16BPU603A	MANAGING BUSINESS PROCESSES – II	Semester VI L T P C 6 - - 4

COURSE OBJECTIVE

- To equip the students with the knowledge of business processes in BPS industry
- To Understand different Problem solving techniques
- To Understand different Process improvement techniques
- To Understand Six Sigma and its procedures
- To Understand various risk in BPS industry

COURSE OUTCOMES

- Student will understand the different process levels and working of BPS industry.
- Student will be able to understand different problem analyzing and solving techniques
- Student will be able to understand different techniques used to improve the business process
- Student will be introduced to Six Sigma quality improvement techniques and its role in sustaining quality
- Student will understand the different risk and ways of mitigating them in the BPS industry.

Unit I
Problem Solving Techniques
Systematic Problem Solving basics (PDCA) - Problem Solving tools - Brainstorming - Basic 7QC tools - Why Why analysis - FMEA (Process Failure Mode Effects Analysis)

Unit II
Process Improvement Methods
Need for Process Improvement - Introduction to Lean Methodology - Toyota Lean Principles - Continuous Process - Pull Vs Push - Types of Waste - Toyota House of Quality – Jidoka- Just in Time- Value stream mapping- 5S- Kaizen

Unit III
Process Improvement Methods- Six Sigma I
Introduction to Six Sigma Methodology – Meaning of Six Sigma – History - Six Sigma Organization - Six Sigma Project methodology DMAIC Vs DFSS - Problem Definition - CTQ Drill down - Project Charter – Data types - Descriptive statistics - Box Plot – Defect Vs Defective- DPU & DPMO calculations.

Unit IV
Six Sigma II
Balse lining Methodology – MSA – Use of Normal Probability distribution - Estimation of Six Sigma value - Process capability - Sampling- α and β error - Use of Hypothesis Testing for process management - Use of correlation and regression – control charts - Control Plan.

Unit V
Risk Management
What is Risk? Risk Types – Operational Risk, Information Security Risk, Financial Risk, Strategic Risk - Risk Mitigation Plans.

Suggested Readings

Text Book

TCS study material

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Coimbatore – 641 021.

LECTURE PLAN
DEPARTMENT OF COMMERCE

STAFF NAME: V.VIVEK
SUBJECT NAME: MANAGING BUSINESS PROCESS 2 SUB.CODE:16BPU603A
SEMESTER: VI CLASS: III B.COM .BPS

S.No	Lecture Duration Period	Topics to be Covered	Support Material/Page Nos
		UNIT-I	
1	1	Basics of systematic problem solving	T1 C1-Pg:7
2	1	PDCA cycle	T1 C1-Pg:8
3	1	Problem solving tools	T1 C1-Pg:9-10
4	1	Brain Storming	T1 C1-Pg:10-11
5	1	7 QC tools, Histogram, Cause and effect diagram,	T1 C1-Pg:13-15
6	1	Check Sheet, Pareto Diagram	T1 C1-Pg:16-17
7	1	Graphs, Control Charts	T1 C1-Pg:18-19
8	1	Scatter diagram	T1 C1-Pg:20-21
9	1	Why why analysis	T1 C1-Pg:25
10	2	Failure mode and effects analysis (FMEA)	T1 C2-Pg:17-19
11	1	Recapitulation and Discussion of Important Questions	
	Total No of Hours Planned For Unit 1=12		
		UNIT-II	
1	1	Need for process improvement	T1 C7-Pg:1
2	1	Introduction to lean	T1 C7-Pg:5
3	1	TOYOTA lean principles	T1 C7-Pg:14
4	1	Continuous process	T1 C7-Pg:6

5	1	Pull & Push	T1 C7-Pg:9
6	1	Types of waste	T1 C7-Pg:26
7	1	TOYOTA house of quality	T1 C7-Pg:8
8	1	JIDOKA	T1 C7-Pg:23
9	1	Just in Time	T1 C7-Pg:28
10	1	Value stream mapping	T1 C7-Pg:15-17
11	1	5s & KAIZEN	T1 C7-Pg:27,18-22
12	1	Recapitulation and Discussion of Important Questions	
	Total No of Hours Planned For Unit II=12		
		UNIT-III	
1	1	Introduction to six sigma methodology and meaning of six sigma	T1 C6-Pg:5
2	1	History of six sigma	T1 C6-Pg:5
3	1	Six sigma organization	T1 C6-Pg:8-9
4	1	Six sigma project methodology DMAIC vs DFSS	T1 C6-Pg:6-7
5	1	Problem Definition	T1 C6-Pg:15
6	1	CTQ Drill down	T1 C6-Pg:14
7	1	Project charter	T1 C6-Pg:16
8	1	Data types	T1 C6-Pg:20-21
9	1	Descriptive statistics	T1 C6-Pg:22-23
10	1	Defect vs Defective	T1 C6-Pg:26,38
11	1	DPU & DPMO calculation	T1 C6-Pg:39
12	1	Recapitulation and Discussion of Important Questions	
	Total No of Hours Planned For Unit III=12		
		UNIT-IV	
1	1	Base lining Methodology	T1 C6-Pg:27
2	1	MSA(Measure system analysis)	T1 C6-Pg:28

3	1	Use of normal probability distribution	T1 C6-Pg:35-36
4	1	Estimation of sixsigma value	T1 C6-Pg:37
5	1	Process capability	T1 C6-Pg:38
6	1	Sampling α and β error	T1 C6-Pg:22-23
7	1	Use of hypothesis testing for process management	T1 C6-Pg:54-55
8	2	Use of correlation and regression	T1 C6-Pg:56-58
9	1	Control charts	T1 C6-Pg:63,69
10	1	Control plan	T1 C6-Pg:64
14	1	Recapitulation and Discussion of Important Questions	
	Total No of Hours Planned For Unit IV=12		
		UNIT-V	
1	1	What is Risk	T1 C5-Pg:5
2	1	Risk types	T1 C5-Pg:8
3	1	Operational Risk	T1 C5-Pg:10
4	1	Information security Risk	T1 C5-Pg:9
5	1	Financial Risk	T1 C5-Pg:8
6	1	Strategic Risk	T1 C5-Pg:8
7	2	Risk mitigation plans	T1 C5-Pg:10-11
8	1	Recapitulation and Discussion of Important Questions	
9	1	Discussion of Previous year ESE questions	
10	1	Discussion of Previous year ESE questions	
11	1	Discussion of Previous year ESE questions	
	Total No of Hours Planned for unit V=12		
		Total Planned Hours	**60**

TEXT BOOK

TCS Study material

UNIT I

SYLLABUS

Problem Solving Techniques Systematic Problem Solving basics (PDCA) - Problem Solving tools - Brainstorming - Basic 7QC tools - Why Why analysis - FMEA (Process Failure Mode Effects Analysis)

Problem solving techniques

The way you approach issues, obstacles, and situations greatly determines your level of success or failure. A popular Harvard study has shown that people with genius level of intelligence have a systematic way in which they resolve whatever they encounter along their path towards their goals. Problems need to be resolved quickly and efficiently, so let's have a look at the 5 steps that can help you accomplish just that:

Solutions exist

The first step is to believe that there is a solution. Without this belief, you cannot go to step 2 and thus you fail. Every situation, any issue you can think of, there IS a solution. Always carry this belief within you, anything can and will be fixed. When it comes to finding a solution, always think that it's a matter of when not if.

Write out the situation

Take a moment and write down everything you can think of about this particular issue that needs to be resolved. You will notice that the more information you write, the clearer it will start becoming, and the easier it will be for you to find the most appropriate solution. The better you understand a situation, the more likely you are to fix it effectively. This is how they resolve issues in corporate meetings and even how they solve crimes; they write everything they can think about on a big board and start connecting dots.

Find the root cause

Once you have written down everything you can think of, ask yourself the following question: "what caused this to happen?" Remember from step 1, that there is always an answer so always believe that you can answer this question. There may be a multitude of answers to that question, and write each one of those down. Now you will have a better view of what really transpired and how it got to that point.

Identify all solutions

Now that you have a list of everything that is potentially a cause of your issue, you can start to easily figure out a solution for each one of them. For example, let's say I run a store and sales of bicycles are down. That's my problem. While writing down the causes, I find that the closest competitor has 15% cheaper prices. So my solution then would be to either make my prices more competitive or accentuate the reasons why my bikes are at a premium (such as better quality, longer lasting, etc.). As you can see, you will end up with a solution to each and every one of the "causes".

Set a deadline

This is where most people fail to follow through. Would you believe that finding the solutions isn't the step that people have the most trouble with? It's actually the part where you have to take action! Most of the time, people KNOW what they have to do, they just don't do it. So, to avoid you falling into this trap, set up a deadline for which you will have this issue taken care of. Stick to it no matter what, carve it in stone if you have to!

PDCA

PDCA known as Deming Cycle or Deming Wheel, PDCA is a tool for continuous improvement of processes and products. Deming always referred to it as the "Shewhart cycle", PDSA (Plan-Do-Study Act). Deming modified it to PDCA because he felt that "check" emphasized inspection over analysis. Current Toyota Production System / Lean manufacturing uses OPDCA where "O" is taken for observation.

They are tools required to facilitate the process of problem solving, including root cause analysis and corrective action.

IS – IS NOT

"IS – IS NOT" is a problem solving tool that explain the rational process for finding the possible root cause of the problem. This technique also helps user to avoid jumping to a false cause. At the end of the IS – IS NOT exercise user gets a confirmed true cause which helps to establish a plan to fix the problem and prevent it to recur.

FMEA

FMEA(Failure Modes and Effects Analysis) is an analysis tool that makes sure that all the potential problems related to product and process are predicted and addressed throughout the product and process development process

CORRELATION

A correlation is a statistical technique, degree and an index of the relationship strength between any two or more quantities (variables) in which they vary together over a period and it shows whether and how strongly pairs of variables are related. Possible correlations range from +1 to -1.

5 WHYS

The 5 Why's is a simple problem-solving technique that helps you to get to the root of a problem quickly. The technique was originally developed by Sakichi Toyoda, a Japanese inventor and industrialist. The 5 Why's was used within the Toyota Motor Corporation during the evolution of its manufacturing methodologies and became very popular in the 1970s by the Toyota Production System, and is now used within Kaizen, Lean Manufacturing, and Six Sigma.

BRAINSTORMING

Brainstorming is a simple technique for gathering the ideas for developing creative solutions to problems. Brainstorming helps you to have diverse experience of all team members into play during problem solving and/or solution development. This increases the confidence and self satisfaction to all team members and a feeling of ownership of the problem which will also help to find better solutions to the problems you face.

