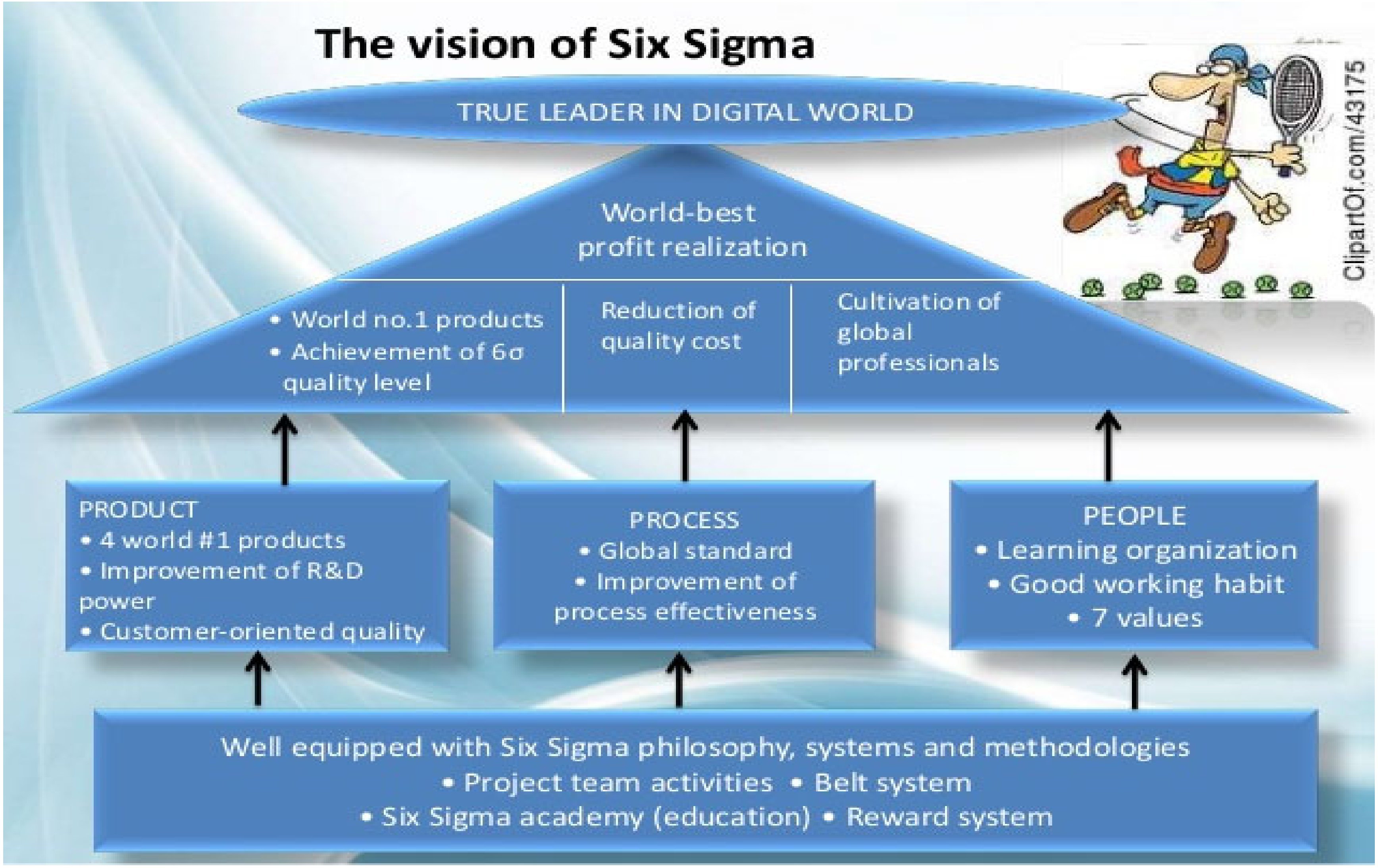
FLOWCHART SYMBOLS



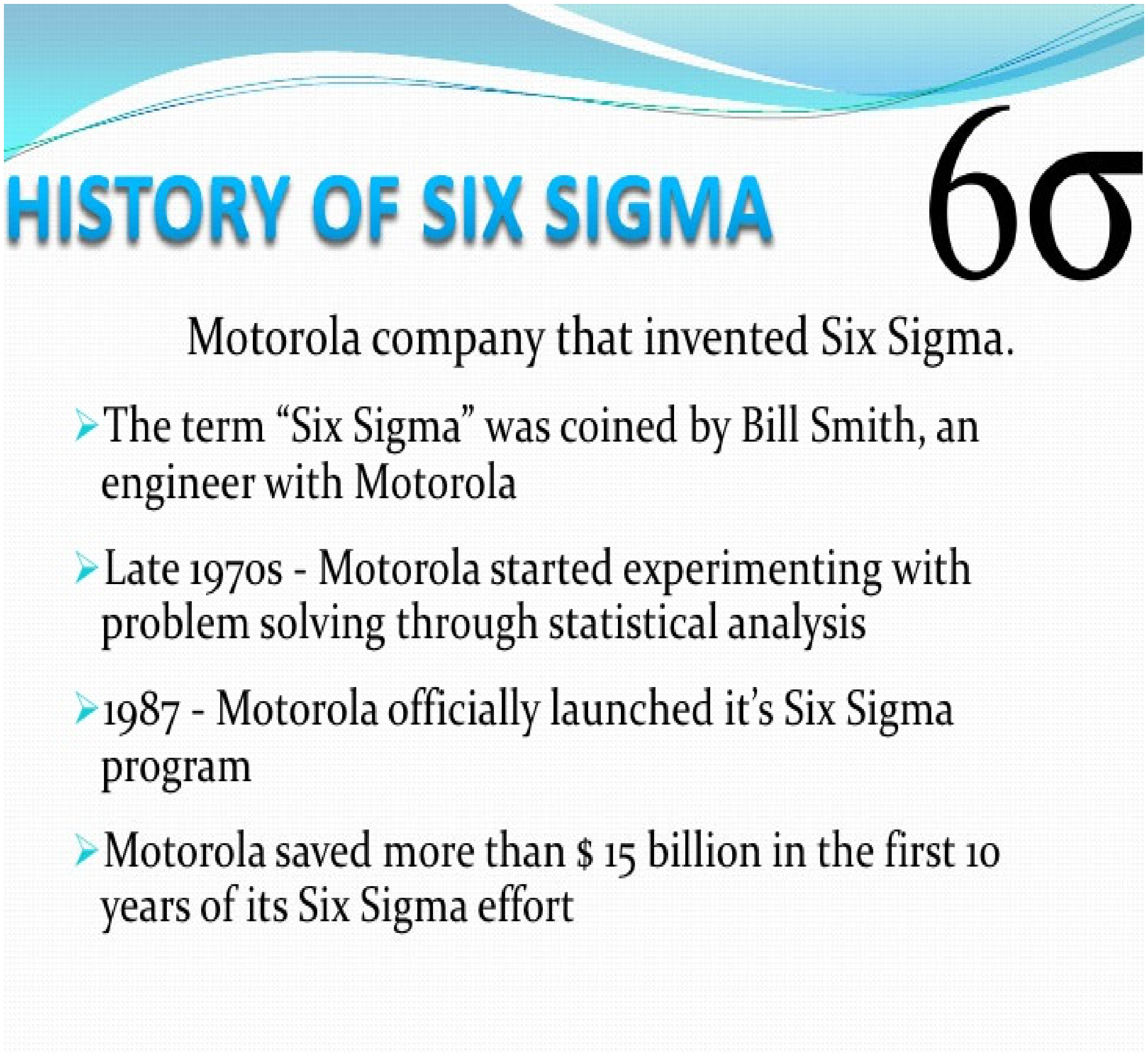
SIX SIGMA- NEW MANAGEMENT TOOL

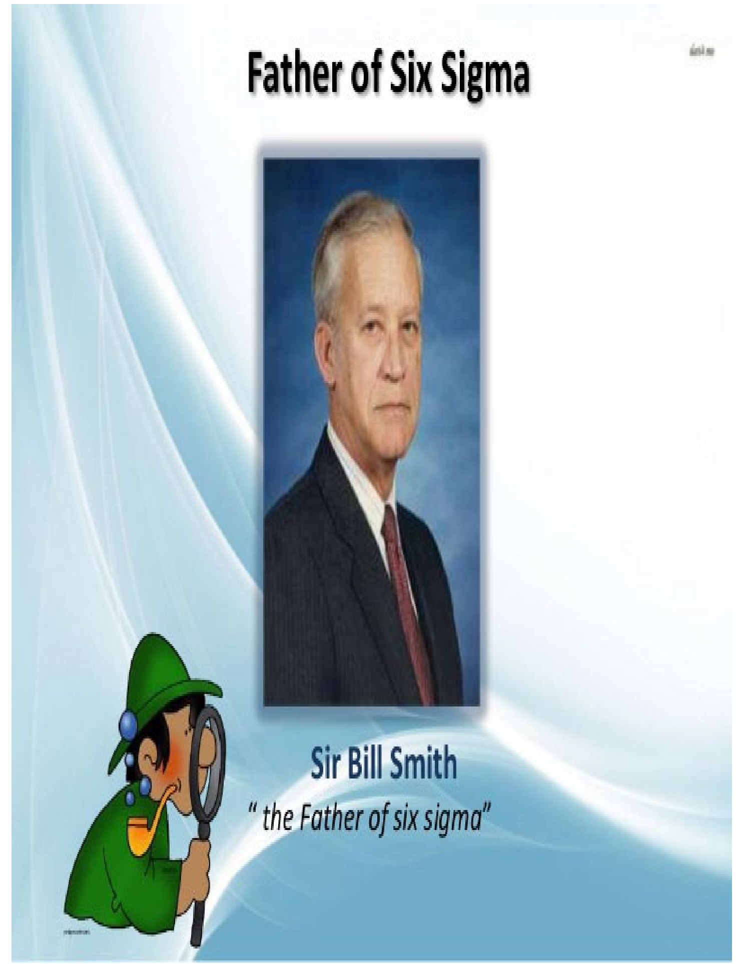


SIX SIGMA- VISION



HISTORY OF SIX SIGMA

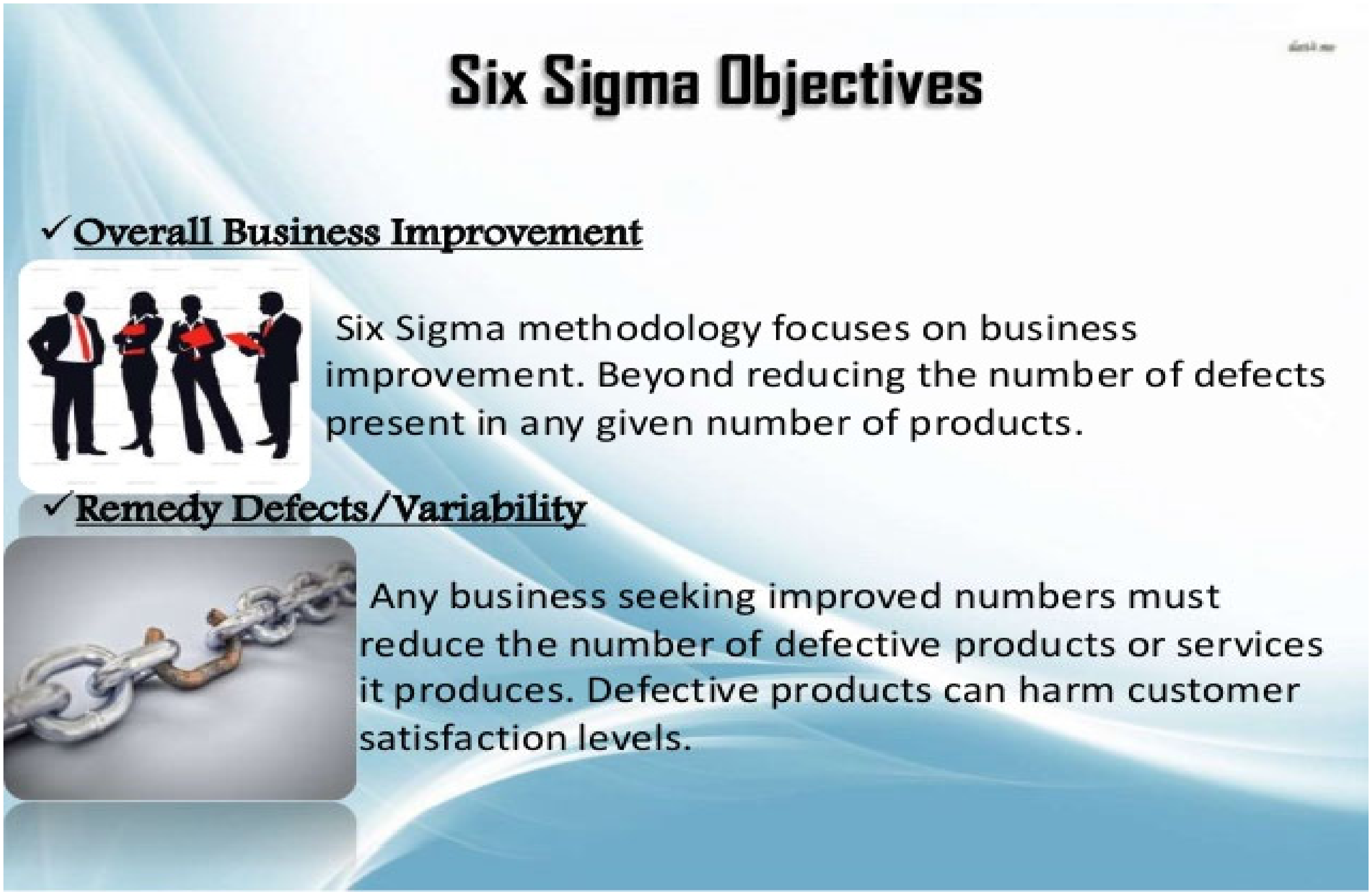




Key Elements of Six Sigma

CUSTOMERS	PROCESSES	EMPLOYEES
Customers define quality. They expect performance, reliability, competitive prices, on-time delivery, service, clear and correct transaction processing and more.	By understanding the transaction lifecycle from the customer's needs and processes, we can discover what they are seeing and feeling.	Company must provide opportunities and incentives for employees to focus their talents and ability to satisfy customers.

OBJECTIVES



Six Sigma Objectives
✓ Overall Business Improvement
Six Sigma methodology focuses on business improvement. Beyond reducing the number of defects present in any given number of products.
✓ Remedy Defects/Variability
Any business seeking improved numbers must reduce the number of defective products or services it produces. Defective products can harm customer satisfaction levels.

✓ **Reduce Costs**

Reduced costs equal increased profits. A company implementing Six Sigma principles has to look to reduce costs wherever it possibly can--without reducing quality.

✓ **Improve Cycle Time**

Any reduction in the amount of time it takes to produce a product or perform a service means money saved, both in maintenance costs and personnel wages. Additionally, customer satisfaction improves when both retailers and end users receive products sooner than expected. The company that can get a product to its customer faster may win her business.

✓ **Increase Customer Satisfaction**

Customer satisfaction depends upon successful resolution of all Six Sigma's other objectives. But customer satisfaction is an objective all its own.