Seven Basic Tools of Quality

The Seven Basic Tools of Quality (also known as 7 QC Tools) originated in Japan when the country was undergoing major quality revolution and had become a mandatory topic as part of Japanese's industrial training program. These tools which comprised of simple graphical and statistical techniques were helpful in solving critical quality related issues. These tools were often referred as Seven Basics Tools of Quality because these tools could be implemented by any person with very basic training in statistics and were simple to apply to solve quality-related complex issues.

The seven QC tools are:

Stratification (Divide and Conquer)

Histogram

Check Sheet (Tally Sheet)

Cause-and-effect diagram ("fishbone" or Ishikawa diagram)

Pareto chart (80/20 Rule)

Scatter diagram (Shewhart Chart)

Control chart

1. Stratification (Divide and Conquer)

Stratification is a method of dividing data into sub–categories and classify data based on group, division, class or levels that helps in deriving meaningful information to understand an existing problem.

The very purpose of Stratification is to divide the data and conquer the meaning full Information to solve a problem.

Un–stratified data (An employee reached late to office on following dates)

5-Jan, 12-Jan,13-Jan, 19-Jan, 21-Jan, 26-Jan,27-Jan

- **Stratified data:** (Same data classified by day of the week)

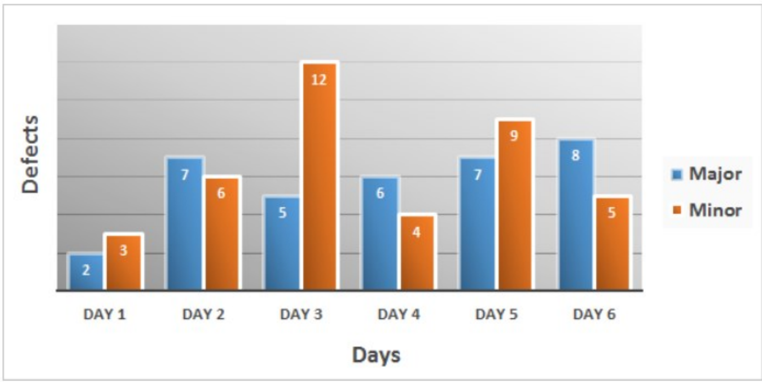
Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Frequency - Late in Office	4	2	1	0	0	0	0

2. Histogram

Histogram introduced by Karl Pearson is a bar graph representing the frequency distribution on each bars.

The very purpose of Histogram is to study the density of data in any given distribution and understand the factors or data that repeat more often.

Histogram helps in prioritizing factors and identify which are the areas that needs utmost attention immediately.



3. Check sheet (Tally Sheet)

A check sheet can be metrics, structured table or form for collecting data and analysing them. When the information collected is quantitative in nature, the check sheet can also be called as tally sheet.

The very purpose of checklist is to list down the important checkpoints or events in a tabular/metrics format and keep on updating or marking the status on their occurrence which helps in understanding the progress, defect patterns and even causes for defects.

Check Sheet - Defect types with their occurrence on day of the week

Defect Types ? (Major/ Minor)	Defects in Supplied Items							Total Count
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	
Rusted Items		□□□□	□□		□□	□		9
Items with Scratch	□							1
Dirty		□		□□□		□□		6
Broken/ Cracks			□□				□	3
Main Body Dent					□□□			3
Missing Components		□□		□□			□	5
Labelling Error					□	□□□		4
Damage in Packaging			□□					2
Wrong Item Issued					□□		□	3
Film on Parts			□□□□					4
Voids in Casting	□					□	□□	4
Incorrect Dimensions			□□	□	□□			5
Failed to pass the quality test		□□				□		3
Total Count	2	9	12	6	10	8	5	52

4. Cause-and-effect diagram. ("Fishbone" or Ishikawa diagram)

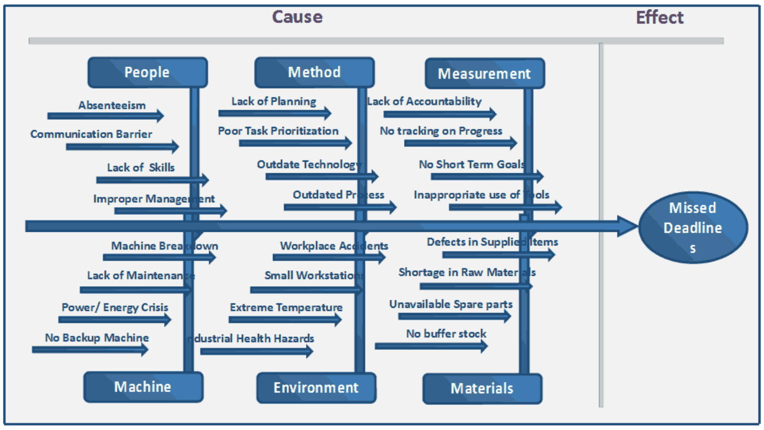
Cause–and–effect diagram introduced by Kaoru Ishikawa helps in identifying the various causes (or factors) leading to an effect (or problem) and also helps in deriving meaningful relationship between them.

The very purpose of this diagram is to identify all root causes behind a problem.

Once a quality related problem is defined, the factors leading to the causal of the problem are identified. We further keep identifying the sub factors leading to the causal of identified factors till we are able to identify the root cause of the problem. As a result we get a diagram with branches and sub branches of causal factors resembling to a fish bone diagram.

In manufacturing industry, to identify the source of variation the causes are usually grouped into below major categories:

- People
- Methods
- Machines
- Material
- Measurements
- Environment



5. Pareto chart (80 – 20 Rule)

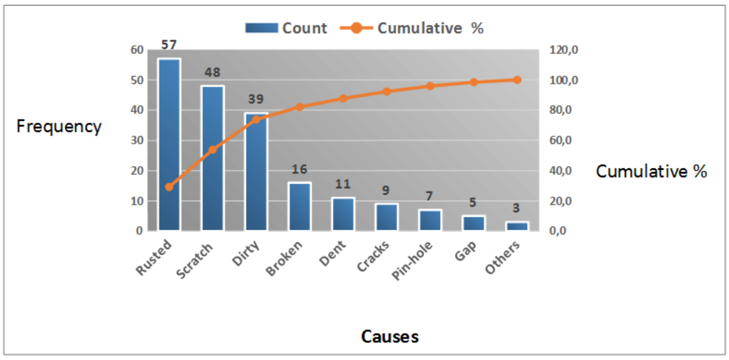
Pareto chart is named after Vilfredo Pareto. Pareto chart revolves around the concept of 80-20 rule which underlines that in any process, 80% of problem or failure is just caused by 20% of few major factors which are often referred as Vital Few, whereas remaining 20% of problem or failure is caused by 80% of many minor factors which are also referred as Trivial Many.

The very purpose of Pareto Chart is to highlight the most important factors that is the reason for major cause of problem or failure.

Pareto chart is having bars graphs and line graphs where individual factors are represented by a bar graph in descending order of their impact and the cumulative total is shown by a line graph.

Pareto charts help experts in following ways:

- Distinguish between vital few and trivial many.
- Displays relative importance of causes of a problem.
- Helps to focus on causes that will have the greatest impact when solved.

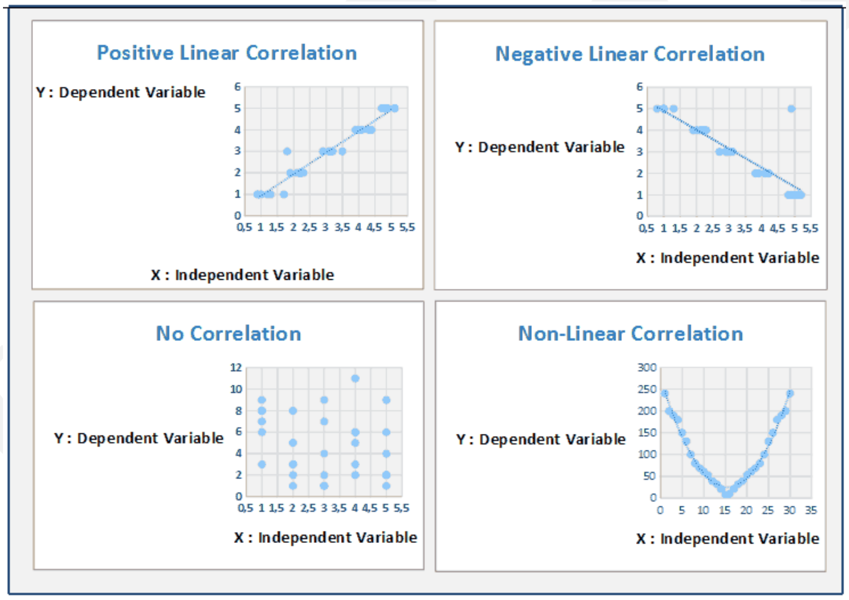


6. Scatter diagram

Scatter diagram or scatter plot is basically a statistical tool that depicts dependent variables on Y – Axis and Independent Variable on X – axis plotted as dots on their common intersection points. Joining these dots can highlight any existing relationship among these variables or an equation in format Y = F(X) + C, where is C is an arbitrary constant.

Very purpose of scatter Diagram is to establish a relationship between problem (overall effect) and causes that are affecting.

The relationship can be linear, curvilinear, exponential, logarithmic, quadratic, polynomial etc. Stronger the correlation, stronger the relationship will hold true. The variables can be positively or negatively related defined by the slope of equation derived from the scatter diagram.



7. Control Chart (Shewhart Chart)

Control chart is also called as Shewhart Chart named after Walter A. Shewhart is basically a statistical chart which helps in determining if an industrial process is within control and capable to meet the customer defined specification limits.

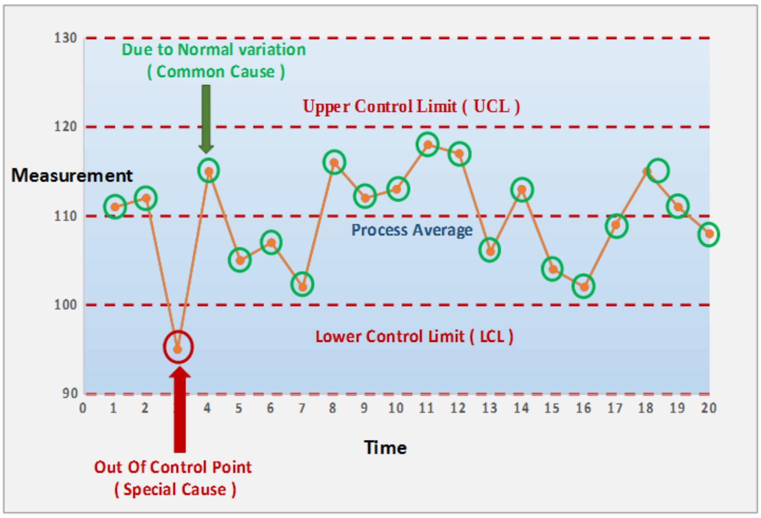
The very purpose of control chart is to determine if the process is stable and capable within current conditions.