CONCEPT

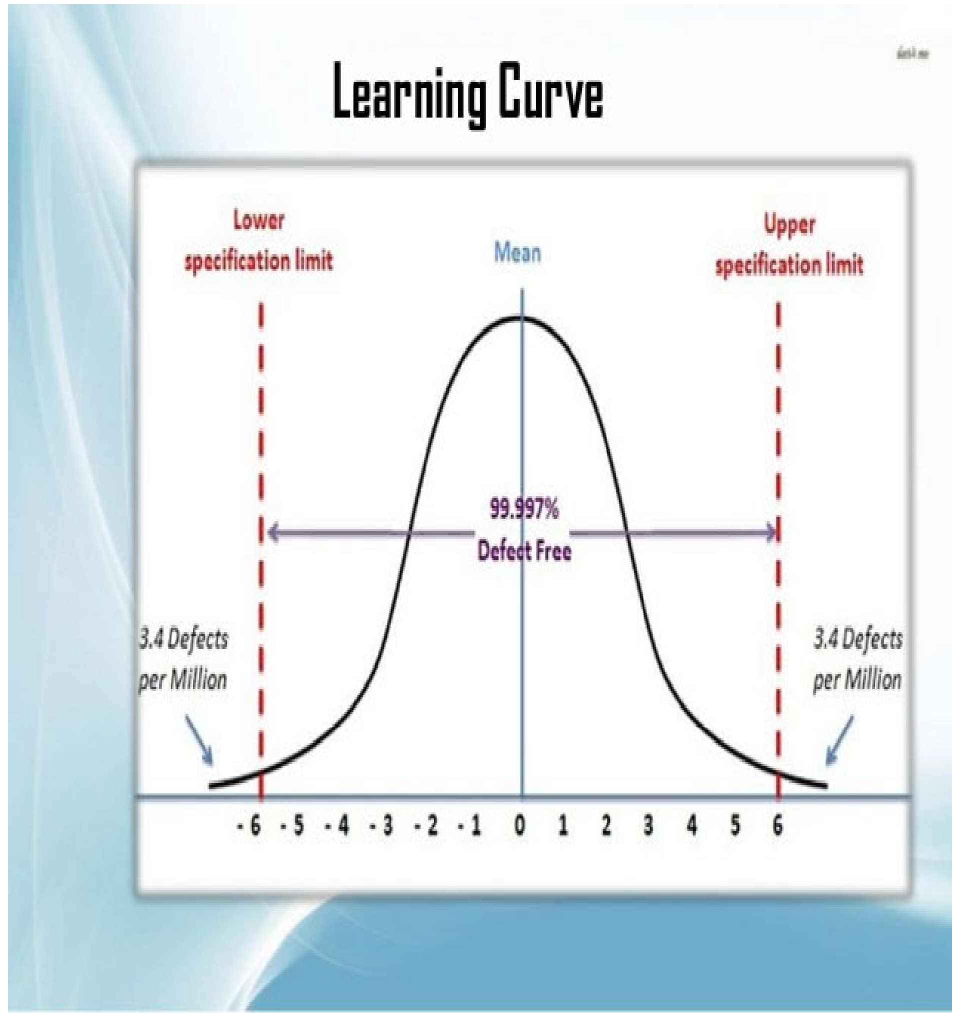
Levels of Six Sigma

	Six Sigma Level	% Accuracy	DPMO
Virtual Perfection	6	99.9997%	3.4
	5	99.98%	233
	4	99.4%	6210
Good	**3.5**	**97.7%**	**22,700**
	3	93.3%	66,807
Improvement Needed	2	69.1%	308,537

CONCEPT…

Relationship to Statistical Analysis

- Sigma (σ)
  - Used to represent standard deviation in a process (standard deviation is a measure of variability)
- Based on the perception that most processes follow the normal distribution
  - Mean (or expected value) = μ
  - Standard Deviation = σ



METHODOLOGY OF SIX SIGMA

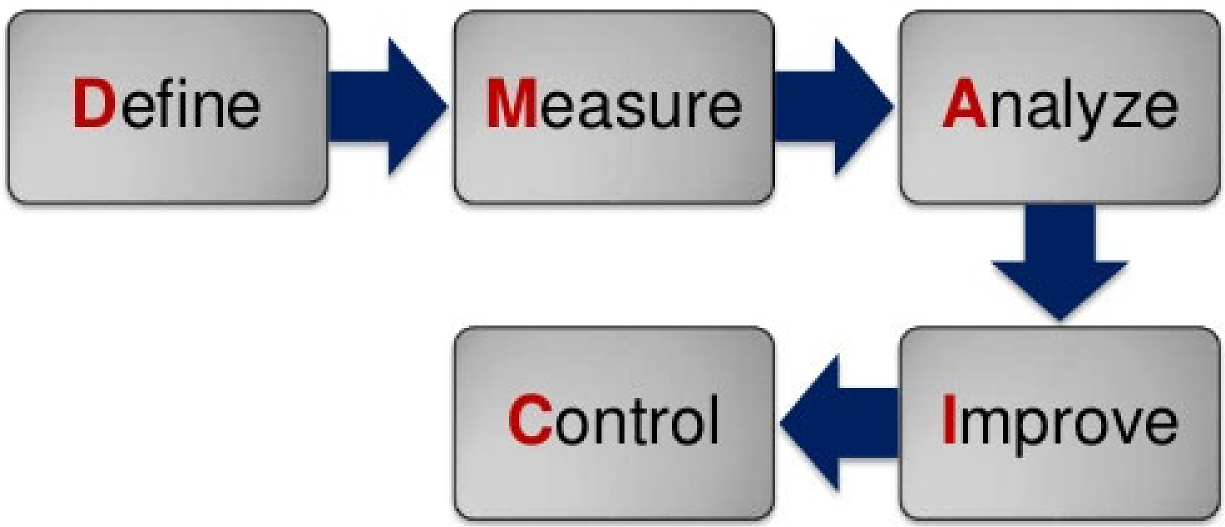
Six Sigma has two key methodologies:

DMAIC: It refers to a data-driven quality strategy for improving processes. This methodology is used to improve an existing business process.

DMADV: It refers to a data-driven quality strategy for designing products and processes. This methodology is used to create new product designs or process designs in such a way that it results in a more predictable, mature and defect free performance.

DMAIC METHODOLOGY

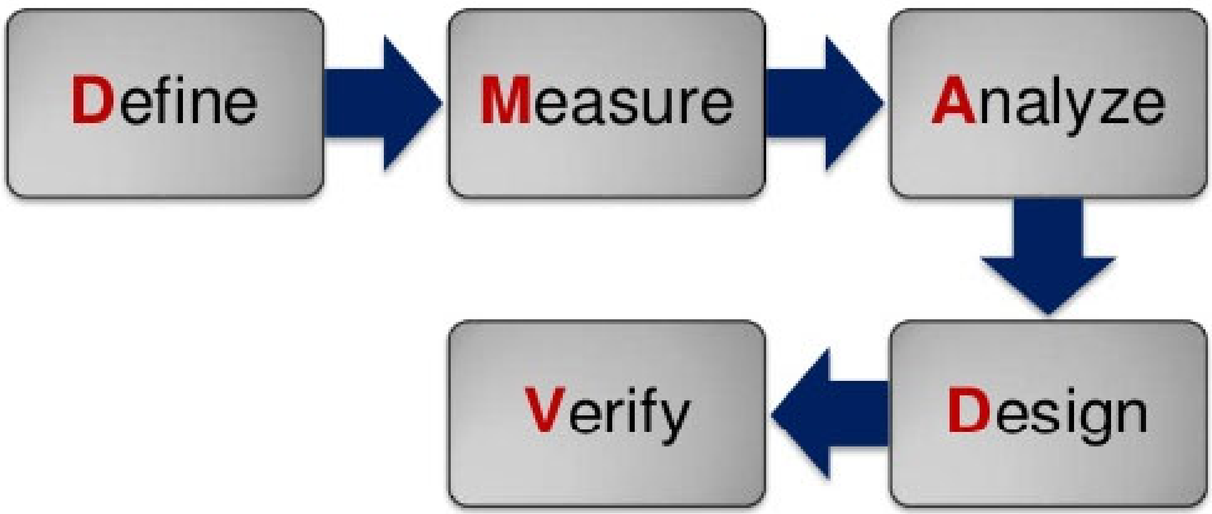
<u>This methodology consists of the following five steps.</u>



- **D**EFINE: Define the problem or project goal that needs to be addressed.
- **M**EASURE: Measure the problem and process from which it was produced.
- **A**NALYZE: Analyze data and process to determine root cause of defects and opportunities.
- **I**MPROVE: Improve the process by finding solutions to fix, diminish, and prevent future problems.
- **C**ONTROL: Implement, control, and sustain the improvement solutions to keep the process on the new course.

DMADV METHODOLOGY

This methodology consists of the following five steps.



- **D**EFINE : Define the Problem or Project Goal that needs to be addressed.
- **M**EASURE: Measure and determine customers' needs and specifications.
- **A**NALYZE: Analyze the process to meet the customer needs.
- **D**ESIGN: Design a process that will meet customers' needs.
- **V**ERIFY: Verify the design performance and ability to meet customer needs.

Six Sigma :Industry Wide Application

Industry	Examples of Six Sigma Applicability
Automotives	i. Enhancing Supplier Quality ii. Improving Safety & Reliability of Finished Vehicles ii. Reducing Manufacturing defects at each stage iv. Using Design FMEA to understand and prevent any possible design failures v. Reducing variation in all the critical parameters that impact the finished product vi. Improving the overall Incoming Material Quality or parts Quality vii. Optimizing Inventory levels for all major parts viii. Reducing time to manufacture ix. Reducing Design defects x. Reducing Supplier Lead time i.e the time take by each supplier to deliver goods xi. Improving First time yield and efficiency of each step in the Manufacturing assembly line.

Few Examples of Companies: Tata Motors, Ford, GM, Maruti, Telco.

Engineering Specializations who contribute : Mechanical, Electrical, Engineering Design, Computer Science, IT

Six Sigma :Industry Wide Application

Industry	Examples of Six Sigma Applicability
Engineering Parts Manufacturing	i. Reduce Manufacturing cycle time (time of order to delivery) ii. Improve Customer Service performance scores iii. Reduce or optimize inventory levels iv. Reduce scrap or cost of poor quality v. Reduce warranty costs vi. Reduce rejections due to design errors vii. Improve parts design process to meet specifications 100% of times viii. Improve parts reliability by identifying & optimizing critical factors that ensure reliability

Few Examples of Companies: Gates India Ltd., Medium to small scale suppliers of parts

Engineering Specializations who contribute : Mechanical, Electrical, IT, Product Design Engineering Design, Electronics and Communication, Computer science

Six Sigma :Industry Wide Application

Industry	Examples of Six Sigma Applicability
Information Technology :Software development	i. Reducing the overall Software development times ii. Reducing the number of errors found during product usage iii. Improving the estimation process to reduce time and cost overruns iv. Improving the requirements gathering process to reduce rework v. Reducing complaints resolution time vi. Creating systems to detect defects early in the process (to reduce high costs associated with defects identified later) vii. Reducing appraisal cost per defect by phase and appraisal type (by project and in total) viii. Reducing rework (All work done to fix an application after it has been delivered to a customer is rework. This includes corrections to features or functions that are incorrect, and also may include "missed requirements" - things the customer expected but did not receive.

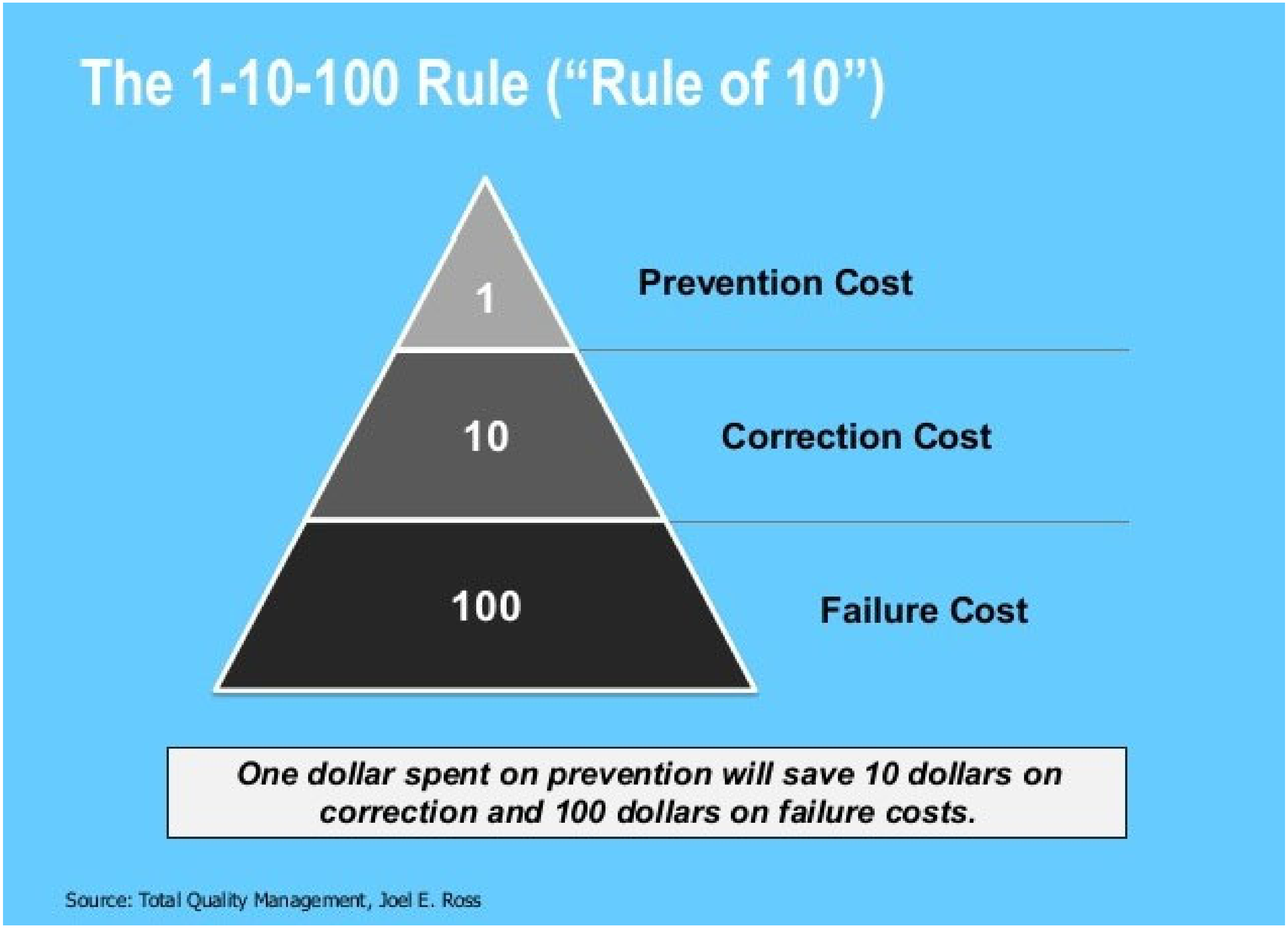
Few Examples of Companies: TCS, Infosys, IBM, HP, Patni, Birlasoft

Engineering Specializations who contribute : Computer Science, IT, Electronics and Communications mainly. All other branches of engineering for specific domain application.

FMEA

What is FMEA?

- FMEA stands for Failure Mode & Effects Analysis
- FMEA is a structured approach to:
  - **Identifying the ways in which a product or process can fail**
  - **Estimating risk associated with specific causes**
  - **Prioritizing the actions that should be taken to reduce risk**
  - **Evaluating design validation plan (design FMEA) or current control plan (process FMEA)**


The 1-10-100 Rule ("Rule of 10")
1
Prevention Cost
10
Correction Cost
100
Failure Cost
One dollar spent on prevention will save 10 dollars on correction and 100 dollars on failure costs.
Source: Total Quality Management, Joel E. Ross

TYPES OF FMEA

Types of FMEa

- Design – focuses on component and subsystems.
- Process – focuses on Manufacturing and Assembly processes.
- System – focuses on global system functions.
- Service – focuses on service functions.
- Software – focuses on software functions.

FMEA FORM

Item / Function	Potential Failure Mode	Potential Effect(s) of Failure	Severity	Class	Potential Cause(s) / Mechanism(s) of Failure	Occurrence	Current Design Controls	Detection	RPN	Recommended Action(s)	Responsibility & Target Completion Date	Actions Taken	Severity	Occurrence	Detection	RPN

STAGES IN FMEA

Fmea Procedure

1. Determine failure mode for each process input.
2. For each failure mode, determine effects – Select a severity level for each effect.
3. Identify potential causes of each failure mode – Select an occurrence level for each cause.
4. List current controls for each cause – Select a detection for each cause.
5. Calculate the Risk Priority Number (RPN).
6. Develop recommended action , assign responsible person and take actions.
7. Assign the predicted Severity, Occurrence and Detection levels and compare RPNs

Risk Priority number (rpn)

❑ Severity × Occurrence × Detection = RPN

- 1000 is maximum and 75* is considered OK!!!
- Severity (S)
  - Importance of the effects on customer requirements.
  - 1 = Not sever, 10 = very sever
- Occurrence (O)
  - Frequency with which a given cause occurs and creates failure modes.
  - 1 = NOT Likely, 10 = Very Likely
- Detection (D)
  - The ability of the current control scheme to detect then prevent a given causes.
  - 1 = Easy to Detect, 10 = Not easy to Detect

What is Control Chart

Definition A statistical tool used to distinguish between process variation resulting from common causes and variation resulting from special causes.

Why to use a Control Chart

One goal of using a Control Chart is to achieve and maintain process stability.

Process stability is defined as a state in which a process has displayed a certain degree of consistency in the past and is expected to continue to do so in the future.

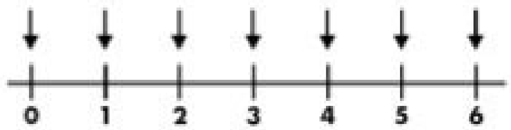
- Monitor process variation over time.
- Differentiate between special cause and common cause variation.
- Assess the effectiveness of changes to improve a process.
- Communicate how a process performed during a specific period

This consistency is characterized by a stream of data falling within control limits based on plus or minus 3 standard deviations (3 sigma) of the centerline

Types of Data

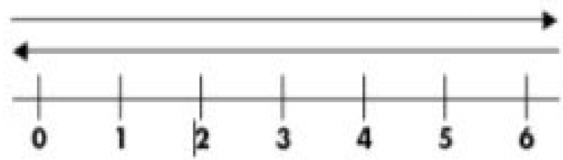
Discrete Data

Discrete data is data that can be counted. (You can't have a half a person).



Continuous Data

Continuous data can be assigned an infinite number of values between whole numbers.