In Control Chart, data are plotted against time in X-axis. Control chart will always have a central line (average or mean), 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, experts can draw conclusions about whether the process variation is consistent (in control, affected by common causes of variation) or is unpredictable (out of control, affected by special causes of variation). It helps in differentiating common causes from special cause of variation.

Control charts are very popular and vastly used in Quality Control Techniques, Six Sigma (Control Phase) and also plays an important role in defining process capability and variations in productions. This tool also helps in identifying how well any manufacturing process is in line with respect to customer's expectation.

Control chart helps in predicting process performance, understand the various production patterns and study how a process changes or shifts from normally specified control limits over a period of time.



FMEA(Failure Modes and Effects Analysis)

It is an analysis tool that makes sure that all the potential problems related to product and process are predicted and addressed throughout the product and process development process.

FMEA is a methodology to analyze and discover:

- All potential failure modes of a process
- The effects these failures have on the process
- How to correct and or mitigate the failures or effects on the process

FMEA is can be used as the main phase of the design process in the early stage.

FMEA provides the structural approach for root cause analysis, severity of the issue and helps to draw the actions for the prevention of the problem.

FMEA development uses the following steps to address:

Potential product / process failure to meet product specification.

- Potential failure modes
- Potential causes of the failure modes
- Enforcement of current controls
- Level of Threat or Risk
- Action for risk reduction

Team responsible for the development of FMEA must gather all related information before the development of FMEA. This will help effective and efficient FMEA development.

FMEA emerged from the US Military in the late 1940s as a tool to improve the evaluation of reliability of equipment. Its benefits quickly became apparent and it was adopted by aerospace industries and NASA during the Apollo program in the 1960s. It was later taken up by many of the larger automotive companies, including

Ford in the 1970s. It has since become a core tool in product development in many organizations and is recommended as a part of an organization's quality management system.

There are two main types of FMEA, Product or Design FMEA (DFMEA) and Process

FMEA (PFMEA).

Product or Design FMEA

What could go wrong with a product while in service as a result of a weakness in design?

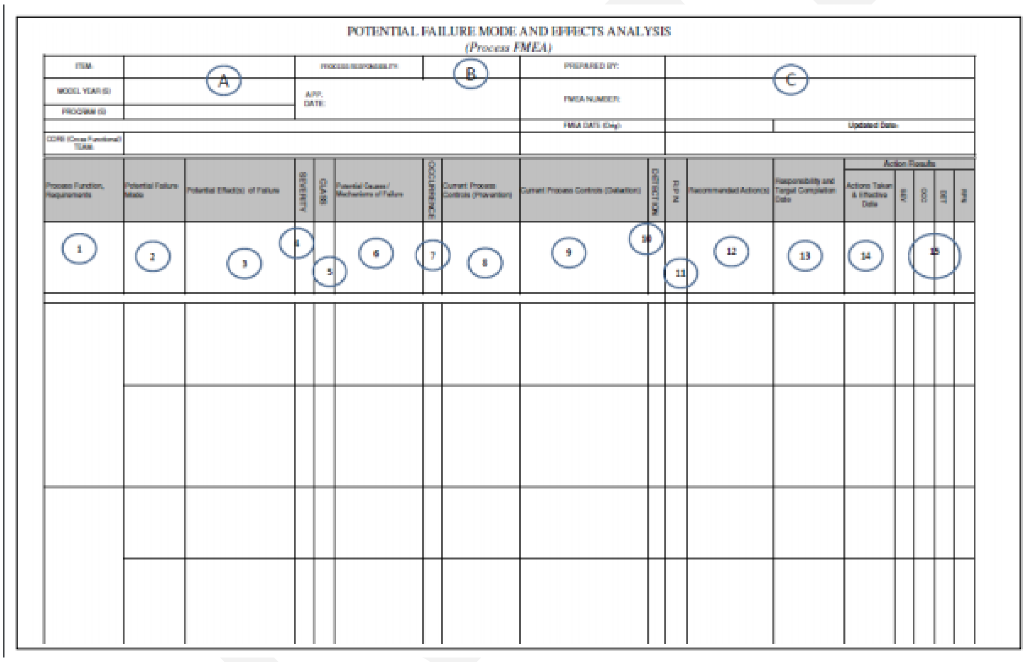
 Carried out during the early stages of a design project

 Tends to assume that the product will be produced to the required design specifications

 Aims to reduce reliance on process controls and inspection to overcome limitations in the basic design and thus, need to consider the technical and physical limitations of the manufacturing and assembly processes

Process FMEA

What could go wrong with a product during manufacture or while in service as a result of non-compliance to specification or design?



POTENTIAL FAILURE MODE AND EFFECTS ANALYSIS
(Process FMEA)

ITEM: (A)	PROCESS RESPONSIBILITY: (B)	PREPARED BY: (C)	
MODEL YEAR (S)	APP. DATE:	FMEA NUMBER:	
PROGRAM (S)		FMEA DATE (Orig):	Updated Date:
CORE (Cross Functional) TEAM			

Process Function, Requirements	Potential Failure Mode	Potential Effect(s) of Failure	SEVERITY	CLASS	Potential Causes / Mechanisms of Failure	OCCURRENCE	Current Process Controls (Prevention)	Current Process Controls (Detection)	DETECTION	R.P.N	Recommended Action(s)	Responsibility and Target Completion Date	Action Results: Actions Taken & Effective Date	SEV	OCC	DET	RPN
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			

Details of Elements in FMEA Table:

A. Item & Core Team Identification:

Details of the Product identification Name, Number etc., Responsible Core team

involved in the development of the FMEA.

B. Date & Completed by:

To record the name of the champion and when the analysis took place.

C. FMEA number & reference information:

Reference document numbering for quick and easy traceability

1. System / component / function:

The specific name of the process function or characteristics / number of the item or element under study.

2. Potential Failure Modes:

The manner in which a component, subsystem or system could possibly fail while being used. Team should validate the potential failure modes through a review of past things gone wrong, concerns, reports and team brainstorming.

3. Potential Effects of Failure:

Record the effects of the potential failure mode. What could go wrong? Provide as detailed description as is necessary of the potential impact of failure. An individual failure mode may have many possible effects.

4. Severity rating:

Each failure effect can be judged for its potential seriousness. Typically, this is done by scoring the effect on a 1 to 5 (or 10): scale. Team should discuss with arguments and agreed to a representative severity rating that explains the effect of failure mode.

Rating Criteria:

5 (9-10) with potential safety risk or legal problems - potential loss of life or major dissatisfaction

4 (7-8) High potential customer dissatisfaction - serious injury or significant mission disruption

3 (5-6) Medium potential customer dissatisfaction - potential small injury, mission inconvenience / delay

2 (3-4) The customer may notice the potential failure and may be a little dissatisfied

-annoyance

1 (1-2) The customer will probably not detect the failure – undetectable

5. Classification:

This column may be used to identify the high priority failure modes which must be addressed (e.g. safety issues, sales issues etc.)

6. Potential Cause / Mechanisms of Failure:

Each failure mode will have an underlying root cause. Team should focus on an understanding of the failure mechanism for each failure mode. Causes are the circumstances that induce or activate a failure mechanism. Possible causes could include: Wrong tooling, poor alignment, operator error, component missing, defective components, maintenance required, environment etc.

7. Occurrence Ranking:

It is also necessary to consider the likelihood of the potential failure occurring. A consistent occurrence ranking system should be used to ensure continuity.

Typically, this is done by scoring the occurrence on a 1 to 5 (or 10): scale as shown below:

Rating Criteria:

5 (9-10) Very high probability of occurrence

4 (7-8) High probability of occurrence

3 (5-6) Moderate probability of occurrence

2 (3-4) Low probability of occurrence

1 (1-2) Remote probability of occurrence

This section is critical in the FMEA procedure and each of the responses categorized as very high or high should be considered and addressed.

8 & 9. Current Process control:

There are two types of process controls to consider:

· Prevention: Aim to eliminate the potential failure? These could include labels, barriers, instructions or total redesigns.

· Detection: Identify (detect) the cause of failure followed up by the implementation of the corrective action to catch the problem.

10. Detection rating:

The final rating aims to establish how 'detectable' the potential failure will be. In order to achieve a lower ranking, generally the planned detection control has to be improved.

Suggested ratings on a scale of 1 to 5 (or 10):

Rating Criteria:

5 (9 or 10) Zero probability of detecting the potential failure cause

4 (7 or 8) Close to zero probability of detecting potential failure cause

3 (4, 5 or 6) Not likely to detect potential failure cause

2 (2 or 3) Good chance of detecting potential failure cause

1 (1) Almost certain to identify potential failure cause

11. Risk Priority Number (RPN) The RPN is simply the product of the severity, occurrence and detection ratings: RPN = Severity rating x Occurrence rating x Detection rating - perhaps more easily remembered as: RPN= S*O*D The RPN value gives an indicator of the design risk and generally, the items with the highest RPN and severity ratings should be given first consideration. 12. Recommended actions: The intent of any recommended action is to reduce rankings in the following order: severity, occurrence and detection. · Only a design or process revision can bring about a reduction in the severity ranking. · A reduction in the occurrence rating can be achieved by controlling one or more causes of the failure mode along with a revision of product and process design. · A reduction in the detection rating can be done by applying error/mistake proofing or by the modification, automation and improvement of the detection process. 13. Responsibility: All actions should be clearly assigned to an individual, department and/or organization with a clear target completion date. Team leader is responsible for ensuring that all recommended actions are implemented and adequately addressed. 14. Actions taken and effective date: Brief description of the actions taken with task completion date. 15. Severity, Occurrence, Detection and RPN: These columns identifies the result of the preventive/corrective actions and the effect of the action in terms of S, O, D rankings and new RPN for the item. Verification of the corrective actions is needed to be completed for continual improvements.