Examples

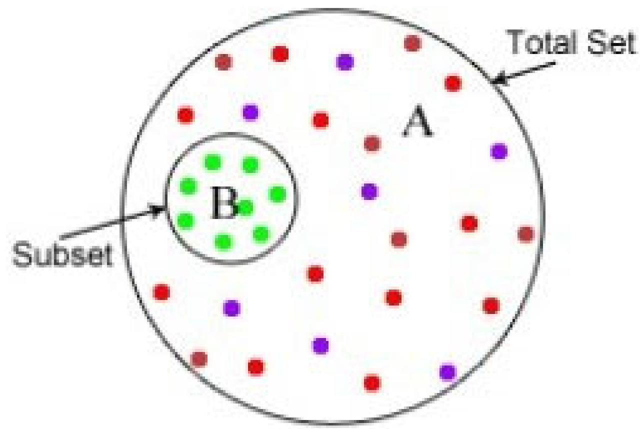
Discrete Data	Continuous Data
Unpopped kernels of popcorn in a bag	Age
Class size	Weight
Family size	Height
Calories in a hamburger	Time it takes to get to school
	Temperature
	Grade-point average
	Calories in a hamburger

Defects and Defectives

Defects are the subset of defectives. There may be n no. of defects to have one defective product. Say for ex. Consider a cylindrical rod as a final product. In that the possible defects are crack, soft, bend, dimensional tolerance, eccentricity etc. For getting one defective rod, is it sufficient to have one or more defects as mentioned earlier.

At least one or more defects tends to have a defective product.

Ex. 2: Consider a human being. If he is not feeling well, it is something similar to a defective. Why this illness happened? This is because of fever or stomach pain or diarrhea (defects)etc. All these illness are defects. At least if one appears, then that person will not be feeling good. If all the diseases has come, again the same person will be suffering.



Types of Control Charts

Continuous Data	Discrete Data
➢I and MR Chart (individual and moving range) ➢X-bar and R Chart ➢X-bar and S Chart	➢N Chart ➢NP Chart ➢C chart ➢U chart

Control Limits Vs Specification Limits

Control Limits - Control limits, also known as natural process limits, are horizontal lines drawn on a statistical process control chart, usually at a distance of ±3 standard deviations of the plotted statistic from the statistic's mean.

Specification Limits -Specification limits, Boundaries or parameters that define acceptable performance for a process expressed as a target limit as well as an upper and lower limit.

The table below contrasts control limits and specification limits:

Control Limits	Specification Limits
➢Voice of the process	➢Voice of the customer
➢Calculated from Data	➢Defined by the customer
➢Appear on control charts	➢Appear on histograms
➢Apply to subgroups	➢Apply to items
➢Guide for process actions	➢Separate good items from bad
➢What the process is doing	➢What we want the process to do

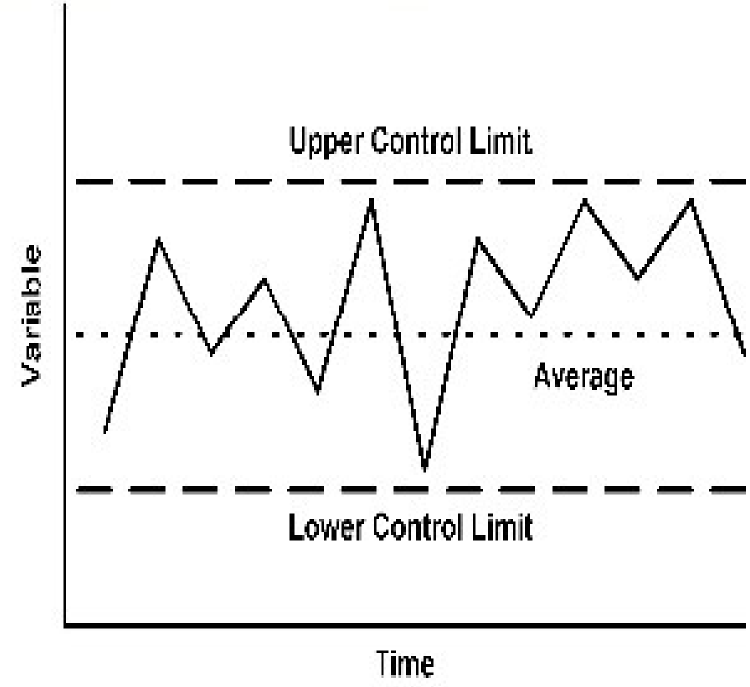
Common Cause Variation

what is "common cause" variation?

When all variation in a system is due to common causes, the result is a stable system said to be in statistical control. The practical value of having a stable system is that the process output is predictable within a range

A common cause of variation is a variation from the mean that is caused by the system as a whole. This variation is not due to an assignable cause, but rather represents variation inherent in the process you are studying.

When a work process has only common causes of variation and no special causes, that process is "in control." This means that it is stable, consistent, and predictable. It might be predictably good or predictably bad, or it might be a very regular mix of good and bad results.

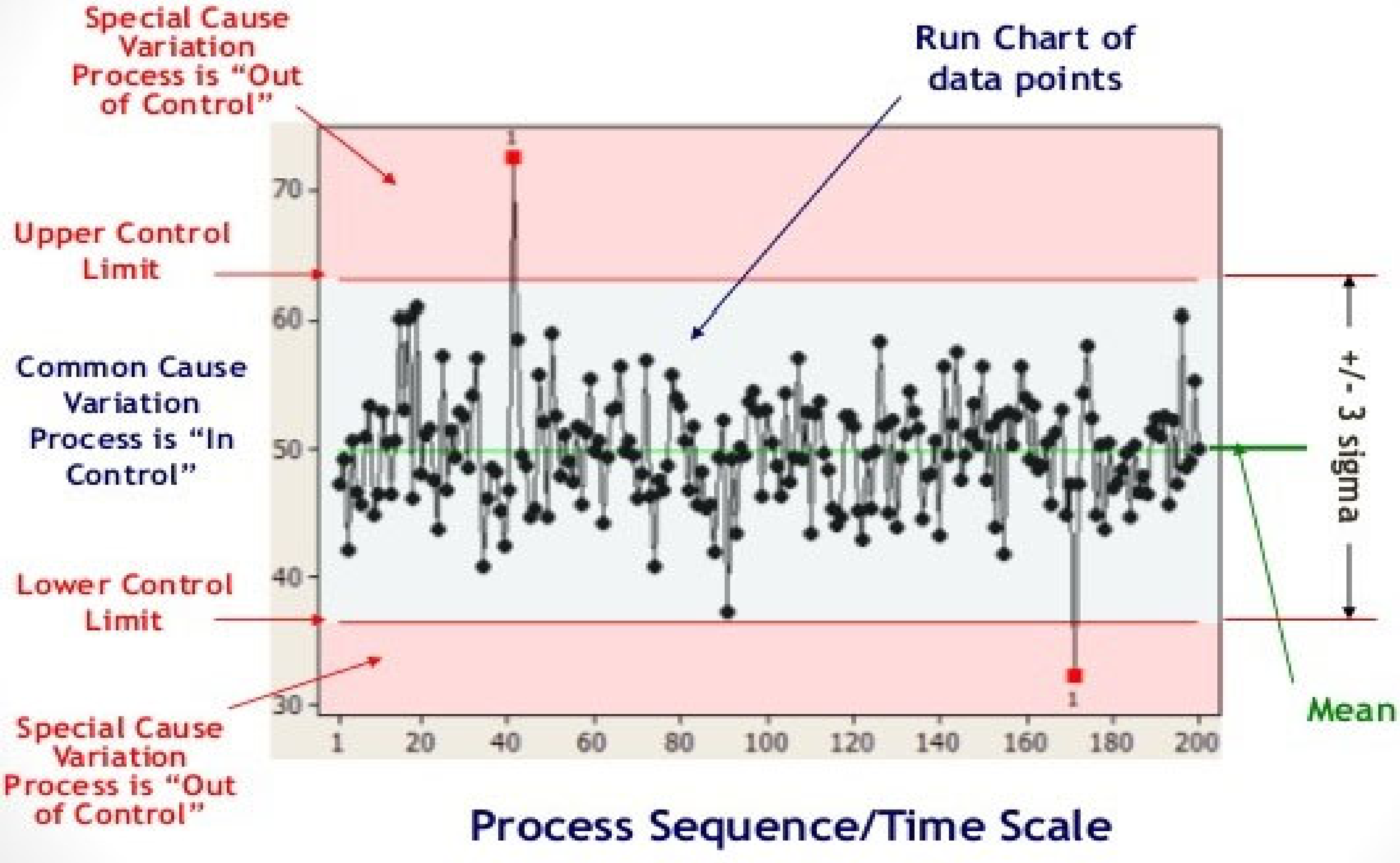


Common causes are problems inherent in the system itself. They are always present and effect the output of the process.
Examples of common causes of variation are poor training, inappropriate production methods, and poor workstation design