Tips on use of Failure Modes and Effects Analysis

- Preparation is essential
- Facilitation is critical
- Customize the scales where needed
- Multiple sessions more effective
- Brainstorming rules apply
- Allocate sufficient time for an effective outcome

Application of Failure Modes and Effects Analysis

- Concept

- Design/Product
- Process .
- Implementation
- Change

KARPAGAM ACADEMY OF HIGHER EDUCATION - COIMBATORE 21
SUBJECT CODE:16BPU603A SUBJECT: MANAGING BUSINESS PROCESS 2

Unit 1

Question	**option A**	**option B**	**option C**	**Option D**		**Answer**
______is an unforeseen situation that requires an resolution which is not known immediately	problem	process	management	control		problem
_____is used to understand the process steps	flow chart	fish bone diagram	pareto chart	control chart		flow chart
_____is used to diagnose the root cause of the problem	flow chart	fish bone diagram	pareto chart	control chart		fish bone diagram
_____is an articulate explanation of the problem that needs attention by problem solving team	Problem flowchart	problem statement	problem discovery	solution		problem statement
_____is an average if all the data points	Mean	Median	mode	standard deviation		Mean
______reflect to middle data point of the data set.	Mean	Median	mode	standard deviation		Median
_____reflect number count, maximum number of time in the data	Mean	Median	mode	standard deviation		mode
______is conducted when you know the problem or a problem is occurred and you want to know what went wrong	meeting	interview	press meet	Root cause analysis		Root cause analysis
____is used to identify root cause for a non data based problem	why why analysis	variant analysis	pareto chart	hypothesis test in		why why analysis
_____is used to identify root cause for a data based problem	why why analysis	variant analysis	pareto chart	anova		pareto chart
_____is a non structured, free flow of thoughts and ideas intended to solve a problem by the team	why why analysis	Brain storming	pareto chart	hypothesis testing		Brain storming
In order to prevent an action _____ needs to be done	Corrective action	no action	preventive action	smart action		Corrective action
In order to avoid a potential problem from occurring in the future_____need to be taken	Corrective action	no action	preventive action	smart action		preventive action
_______is used most commonly to depict frequency distribution	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
_______is a graphical representation of tabulated frequencies which shows data falling into various categories	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
______is used to show or summarize continuous and discrete data which is measured on an interval scale	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
______is used to illustrate major features of data distribution in convenient form	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
_____is used to determine the shape of the data and to see if it is distributed normally	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
______is used when one wants to analyse the output which is coming form supplier process	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
Fish bone diagram is also called	Histogram	Ishikawa diagram	check sheet	pareto chart		Ishikawa diagram
_____is used to identify multiple causes for a concern	Histogram	fish bone diagram	check sheet	pareto chart		fish bone diagram
______is used to set things in order in a brain storming session	Histogram	fish bone diagram	check sheet	pareto chart		fish bone diagram
_____is used when possible causes for a problem needs to be bought to light	Histogram	fish bone diagram	check sheet	pareto chart		fish bone diagram

______is a predefined format for gathering and evaluating data	Histogram	fish bone diagram	check sheet	pareto chart		check sheet
_____is used when data can be collected regularly by the same operator at the same time	Histogram	fish bone diagram	check sheet	pareto chart		check sheet
_____is used when data is been collected of cause of defects, location of defect and shop floor	Histogram	fish bone diagram	check sheet	pareto chart		check sheet
_____is a type of a bar graph	Histogram	fish bone diagram	check sheet	pareto chart		pareto chart
_____is used when you want to analyse how frequently the causes are occurring in a process	Histogram	fish bone diagram	check sheet	pareto chart		pareto chart
______is used when you want to prioritize few causes from many	Histogram	fish bone diagram	check sheet	pareto chart		pareto chart
_____is used when you want to show a clear picture to other about cause and its behaviour	Histogram	fish bone diagram	check sheet	pareto chart		pareto chart
_____is used when you have data which is paired	Histogram	fish bone diagram	Scatter diagram	pareto chart		Scatter diagram
_____is used when determining the two variables are related		fish bone diagram	Scatter diagram	pareto chart		Scatter diagram
_____is used when human factors are involved in the problem	why why analysis	fish bone diagram	Scatter diagram	pareto chart		why why analysis
FMEA is	Failure mode and effects analysis	fast mode and effect analysis	fashion mode and effects analysis	forest mode and effect analysis		failure mode and effects analysis
_____is used to analyse entire product and process life cycle to identify all problems	Failure mode and effects analysis	fish bone diagram	Scatter diagram	pareto chart		failure mode and effects analysis
_____is a systematic tool to identify all possible failures in product or service	Failure mode and effects analysis	fish bone diagram	Scatter diagram	pareto chart		failure mode and effects analysis
_____helps to identify risks in the process	Failure mode and effects analysis	fish bone diagram	Scatter diagram	pareto chart		failure mode and effects analysis
_____helps to bring to light probable potential failures and potential causes	Failure mode and effects analysis	fish bone diagram	Scatter diagram	pareto chart		failure mode and effects analysis
____comes up with an action plan to mitigate failures	Failure mode and effects analysis	fish bone diagram	Scatter diagram	pareto chart		failure mode and effects analysis
______is brought into action before the completion of the product design	Design FMEA	Process FMES	product FMES	Effect FMEA		Design FMEA
______is brought into action before the release of the design of the process	Design FMEA	Process FMES	product FMES	Effect FMEA		Process FMES
Any errors or defects can be termed as _____	failure	effect	management	process		failure
____are the ways in which a process can fail	model	failure modes	failure effects	failure process		failure modes
_____is the analysis of the consequences of the failures	model	failure modes	Effects analysis	failure process		Effects analysis
Failures are prioritized according to the ________	frequency	effect	consequences	modes		consequences
_____ documents current knowledge about the failure risks	FEMA	FAME	MFEA	FMEA		FMEA
_____is used during the design phase to stop failure	FEMA	FAME	MFEA	FMEA		FMEA
______is used during the daily operations to control the process	FEMA	FAME	MFEA	FMEA		FMEA
______is an end to end tool which starts at the inception of the product and continues till life cycle	FEMA	FAME	MFEA	FMEA		FMEA
Removing time lost is a benefit of ____process	problem solving	FEMA	business	management		problem solving
Identifying the weak point in process is a benefit of____process	problem solving	FEMA	business	management		problem solving

Discovering systematic causes for a problem is a benefit of _____process	problem solving	FEMA	business	management		problem solving
____is used to identify the primary cause that resulted in the problem	problem solving	Root cause analysis	process	management		Root cause analysis
_____is the extent of the problem then trying to limit it	Corrective action	preventive action	Containment action	no action		Containment action
_____is used to watch the change in the process form one time to another	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
______is used to determine two different processes and their outputs	Histogram	fish bone diagram	check sheet	pareto chart		Histogram
_____is used to set things in order in a brainstorming session	Histogram	fish bone diagram	check sheet	pareto chart		fish bone diagram
_____are graphs with upper and lower limits	Histogram	Control charts	check sheet	pareto chart		Control charts
____is very strong tool from visual perspective	bar graph	pie graph	line graph	control chart		bar graph
which graph will have upper and lowe limits	Histogram	Control charts	check sheet	pareto chart		Control charts

UNIT II

SYLLABUS

Process Improvement Methods Need for Process Improvement - Introduction to Lean Methodology - Toyota Lean Principles - Continuous Process - Pull Vs Push - Types of Waste - Toyota House of Quality – Jidoka- Just in Time- Value stream mapping- 5S- Kaizen

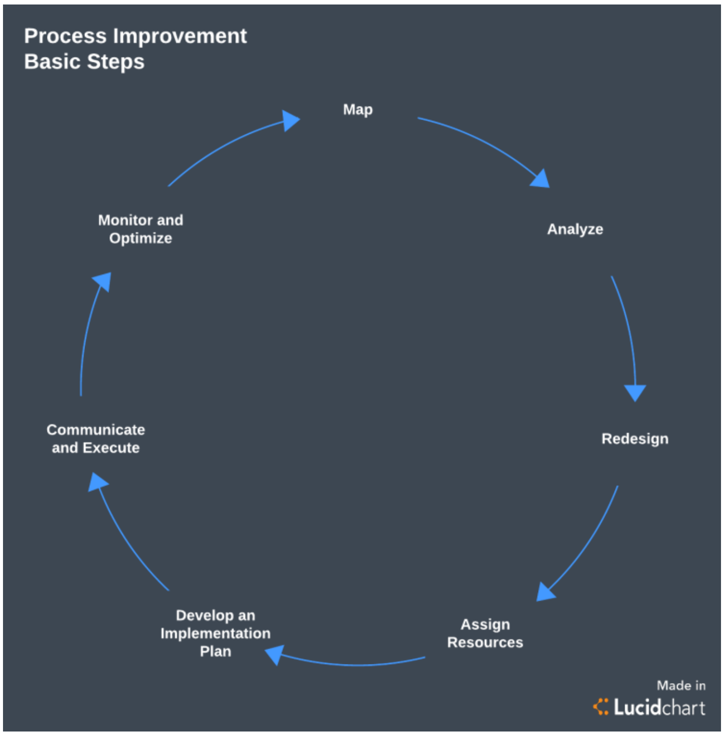
Need for process improvement

What is process improvement?

The definition of process improvement is pretty straightforward. It's the process of identifying, analyzing, and improving existing business processes. More simply, it's taking a look at your organization and figuring out how you can do things better.

Process improvement aims to eliminate weak points or bottlenecks in business operations. By identifying those weak points, you help your business:

- Reduce process completion time.
- Improve process efficiency and quality.
- Eliminate wasted efforts.
- Reduce friction in business processes.
- Meet regulatory compliance.



1. Map the process

Once you've selected a process to improve, visually map out the current steps to see the process as a whole and help you find areas for improvement. Consider mapping your process using process flowchart templates from Lucidchart.

2. Analyze the process

After you've mapped out the process, take a closer look at each step. Use the same diagram from the first step to identify where problems occur. Note areas where delays occur, where you use too many resources, or where you spend a lot of money.

3. Redesign the process

Now redesign the process to eliminate the problems you've identified. It's best to complete this step with your team. They'll make sure that you have a correct understanding of the old process and that you don't miss anything. Talk with your team about the problems you've found and how you can solve the problem. You can even brainstorm to come up with ideas and keep track of potential solutions.

4. Assign resources

Who do you need to include to make the change happen? Consider the teams who will be impacted by this change—you might need to talk with managers or colleagues from other departments if you require extra help to get the new processes underway.

5. Develop an implementation plan

With resources assigned and a solution chosen, it's time to create an implementation plan. Your plan should be as detailed as possible. You'll want to include the team members you've identified from the previous step in your plan. List the specific tasks that each of your resources will be working on.

6. Communicate and execute

You're now ready to put your plan into action. Before you move into the execution phase, communicate the plan to your team. Even if you've previously discussed the new process, communicate your plan to carry out the work. Keeping your team in the loop reduces the chance your team will resist the new process.

7. Monitor and optimize

Process improvement is not a one-time event. It's a continuous effort.

Introduction to Lean

Many companies today have been around for several decades or more. When these companies were started, they implemented processes that worked then and for the most part, still work today. They keep doing things the same way without change simply because they have always done it that way, the "don't fix it if it is not broken" principle. The problem is that the business world isn't the same as it was a few decades ago. With recent advances in technology and communication came changes in the way we do business. Today we do business in a world market and parts and supplies are commonly sourced from around the world. Competition for business just keeps increasing. Companies must look for ways to reduce waste and improve product quality to remain competitive. Lean methodology is very effective at eliminating and reducing waste. Many organizations from manufacturing to healthcare have successfully implemented Lean methodology. They have benefited through increased productivity, elimination of waste and improved quality resulting in a positive impact on the bottom line. Regrettably, many organizations have yet to discover the value of Lean methodology.

What is Lean?

Lean is the act of reducing waste and adding customer defined value to products and services. The definition of Lean tends to vary slightly depending upon the source, nevertheless the underlying meaning is the same. In the United States, the predominant thought is that Lean is a system of tools and techniques for reducing waste and adding value in every process. In Japan, Lean is considered a mindset and not a set of tools. The fundamental principles of Lean methodology are based on eliminating all forms of waste and increasing customer perceived value with everything we do. In addition, management must support and encourage the Lean mindset throughout the organization at all levels. Lean means doing more with less while doing it better.

Why Implement Lean

Organizations today must do more with less. Many companies are continually looking for ways to become more competitive in the marketplace. Every new product idea must have a solid business case to back it up. Otherwise, management would not allow that project to continue. On several occasions, the fate of a project has rested upon cost versus market value. Lean is all about adding value to the product while eliminating waste. Is it possible that hidden waste is driving up the cost of your products and services? In order to assure long-term survival in today's economy, organizations must continually reduce waste. Lean helps identify eight types of waste:

Motion: Unnecessary motion of personnel, equipment or information due to inadequate workspace layout, missing parts or tools and ergonomic issues

Transportation: Transporting items or information that is not required to perform the process from one location to another

Waiting: Time waiting for parts, tools, supplies or the previous process step

Overproduction: Producing more product than what is required to meet current demand

Defects: Non-conforming products or services requiring resources to correct

Inventory: Inventory or information that is being stored or not being processed likely due to line imbalance or overproduction

Unrecognized talent: Failure to effectively engage employees in the process and fully utilize their knowledge and skills

Extra processing: Activity that is not adding value or required to produce a functioning part, product or service

By continually identifying and eliminating waste in our processes, we can lower costs and increase margin. Lean, done properly, enables an organization to be more adaptable to changes in the market and the economy. To quote the words of W. Edwards Deming, "No one has to change. Survival is optional." Through implementation of Lean, organizations will benefit from streamlined processes, reduced waste and lower manufacturing cost. In addition, the development of a continuous improvement company culture is also an outcome of Lean. These organizations will not merely survive; these organizations will grow and given that, create additional jobs.

How to Implement Lean

Commitment to Succeed

There are certain steps involved in the implementation of Lean and various tools utilized within the Lean methodology. Although, before any improvement activities occur the Lean initiative must have the full support of management. There must be a commitment from management to provide the proper resources and on-going support to implement a Lean program that will stand the test of time. Companies will at times organize one "Lean Event" and initiate 5S, congratulate themselves and stop supporting the initiative. At the heart of

Lean is gradual continuous improvement or Kaizen. An organization cannot expect to implement Lean overnight. It will require time, resources and hard work to build a robust and effective Lean program.

Employee Training

One very important thing you must consider is training and education for your teams. Every professional sports team receives rigorous and continuous training to refine their skill-sets and coaching to keep them motivated and on track towards success. Proper training in Lean methodology and all the tools, along with regular guidance and encouragement, will greatly improve your team's chance of success and provide for a smoother transition towards a Lean culture.

Identifying Waste

Waste exists in most every process in one form or another. No matter how efficient your process currently is, it most likely can be improved. Any step or operation that does not add value is waste. One method used to discover waste is the Value Stream Map. The Value Stream Map depicts how materials, parts and processes flow through the organization and on to the customer. In addition, the map should identify how different actions and departments are interconnected. Through examination of the map, your team can identify which actions and processes add value and which are wastes. The team can then develop a "future state" map with as many of the non-value added actions and processes excluded. As you develop the new value stream, look for ways to change to a pull system where production is based on customer demand and eliminate the waste.

Determining Root Cause

For each of the wastes identified using the Value Stream Map the team should determine the root cause. Root Cause Analysis (RCA) is often performed through brainstorming and use of a fishbone or cause and effect diagram. Once the most likely causes are identified the team could then perform a 5 Why exercise and determine the root cause.

Taking Action

Once the root causes for each waste have been determined, the team should put together an action plan. The actions should take into account any effects on the rest of the process. Anytime we make a change, new content is introduced into the process. Unknown content is process risk and can be evaluated by Failure Mode and Effects Analysis (FMEA).

Principles of Lean Toyota Production System (TPS)

Principle 1: Base your management decisions on a long term philosophy, even at the expense of short-term financial goals.

Principle 2: Create continuous process flow to bring problems to the surface.

Principle 3: Use "Pull" system to avoid overproduction.

Principle 4: Level out the workload (heijunka). ("Work like a tortoise, not the hare").

Principle 4: Level out the workload (heijunka). ("Work like a tortoise, not the hare").

Principle 5: Build a culture of stopping to fix problems, to get quality right at the first time.

Principle 6: Standardized tasks are the foundation for continuous improvements and employee empowerment.

Principle 7: Use Visual Control so no problems are hidden.

Principle 8: Use only reliable, thoroughly tested technology that servers your people and process.

Principle 9: Grow leaders who thoroughly understands the work, live philosophy and teach it to others.

Principle 10: Develop exceptional people and teams who follow your company's philosophy.

Principle 11: Respect your extended network of partners and suppliers by challenging them and helping them improve.
Principle 12: Go to gemba and see for yourself to thoroughly understand the situation (Genchi Genbutsu).
Principle 13: Make decision slowly by consensus (use cross functional teams), thoroughly considering all options; implement decisions rapidly.
Principle 14: Become a learning organization through relentless reflection (hansei) and continuous improvements (Kaizen).

Key Concepts of Continuous (Lean Process) Improvement

#1: Lean Process Improvement is a Mindset, Not an Event
#2: It's Most Effective When Practiced Across the Organization
#3: It Helps You Maximize Value and Deliver Faster

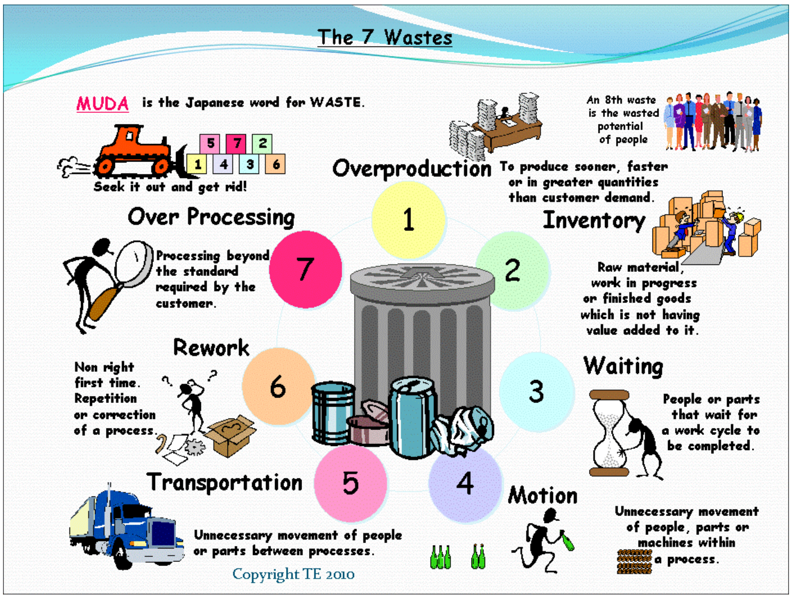
Push-Pull Manufacturing

"Push type" means Make to Stock in which the production is not based on actual demand. "Pull type" means Make To Order in which the production is based on actual demand. In supply chain management, it is important to carry out processes halfway between push type and pull type or by a combination of push type and pull type.

Wastes of Lean Manufacturing

The seven wastes of Lean Manufacturing are what we are aiming to remove from our processes by removing the causes of Mura and Muri as well as tackling Muda directly. But what exactly are the seven wastes of Lean Manufacturing (or 7 Mudas)?
The Seven Wastes of Lean Manufacturing are;

- Transport
- Inventory
- Motion
- Waiting
- Over-Processing
- Overproduction
- Defects



The TOYOTA House of Quality

The "house of quality," the basic design tool of the management approach known as quality function deployment (QFD), originated in 1972 at Mitsubishi's Kobe shipyard site. Toyota and its suppliers then developed it in numerous ways. The house of quality has been used successfully by Japanese manufacturers of consumer electronics, home appliances, clothing, integrated circuits, synthetic rubber, construction equipment, and agricultural engines. Japanese designers use it for services like swimming schools and retail outlets and even for planning apartment layouts.

A set of planning and communication routines, quality function deployment focuses and coordinates skills within an organization, first to design, then to manufacture and market goods that customers want to purchase and will continue to purchase. The foundation of the house of quality is the belief that products should be designed to reflect customers' desires and tastes—so marketing people, design engineers, and manufacturing staff must work closely together from the time a product is first conceived.
The house of quality is a kind of conceptual map that provides the means for interfunctional planning and communications. People with different problems and responsibilities can thrash out design priorities while referring to patterns of evidence on the house's grid.

JIDOKA

Providing machines and operators the ability to detect when an abnormal condition has occurred and immediately stop work. This enables operations to build in quality at each process and to separate men and machines for more efficient work. Jidoka is one of the two pillars of the Toyota Production System along with just-in-time.
Jidoka highlights the causes of problems because work stops immediately when a problem first occurs. This leads to improvements in the processes that build in quality by eliminating the root causes of defects.
Jidoka sometimes is called autonomation, meaning automation with human intelligence. This is because it gives equipment the ability to distinguish good parts from bad autonomously, without being monitored by an operator. This eliminates the need for operators to continuously watch machines and leads in turn to large productivity gains because one operator can handle several machines, often termed multiprocess handling.