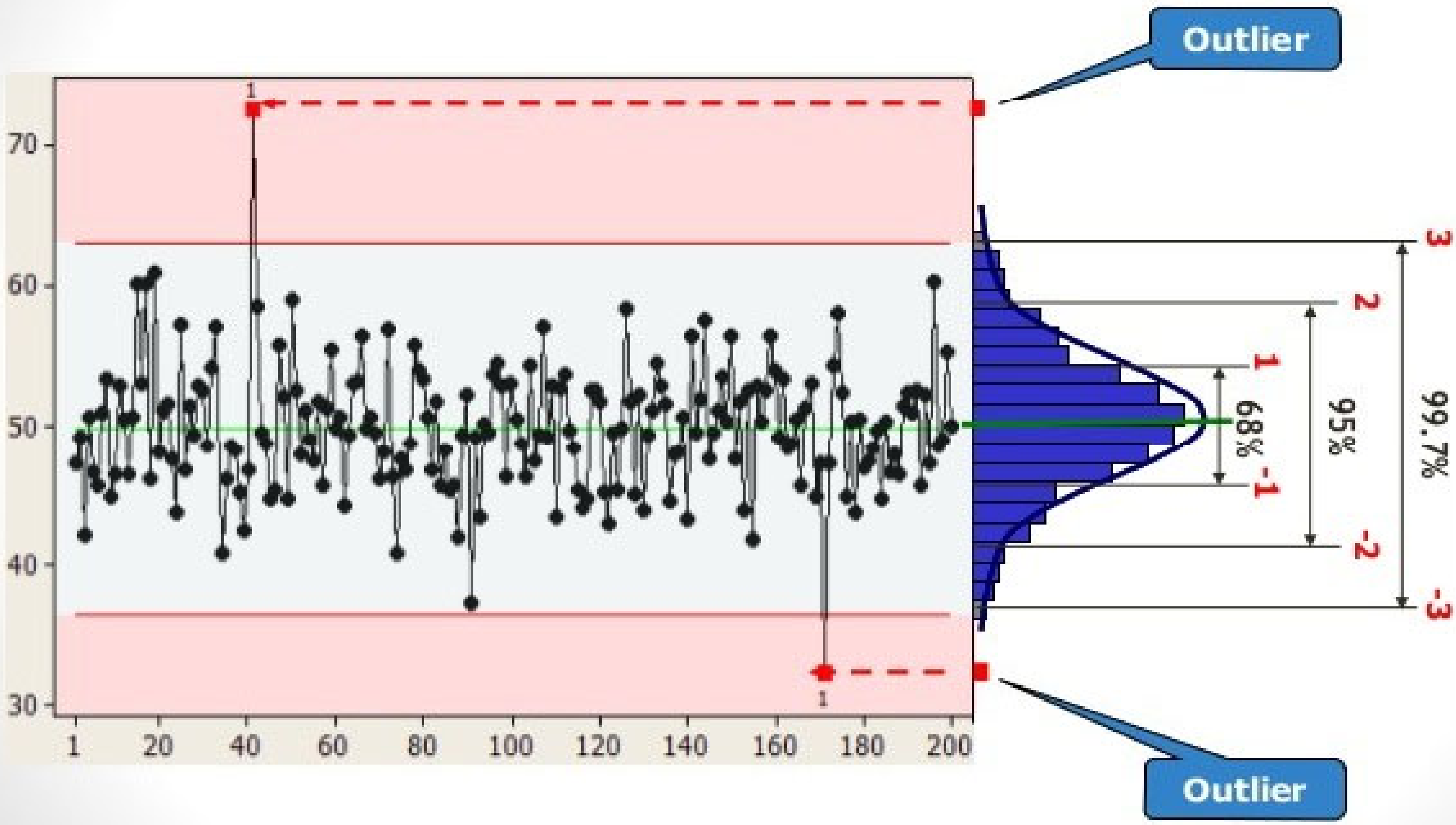
Common Cause Vs Special Cause Variability

COMMON CAUSE ATTRIBUTES	SPECIAL CAUSE ATTRIBUTES
Generally small variability in each measurement due to "natural" reasons. Common cause issues result in minor fluctuations in the data	Generally larger variability in each measurement due to "unnatural" reasons. A cause can be assigned for the fluctuations in the data.
Common cause = chance cause = statistical control = stable & predictable = natural pattern of variability = variability inside the historical experience base	Special causes = assignable causes = systemic causes = unstable & erratic = unnatural pattern of variability = variability outside the historical experience base
Common cause variability is institutionalized and accepted as "that's the way things are"	Special cause variability are sore thumbs that standout and are fixable. They are big surprises. They are "exceptions to that's the way things are"
When the reason for common cause variability is identified, it becomes special causes	Many small special causes are identifiable but may be treated as uneconomical to correct or control

Control Chart Anatomy



Control and Out of Control



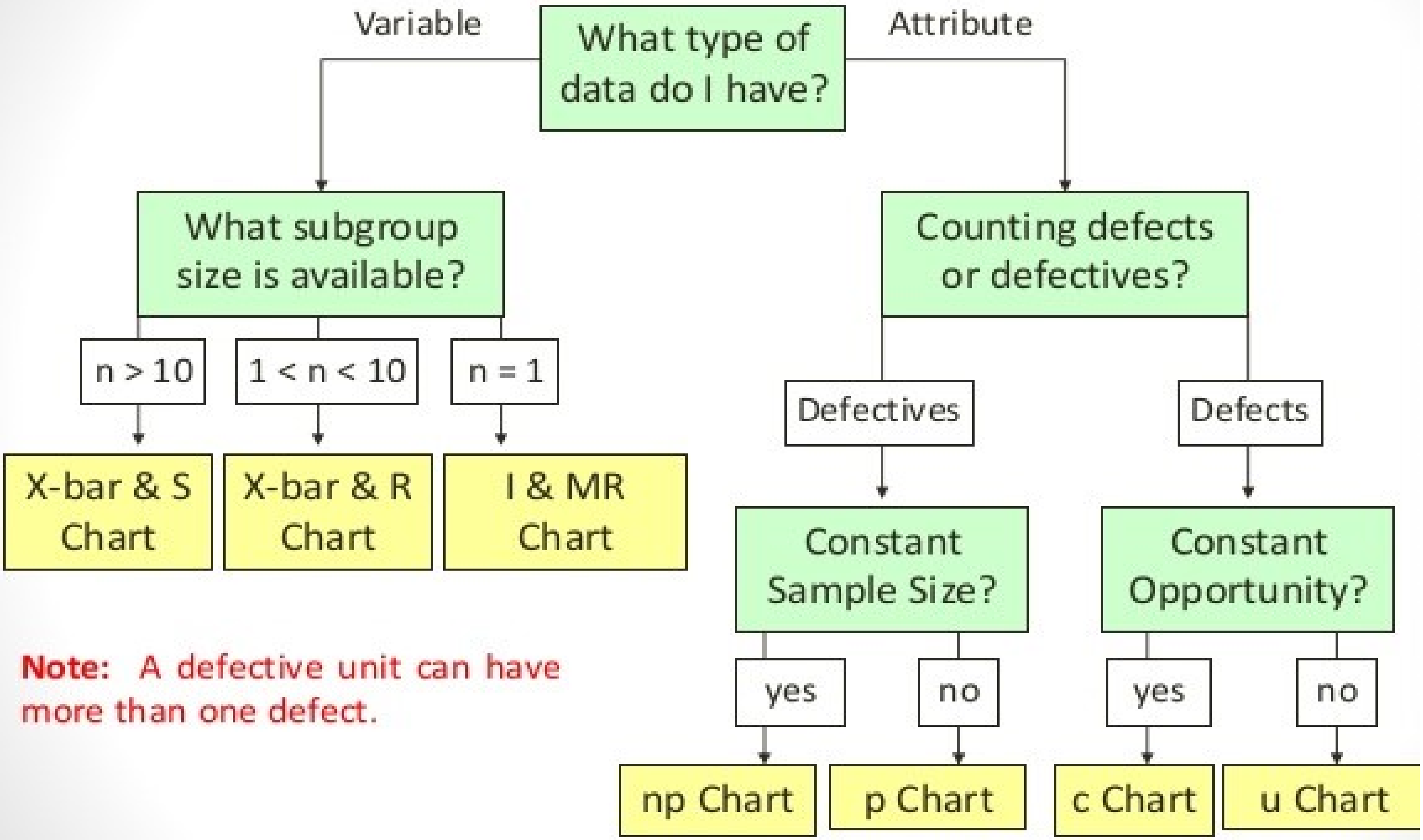
TYPES OF CONTROL CHART

- There are two main categories of Control Charts, those that display ***attribute data***, and those that display ***variables data***.

- **Attribute Data:** This category of Control Chart displays data that result from counting the number of occurrences or items in a single category of similar items or occurrences. These "count" data may be expressed as pass/fail, yes/no, or presence/absence of a defect.