5S

When 5S is implemented properly, it can identify and reduce many forms of waste in any process or workstation. An organized work area reduces excessive motion and wasted time looking for the right tool. The visual aspect of the 5S methodology is also very effective. When everything has a place, waste in the form of looking for tools or supplies is eliminated. Improved visual controls are implemented as part of 5S to make any process non-conformances obvious and easily detectable.
The 5S list is as follows:
Seiri / Sort – Separating the essential from the nonessential items
Seiton / Straighten – Organizing the essential materials, everything has its place
Seiso / Shine – Cleaning the work area
Seiketsu / Standardize – Establishing a system to maintain and make 5S a habit
Shitsuke / Sustain – Establishing a safe and sanitary work environment

JIT

Just in Time (JIT) manufacturing is a core component of Lean methodology. JIT manufacturing seeks to eliminate waste in the form of overproduction and excess inventory. The key principles of JIT manufacturing are as follows:
Minimize stock and resources and purchase materials and ship products only when required
Eliminate waste in the form of excess inventory
Produce smaller batches based on the actual demand allowing production to operate smoothly and balanced

Kaizen

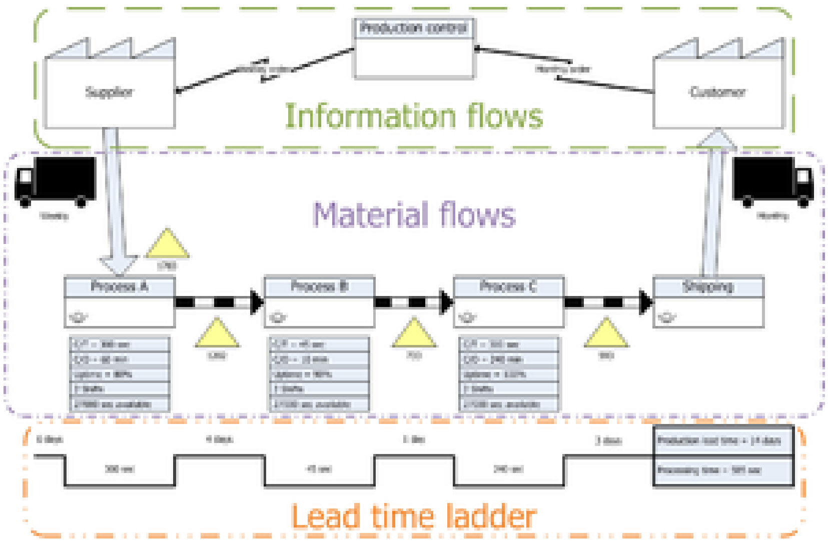
Kaizen is a key building block for a robust sustainable Lean initiative. The goal of Kaizen is to improve productivity, reduce waste, eliminate unnecessary hard work and humanize the workplace. Kaizen is not a specific tool or set of tools to improve quality. Kaizen is more than a destination, it is a journey. Kaizen philosophy empowers everyone to assume responsibility of their work processes and improve them. With Kaizen, workers at all levels of the organization are engaged in constantly watching for and identifying opportunities for change and improvement. Kaizen is a culture change that supports gradual continuous improvement on a daily basis. When everyone is working to reduce waste and improve processes the organization becomes Lean.

Through proper planning, education and application of the Lean tools, processes can be optimized and waste eliminated. In addition, participation in the improvement activities tends to build employee morale. When the workers are involved in the improvements they tend to feel more ownership of their processes. When this occurs you can build towards a gradual continuous improvement culture. Rather than making large expensive changes that can be disruptive to the workplace, you will begin making smaller sustainable changes. The application of Lean methodology is achieving measurable results across all types of industries. Lean methodology helps you reduce costs while delivering added value to your customers.

Value stream mapping

It is a lean tool that employs a flow diagram documenting in high detail every step of a process. Many lean practitioners see value stream mapping as the fundamental tool to identify waste, reduce process cycle times, and implement process improvement. Some organizations treat the value stream map as the hallmark of their lean efforts.

In analyzing value stream maps, it has occurred to me that some may have been created primarily as heuristic tools to teach lean concepts. It seemed as if the process improvement teams had focused on the method as the end, rather than how to use the method as a means to achieve an end. The detail was overwhelming. In some cases, the time spent creating the maps actually became a waste of time in itself, resulting in a negative return on the process improvement effort.



KARPAGAM ACADEMY OF HIGHER EDUCATION - COIMBATORE 21

SUBJECT CODE:16BPU603A SUBJECT: MANAGING BUSINESS PROCESS 2

Unit 2

Question	option A	option B	option C	Option D		Answer
_____means focus on preserving value by working	lean	six sigma	jidoka	JIT		lean
TPS is	Toyota Production System	Taipei Production system	Toyota planning system	taipei planning system		Toyota Production System
OMCD is	Ohno management consulting division	Operations management consulting division	Ohno manager consulting division	operations manager coordinator division		Operations management consulting division
In the classic way, price = profit margin +_______	stock	cost	over head	salary		cost
According to lean profit = price - _______	stock	cost	over head	salary		cost
Muda means	fast	slow	time	waste		waste
The foundation of the lean system is _____ and _____	fast and quality	slow and steadiness	quality and process	stability and standardization		stability and standardization
The walls of house of lean are _____ and ____	muda and jidoka	jidoka and kaizen	muda and just in time	Just in time and Jidoka		Just in time and Jidoka
The roof of house of lean is ____	product	process	client focus	management		client focus
TPS core objective is to provide _____ Quality at ______Price	High & Low	Low & Low	Low & High	High & High		High & Low
____ is an activity for which customer doesn't willing to pay	profit	cost	over head	muda		muda
____refers to any motion that adds worth to the merchandise	actual work	auxiliary work	muda	no work		actual work
____is the motion that supports actual work	actual work	auxiliary work	muda	no work		auxiliary work
man and machine element both are considered as ____motion	wasted	boosted	fasted	timely		wasted
poor ergonomic strategy will_______affects output & quality	positively	negatively	neutrally	cognitively		negatively
reducing the muda in human motion can be done by having control on ______	ergonomics	statistics	data	solutions		ergonomics
WIP means	work in progress	work in position	work in product	work in place		work in progress
____increases lead time	delay	on time	defect	human		delay
lead time = _____time +______time	Processing & Retention	Processing & Polishing	Processing & over processing	Processing & consuming		Processing & Retention
____are wastes that are majorly contributed through inefficient workplace design	Delay	Transportation	defect	over processing		Transportation
muda in___is to rework or fixing defective products	Delay	Transportation	defect	over processing		defect
______is a kind of muda where process preform more than the customer requirement	Delay	Transportation	defect	over processing		over processing
over processing is generally common in companies driven by _______departments	Engineering	Medical	Civil	Electronics		Engineering

____is a kind of muda which is related to keeping of unnecessary raw materials and pending works	Delay	Transportation	defect	Inventory		Inventory
_____is said to be the root cause of major manufacturing challenges	Transportation	defect	Inventory	overproduction		overproduction
______is a set of activities across all departments of organization	value stream mapping	defect	Inventory	overproduction		value stream mapping
_____represents end to end process, material and information flow	value stream mapping	defect	Inventory	overproduction		value stream mapping
______will help you in finding the waste	value stream mapping	defect	Inventory	overproduction		value stream mapping
____is to understand customer expectation and then preparing strategy for creating process to respond customer demand	pull	push	side	hide		pull
___is only produce what and when the customer wants	pull	push	side	hide		pull
_____helps in seeing and understanding physical flow of material and information	value stream mapping	defect	Inventory	overproduction		value stream mapping
_____helps to visualize the production flow	value stream mapping	defect	Inventory	overproduction		value stream mapping
_____allows to see waste in the system	value stream mapping	defect	Inventory	overproduction		value stream mapping
____prevents focusing on large improvement opportunities with little impact	value stream mapping	defect	Inventory	overproduction		value stream mapping
______creates framework for designing complete system	value stream mapping	defect	Inventory	overproduction		value stream mapping
______demonstrates interaction between information and material flow	value stream mapping	defect	Inventory	overproduction		value stream mapping
_____is a formula to calculate time in which a product is manufactured	Takt Time	Value stream mapping	Inventory	overproduction		Takt Time
_____is an arrangement of machines, people, methods and material	host cell	past cell	process cell	development cell		process cell
____is the stage where you have doubt on any particular process step throw it out	sort	set in order	shine	sustain		sort
Red tagging rule of thumb is used in____	sort	set in order	shine	sustain		sort
_____is said as a place for everything and everything in its place	sort	set in order	shine	sustain		set in order
Inspection of equipment is done in ____ level	sort	set in order	shine	sustain		shine
_____ is defined by Toyota as "automation with a human mind"	Jidoka	Just in time	Kaizen	5S		Jidoka
______means continually producing defect free products and establishing	Jidoka	Just in time	Kaizen	5S		Jidoka
______is a material requirement planning system	Jidoka	Just in time	Kaizen	5S		Just in time
______is the delivery of material or product at the exact time and place where it is used	Jidoka	Just in time	Kaizen	5S		Just in time
_____aims in reducing on hand inventory	Jidoka	Just in time	Kaizen	5S		Just in time
on hand inventory is also called_____	buffer stock	full inventory	partial inventory	kanban		buffer stock

Lead time increases due to_____	delay	on time	defect	human		delay
_____helps in identifing what you need to meet your production objective	Red Tag	Blue Tag	Green Tag	Yellow Tag		Red Tag
______are attached to unneeded items during the sort phase of 5S	Red Tag	Blue Tag	Green Tag	Yellow Tag		Red Tag
According to Toyota_____helps to have clean, well ordered workplace which is the basic foundation of improvement	Red Tag	Blue Tag	Green Tag	Yellow Tag		Red Tag
______is a type of redtapping tool	stage S1	stage S2	stage S3	stage S4		stage S1
Most of the unwanged stuff doesn't look like a junk, so_____ can be helpful	Red Tag	Blue Tag	Recycle	weight		Recycle
In JIDOKA, JI refers to	small troops	workers	residents	automation		workers
In JIDOKA, Do refers to	small troops	motion or work	residents	automation		motion or work
In JIDOKA, KA refers to	small troops	motion or work	residents	automation		automation
_____defect % will lead to frequent line stoppages	High	medium	low	moderate		High
____is a variation leading to unbalanced situations	Muda	Muri	Mura	Maari		Mura
Japanese created a method to reduce setup time called	SMED	SAMD	DEFD	KASD		SMED

UNIT III

SYLLABUS

Process Improvement Methods- Six Sigma I
Introduction to Six Sigma Methodology – Meaning of Six Sigma – History - Six Sigma Organization - Six Sigma Project methodology DMAIC Vs DFSS - Problem Definition - CTQ Drill down - Project Charter – Data types - Descriptive statistics - Box Plot – Defect Vs Defective- DPU & DPMO calculations.

Introduction to Six Sigma:

Six Sigma is usually related to the magic number of 3.4 defects per million opportunities. People often view Six Sigma as yet another rigorous statistical quality control mechanism.

Pioneered at Motorola in the mid-1980s, Six Sigma was initially targeted to quantify the defects occurred during manufacturing processes, and to reduce those defects to a very small level. Motorola claimed to have saved several million dollars. Another very popular success was at GE. Six Sigma contributed over US $ 300 million to GE's 1997 operating income.

Today Six Sigma is delivering business excellence, higher customer satisfaction, and superior profits by dramatically improving every process in an enterprise, whether financial, operational or production. Six Sigma has become a darling of a wide spectrum of industries, from health care to insurance to telecommunications to software.

What is 6 Sigma?

It is important to recall that every customer always values consistent and predicable services and/or products with near zero defects. Therefore they experience the variation and not the mean. Mean is their expectation, and our target.

If we can measure process variations that cause defects i.e. unacceptable deviation from the mean or target, we can work towards systematically managing the variation to eliminate defects.

Six Sigma is a methodology focused on creating breakthrough improvements by managing variation and reducing defects in processes across the enterprise.

Sigma is a Greek symbol represented by "σ".

Why is Six Sigma called Six Sigma, and not Four or Five Sigma or Eight Alpha (another Greek symbol)? Sigma is a statistical term that measures process deviation from the process mean or target. Mean is also referred to as average in common language. The figure of six was arrived statistically by looking at the current average maturity of most business enterprises. We would like to revise this figure to 8 or may be 9, provided the world becomes a more orderly and predictable (even with increasing entropy or chaos) place to live in!

There is a detailed discussion on keywords "breakthrough improvement" and "variation" apart from the "methodology" in later sections.

Example

Consider a pizza delivery shop that guarantees the order delivery within 30 minutes from the time of accepting an order. In the event of a delivery time miss, the customer is refunded 100% money. How often do we notice timely delivery from a thirty-minute pizza delivery shop? In contrast, we always take note of delayed deliveries, or that shop's variation. This pizza shop will have to make 99.9997% deliveries within 30 mins to be called a six sigma shop.

It is evident that the "delivery time" is a critical-to-quality parameter from the customer perspective and has a significant impact on profits. In addition, it is an entry barrier for the competition. Such a parameter is called a CTQ and its definition in context of our pizza shop is given below:

CTQ Name: Timely Pizza delivery

CTQ Measure: Time in Minutes

CTQ Specification: Delivery within 30 minutes from the order acceptance time

Now we can easily define a defect:

Defect: Delivery that takes longer than 30 minutes

Unit: Order

Opportunity: 1 per order i.e. only "1" defect can occur in "1" order

The Six Sigma conversion graph illustrating the relationship between sigma values and defects/million opportunities is given below:

History of Six sigma

The roots of Six Sigma as a measurement standard can be traced back to Carl Friedrich Gauss (1777-1855) who introduced the concept of the normal curve. Six Sigma as a measurement standard in product variation can be traced back to the 1920's when Walter Shewhart showed that three sigma from the mean is the point where a process requires correction. Many measurement standards (Cpk, Zero Defects, etc.) later came on the scene but credit for coining the term "Six Sigma" goes to a Motorola engineer named Bill Smith. (Incidentally, "Six Sigma" is a federally registered trademark of Motorola).

In the early and mid-1980s with Chairman Bob Galvin at the helm, Motorola engineers decided that the traditional quality levels — measuring defects in thousands of opportunities – didn't provide enough granularity. Instead, they wanted to measure the defects per million opportunities. Motorola developed this new standard and created the methodology and needed cultural change associated with it. Six Sigma helped Motorola realize powerful bottom-line results in their organization – in fact, they documented more than $16 Billion in savings as a result of our Six Sigma efforts.

Since then, tens of thousands of companies around the world have adopted Six Sigma as a way of doing business. This is a direct result of many of America's leaders openly praising the benefits of Six Sigma. Leaders such as Larry Bossidy of Allied Signal (now Honeywell), and Jack Welch of General Electric Company. Rumor has it that Larry and Jack were playing golf one day and Jack bet Larry that he could implement Six Sigma faster and with greater results at GE than Larry did at Allied Signal. The results speak for themselves.

Six Sigma has evolved over time. It's more than just a quality system like TQM or ISO. It's a way of doing business. As Geoff Tennant describes in his book Six Sigma: SPC and TQM in Manufacturing and Services: "Six Sigma is many things, and it would perhaps be easier to list all the things that Six Sigma quality is not. Six Sigma can be seen as: a vision; a philosophy; a symbol; a metric; a goal; a methodology." We couldn't agree more.

Six sigma Organization

Under a Six Sigma program, the members of an organization are assigned specific roles to play, each with a title. This highly structured format is necessary in order to implement Six Sigma throughout the organization.

There are seven specific responsibilities or "role areas" in a Six Sigma program, which are as follows.

Leadership

A leadership team or council defines the goals and objectives in the Six Sigma process. Just as a corporate leader sets a tone and course to achieve an objective, the Six Sigma council sets the goals to be met by the team. Here is the list of leadership Council Responsibilities −

- Defines the purpose of the Six Sigma program
- Explains how the result is going to benefit the customer
- Sets a schedule for work and interim deadlines
- Develops a mean for review and oversight
- Support team members and defend established positions

Sponsor

Six Sigma sponsors are high-level individuals who understand Six Sigma and are committed to its success. The individual in the sponsor role acts as a problem solver for the ongoing Six Sigma project. Six Sigma is generally led by a full-time, high-level champion, such as an Executive Vice President.

Sponsors are the owners of processes and systems, who help initiate and coordinate Six Sigma improvement activities in their areas of responsibilities.

Implementation Leader

The person responsible for supervising the Six Sigma team effort, who supports the leadership council by ensuring that the work of the team is completed in the desired manner, is the implementation Leader.

Ensuring success of the implementation plan and solving problems as they arise, training as needed, and assisting sponsors in motivating the team are some of the key responsibilities of an implementation leader.

Coach

Coach is a Six Sigma expert or consultant who sets a schedule, defines result of a project, and who mediates conflict, or deals with resistance to the program.

Duties include working as a go-between for sponsor and leadership, scheduling the work of the team, identifying and defining the desired results of the project, mediating disagreements, conflicts, and resistance to the program and identifying success as it occurs.

Team Leader

It is an individual responsible for overseeing the work of the team and for acting as a go-between with the sponsor and the team members.

Responsibilities include communication with the sponsor in defining project goals and rationale, picking and assisting team members and other resources, keeping the project on schedule, and keeping track of steps in the process as they are completed.

Team Member

An employee who works on a Six Sigma project, given specific duties within a project, and has deadlines to meet in reaching specific project goals.

Team members execute specific Six Sigma assignments and work with other members of the team within a defined project schedule, to reach specifically identified goals.

Process Owner

The individual who takes on responsibility for a process after a Six Sigma team has completed its work.

Extended Definitions of Roles Belt - Colors

The assignment of belt colors to various roles is derived from the obvious source, the martial arts. Based on experience and expertise following roles have evolved over the year.

NOTE − The belt names are a tool for defining levels of expertise and experience. They do not change or replace the organizational roles in the Six Sigma process.

Black Belt

The person possessing this belt has achieved the highest skill level and is an experienced expert in various techniques. As applied to the Six Sigma program, the individual designated as a Black Belt has completed a thorough internal training program and has the experience working on several projects.

The black belt holder is usually given the role of a team leader, the person who is responsible for execution and scheduling.

Master Black Belt

A person who deals with the team or its leadership; but is not a direct member of the team itself. This may be equivalent to the role played by the coach, or for more technical and complex projects.

The Master Black Belt is available to answer procedural questions and to resolve the technical issues that come up.

Green Belt

The Green Belt designation can also belong to the team leader or to a member of the team working directly with the team leader.

A Green Belt is less experienced than a Black Belt but is cast in a key role within the team.

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 & 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.

There is one more methodology called **DFSS** − Design For Six Sigma. DFSS is a data-driven quality strategy for designing or redesigning a product or service from the ground up.

Sometimes a DMAIC project may turn into a DFSS project because the process in question requires complete redesign to bring about the desired degree of improvement.

DMAIC Methodology

This methodology consists of the following five steps.

Define --> **M**easure --> **A**nalyze --> **I**mprove -->**C**ontrol

- **Define** − Define the problem or project goal that needs to be addressed.
- **Measure** − Measure the problem and process from which it was produced.
- **Analyze** − Analyze data and process to determine root causes of defects and opportunities.
- **Improve** − Improve the process by finding solutions to fix, diminish, and prevent future problems.

- **Control** − Implement, control, and sustain the improvements solutions to keep the process on the new course.

We will discuss more on DMAIC Methodology in the subsequent chapters.

DMADV Methodology

This methodology consists of five steps −

Define --> **M**easure --> **A**nalyze --> **D**esign -->**V**erify

- **Define** − Define the Problem or Project Goal that needs to be addressed.
- **Measure** − Measure and determine customers needs and specifications.
- **Analyze** − Analyze the process to meet the customer needs.
- **Design** − Design a process that will meet customers needs.
- **Verify** − Verify the design performance and ability to meet customer needs.

DFSS Methodology

DFSS is a separate and emerging discipline related to Six Sigma quality processes. This is a systematic methodology utilizing tools, training, and measurements to enable us to design products and processes that meet customer expectations and can be produced at Six Sigma Quality levels.

This methodology can have the following five steps.

Define --> **I**dentify --> **D**esign --> **O**ptimize -->**V**erify

- **Define** − Define what the customers want, or what they do not want.
- **Identify** − Identify the customer and the project.
- **Design** − Design a process that meets customers needs.
- **Optimize** − Determine process capability and optimize the design.
- **Verify** − Test, verify, and validate the design.

PROBLEM STATEMENT FOR SIX SIGMA

Problem Statement:
Problem statement should quantitatively describe the pain in the current process

- What is the pain ?
- Where is it hurting?
- When – is it current? How long it has been?
- What is the extent of the pain?