- **Variables Data:** This category of Control Chart displays values resulting from the measurement of a continuous variable. Examples of variables data are elapsed time, temperature, and radiation dose.

TYPES & SELECTION OF CONTROL CHART



Note: A defective unit can have more than one defect.

CONTROL CHARTS FOR ATTRIBUTE DATA

- There are 4 types of Attribute Control Charts:

	Variable Lot Size	Constant Lot Size
Defectives (Binomial Distribution)	p	np
Defects (Poisson Distribution)	u	c

- **Subgroup size for Attribute Data is often 50 – 200.**

What is QFD?

A method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demands into design targets and major QA points to be used throughout out the production phase

Comprehensive process for reaching customer satisfaction

Systematic way to define winning business (conquering business model, products / services)

What is QFD?

Also called another Quality Management System(QMS)

Developed to bring personal interface to modern industry

Links the needs of the customer with design, engineering, production and service functions in the supplier organization

History of QFD

1972	First application at Mitsubishi, Japan
1976	QFD implementation in production of mini vans by Toyota
1979	20% reduction in start up costs in launch of a new van
1982	38% reduction in costs
1984	68% cumulative reduction in costs
1984	First introduced in USA

"QFD is a method for developing a design quality aimed at satisfying the consumer and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase. ... [QFD] is a way to assure the design quality while the product is still in the design stage."

Yoji Akao

Developed QFD in Japan in 1966

Main Goals in Implementing QFD

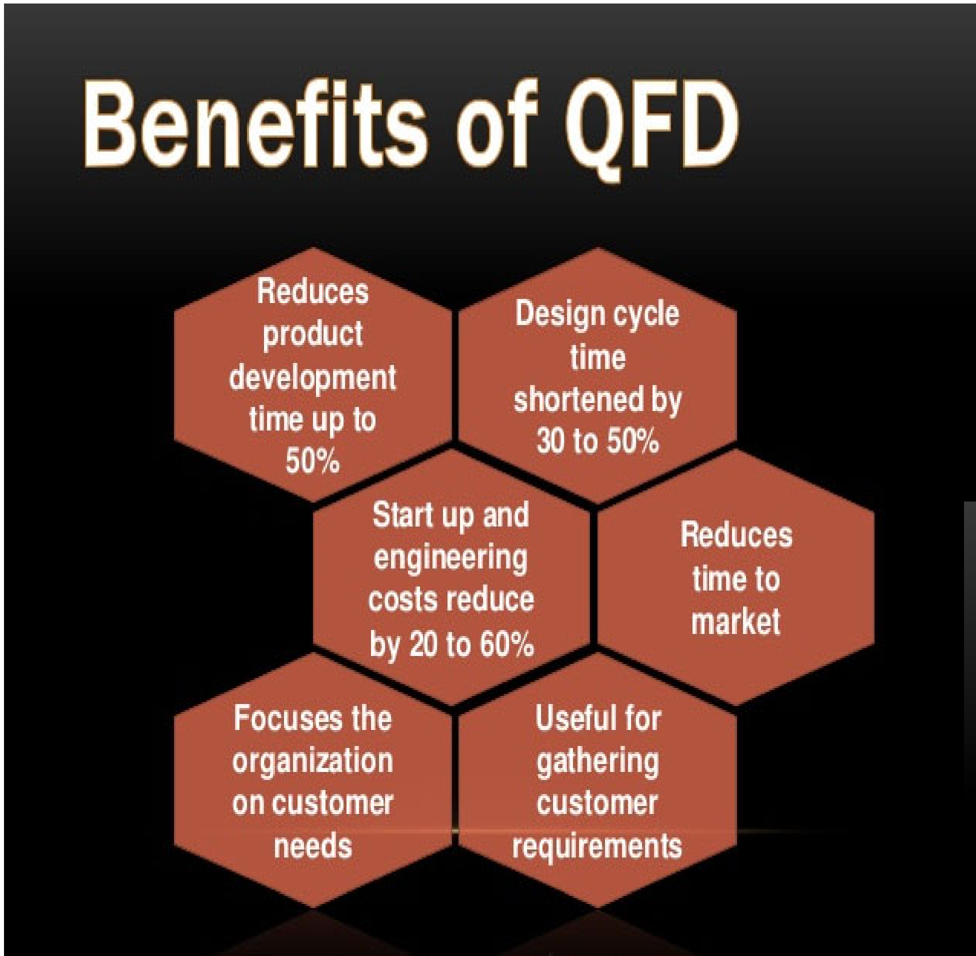
- Prioritize spoken and unspoken customer wants and needs
- Translate these needs into technical characteristics and specifications
- Build and deliver a quality product or service by focusing everybody toward customer satisfaction

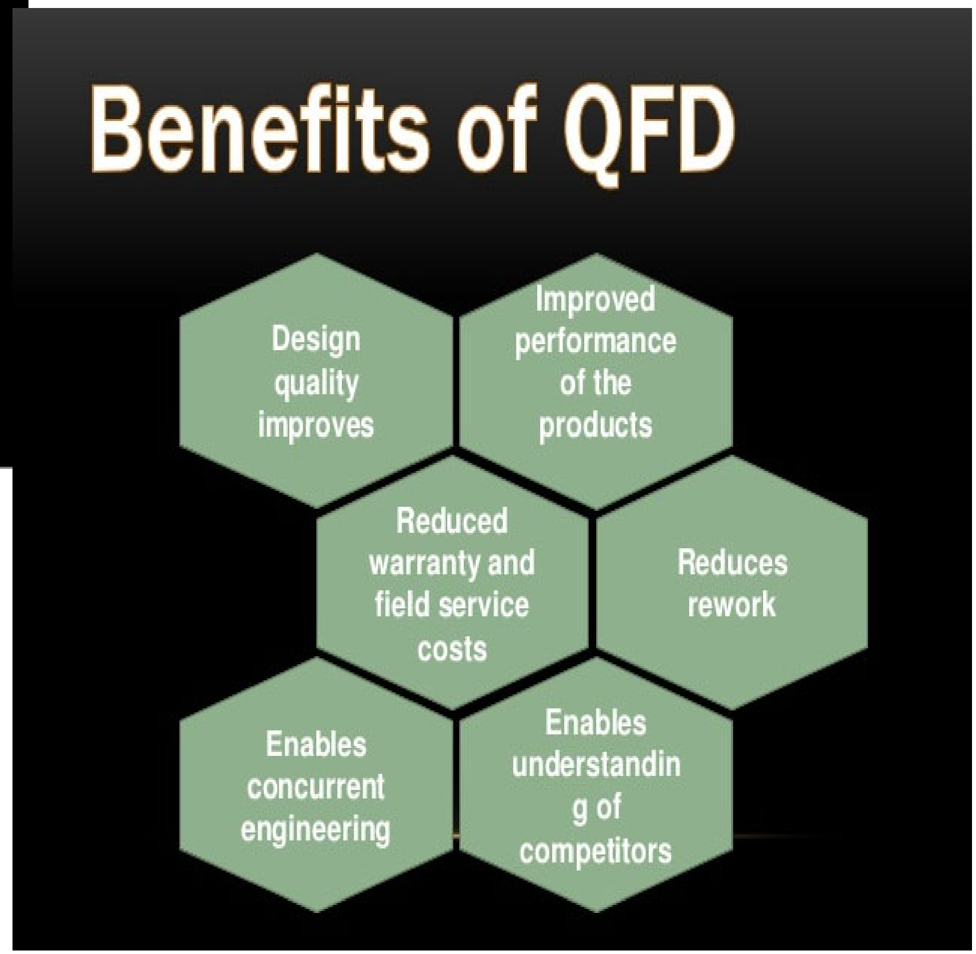
Applications of QFD

- Production / Manufacturing
- Maintenance
- Design Courses and Curriculum

Applications of QFD

- Design of Performance Measures
- Aerospace
- Military Needs


Benefits of QFD
Reduces product development time up to 50%
Design cycle time shortened by 30 to 50%
Start up and engineering costs reduce by 20 to 60%
Reduces time to market
Focuses the organization on customer needs
Useful for gathering customer requirements


Benefits of QFD
Design quality improves
Improved performance of the products
Reduced warranty and field service costs
Reduces rework
Enables concurrent engineering
Enables understandin g of competitors

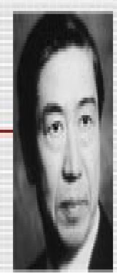
TAGUCHI QUALITY LOSS FUNCTION

Taguchi Loss Function Definition

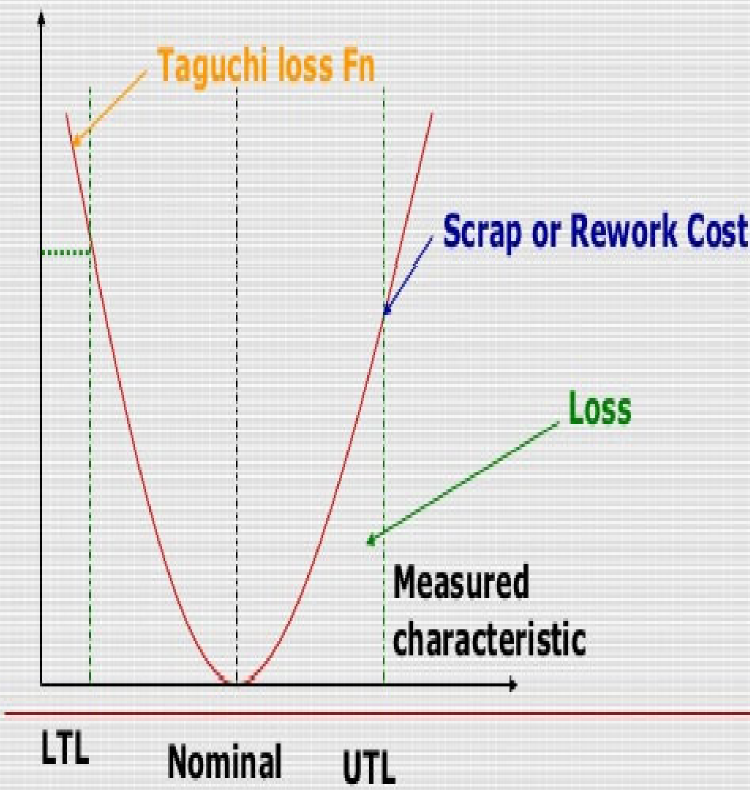
- Taguchi defines Quality as "the loss imparted by the product to society from the time the product is shipped."
- LOSS = Cost to operate, Failure to function, maintenance and repair cost, customer satisfaction, poor design.
- Product to be produced "being within specification"

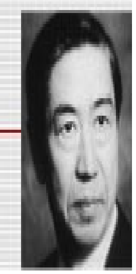
Taguchi's Quadratic Quality Loss Function

- Quality Loss Occurs when a product's deviates from target or nominal value.
- Deviation Grows, then Loss increases.
- Taguchi's U-shaped loss Function Curve.



Taguchi's U-shaped loss Function Curve.





Formula to find Taguchi's Loss Fn

Taguchi uses Quadratic Equation to determine loss Curve

- $L(x) = k(x-N)^2$

Where **L (x)** = Loss Function,

k = C/d² = Constant of proportionality,

where **C –** Loss associated with sp limit

d - Deviation of specification from target value

x = Quality Features of selected product,

N = Nominal Value of the product and

(x-N) = Tolerance

Total Productive Maintenance

T: <u>TOTAL</u>

- Participation of all Employees.
- Include all Departments, operation, equipment and process.

P: <u>PRODUCTIVE</u>

- Pursue the maximization of efficiency of the production system by making all loses zero.
- Zero accidents Zero defects Zero breakdowns.

M: <u>MAINTENANCE</u>

- To improve the efficiency of the equipment.
- Maintenance means the entire life cycle of the production system.
- Maintenance is not only to repair and maintain the machines.

TPM Objectives

1. Increase production while, at the same time, increasing employee morale and job satisfaction.
2. Hold emergency & unscheduled maintenance to a minimum.
3. To provide the safe and good working environment to the worker.
4. Achieve Zero Defects, Zero Breakdown and Zero accidents in all functional areas of the organization.
5. Involve people in all levels of organization.
6. Form different teams to reduce defects and Self Maintenance.
7. To maintain the HSE conditions of plant and equipments.
8. To fulfill Regulatory compliances.

Benefits of TPM

- ✓Increased Employee Morale
- ✓Increased Productivity
- ✓Improved Sharing and Working as a Team
- ✓Improved tidines and cleaning of the working place
- ✓Improved Product Quality
- ✓Improved Customer Satisfaction
- ✓Reduced Costs
- ✓Improved Delivery Time
- ✓Enhanced safety Records
- ✓Improved Image
- ✓Improved Reputation

TPM TARGETS

1. **PRODUCTION**
   I). Obtain Minimum 80% Overall Production Efficiency
   ii). Obtain Minimum 90% Overall Equipment Effectiveness
   iii). Run the Machine during lunchtime

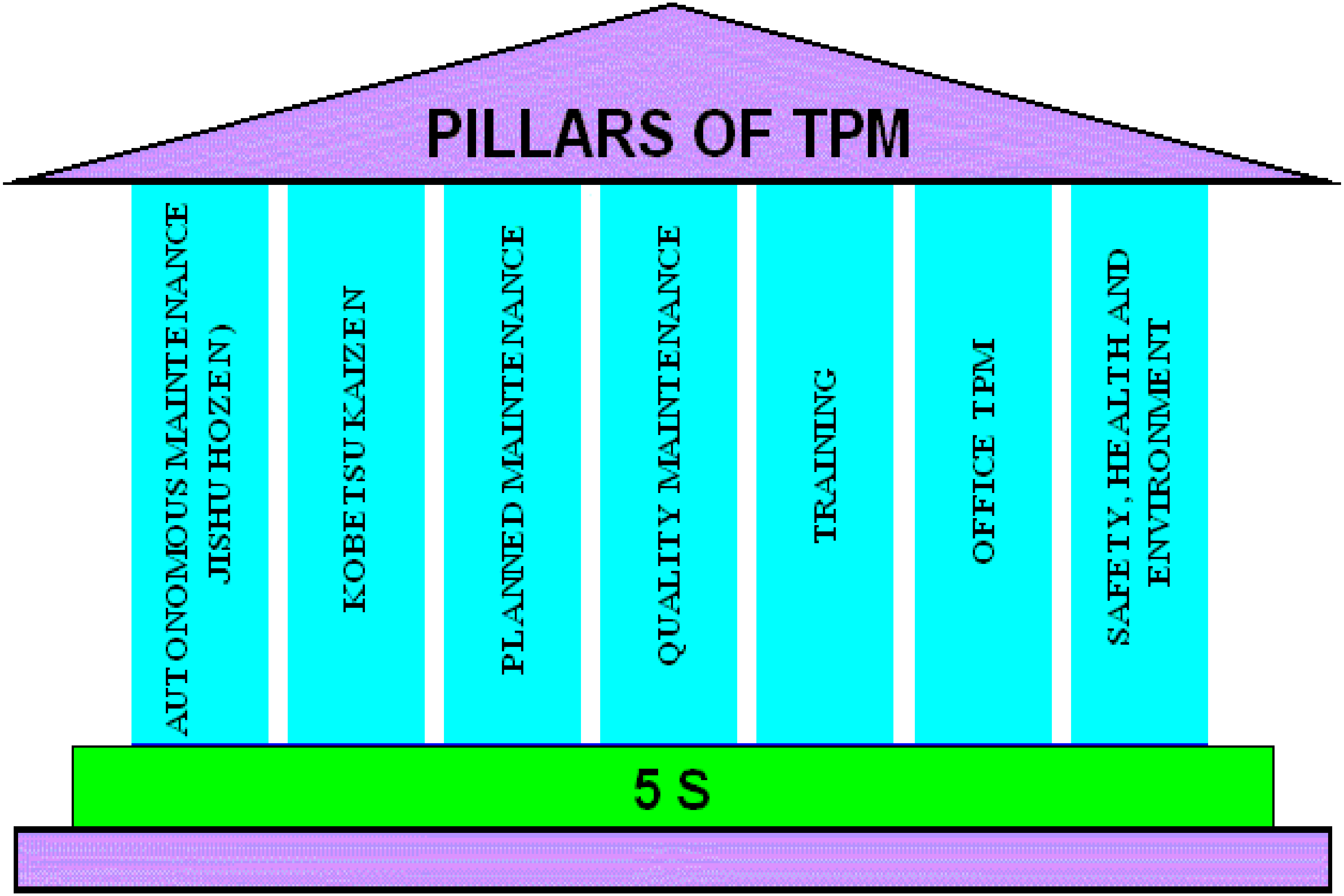
2. **QUALITY**
   Operate in a manner, so that there are no customer complaint

3. **COST**
   Reduce the manufacturing cost as much as possible

4. **DELIVERY**
   Achieve 100% success in delivering the goods as required by the customer

5. **SAFETY**
   Maintain an accident free environment

6. **MULTYTASK**
   Develop multiskilled & flexible workers.


PILLARS OF TPM
AUTONOMOUS MAINTENANCE JISHU HOZEN)
KOBETSU KAIZEN
PLANNED MAINTENANCE
QUALITY MAINTENANCE
TRAINING
OFFICE TPM
SAFETY, HEALTH AND ENVIRONMENT
5 S

THANK YOU