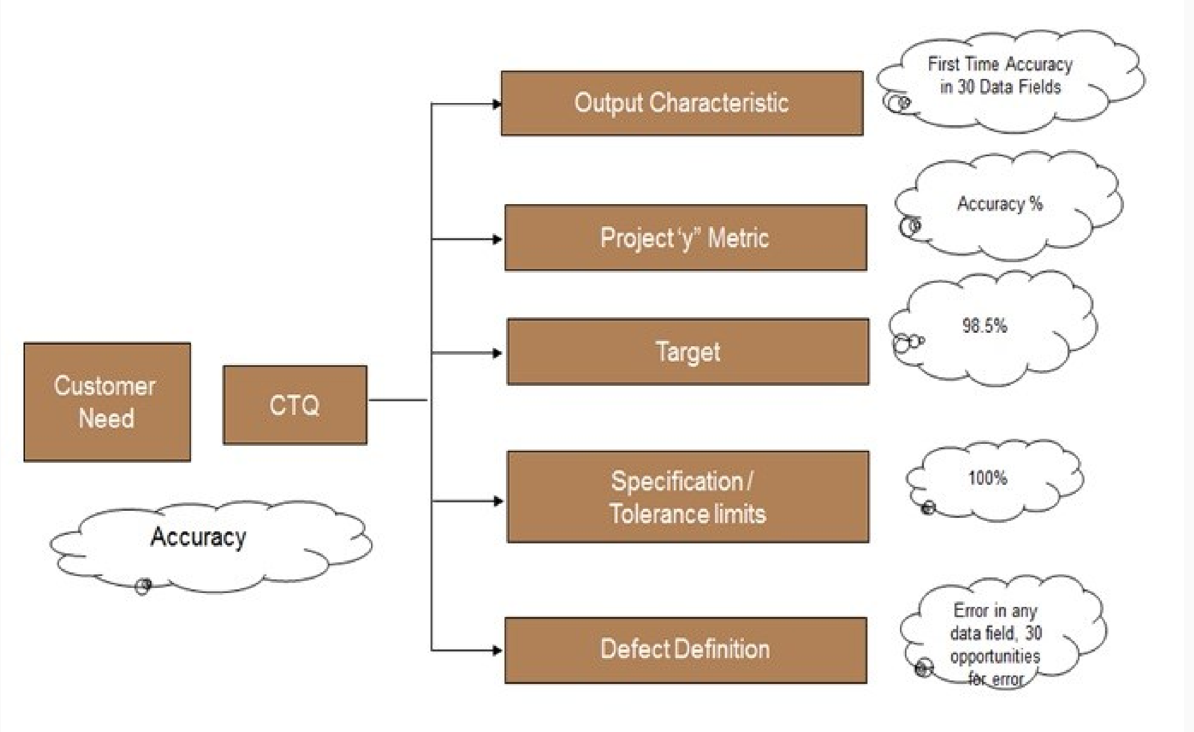
What a Problem Statement should not do is Assign a Cause or Blame and Include a Solution.

Problem Statement Example:
"In the last 3 months **(when)**, 12% of our customers are late, by over 45 days in paying their bills **(what)** . This represents 20% **(magnitude)** of our outstanding receivables & negatively affects our operating cash flow**(consequence)** ."

Six Sigma DMAIC Process - Define Phase - CTQ Drilldown Tree

CTQ (Critical to Quality) drilldown tree is a tool that can be used to effectively convert customer's needs and requirements to measurable product/service characteristics, to establish linkage between Project "Y" & Business "Y" and to bound the project or to make the project manageable.

Below is an example of CTQ Drilldown Tree and their associated measurements for two different processes:



Six Sigma - CTQ (Critical to Quality) Drilldown Tree for Data Entry Application

Customer CTQs	Customer Needs	Output Measurements	Process Measurements	Input Measurements
Accuracy	Right pizza to right person	Y1: % of wrong pizzas delivered	X1.1: % orders matched (post oven)	
Politeness	Pizza delivery person is polite	Y2: % of complaints		
Timeliness	Pizza delivered on time promised to customer	Y3: # minutes taken (customer order time to pizza delivery time)	X3.1: Cook time X3.2: Oven temperature X3.3: Delivery time	X3.4: Order volume

Six Sigma - CTQ (Critical to Quality) Drilldown Tree for Pizza Delivery Process

The Six Sigma project charter:

- Clarifies what is expected of the team
- Keeps the team focused
- Keep the team aligned with process priorities

The Six Sigma project charter describes the **high-level requirements for project success**. The Six Sigma project charter is a key document that defines the **scope and purpose** of any project. Each Six Sigma project has a finite duration with a definite beginning and end. If it doesn't, then probably project team need to re-evaluate its feasibility study.

The Six Sigma project charter includes:

- Measurable or quantifiable objectives to be achieved
- Organizational and Operational boundaries or scope
- Top management support & commitment

The Six Sigma project charter is incomplete until the project sponsor approves it and communicates it to the appropriate stakeholders. Developing and publishing the Six Sigma project charter is the first step in commissioning a project—before any work begins.

7 Project Charter Elements Six Sigma

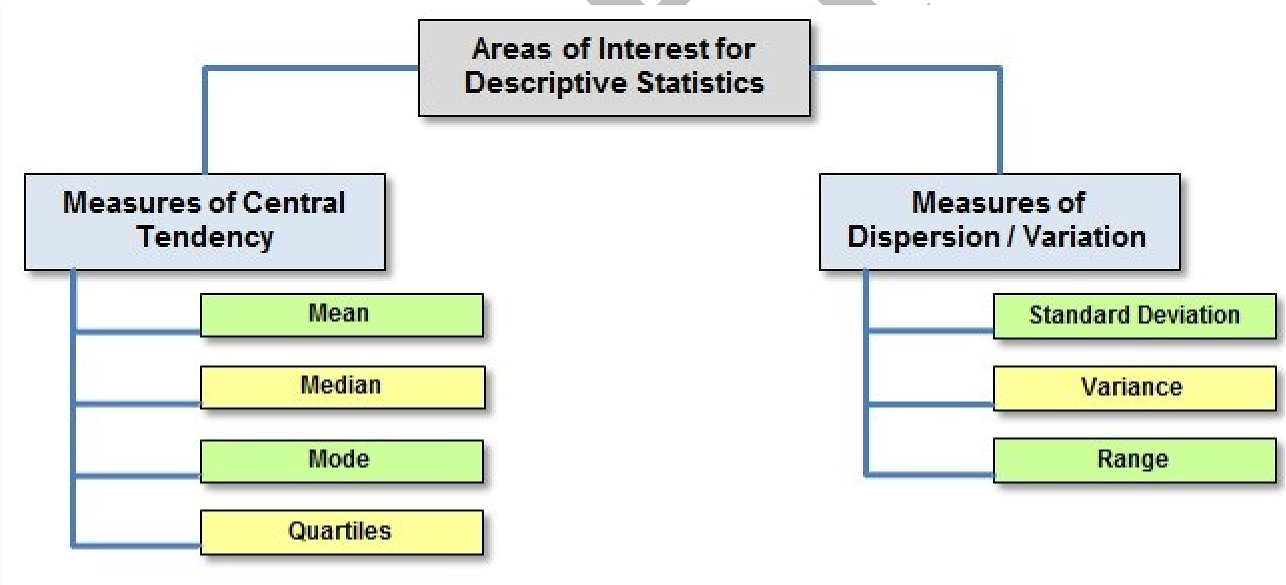
Each organization has a standardized way to present a Six Sigma project charter. Therefore, the Six Sigma project charter can take many forms. But as explained in the lean training course some of the common elements, which are found in every Six Sigma project charter, are as follows:

1. Business Case
2. Problem / Opportunity Statement
3. Goals / Projected Benefits
4. Goal statement
5. Project Scope
6. Project Plan
7. Team Structure

The Six Sigma project charter, though a simple document, requires significant preparation time. To draft the Six Sigma project charter in the right manner, the project team should be well-versed with each element. Let us have a look at each element to understand it better.

What is Descriptive Statistics?

Descriptive Statistics is a method of organizing, summarizing, and presenting data in a convenient and informative way.
The actual method used depends on what information we would like to extract.



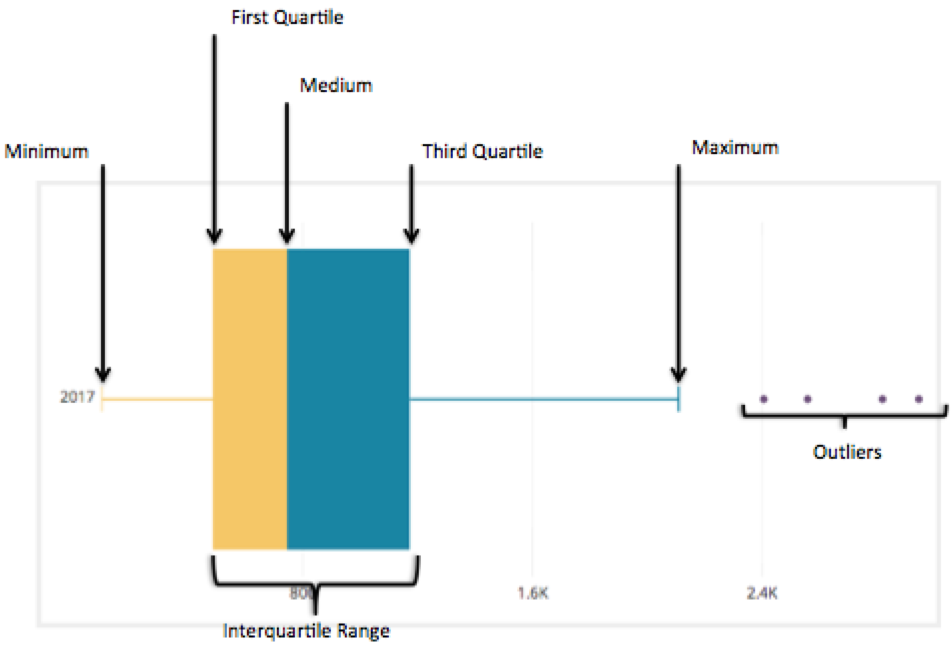
Areas of Interest for Descriptive Statistics

What is a Box Plot?

A Box Plot is the visual representation of the statistical five number summary of a given data set.

A Five Number Summary includes:

- **Minimum**
- **First Quartile**
- **Median (Second Quartile)**
- **Third Quartile**
- **Maximum**



Mathematician John Tukey first introduced the “Box and Whisker Plot” in 1969 as a visual diagram of the “Five Number Summary” of any given data set. As Hadley Wickham describes, “Box plots use robust summary statistics that are always located at actual data points, are quickly computable (originally by hand), and have no tuning parameters. They are particularly useful for comparing distributions across groups.”

Box and whisker plots have been used steadily since their introduction in 1969 and are varied in both their potential visualizations as well as use cases across many disciplines in statistics and data analysis.

The Chartio version of the Box Plot is close to the original definition and presentation, and is used to take a subset of data and quickly and visually show the five number summary of that data set. Also, in Chartio’s version, a tool tip is provided that shows all of the data points summarized in the visualization.

Defect Vs Defective

A product may have many defects – imperfections. But a product is not defective unless the defects prevent the product from functioning. If a product is not usable, it is considered defective.

Defects may be many on a shippable and acceptable product. An example is typos in a book. A typo is a defect, but the book ships to satisfied customers. A defective book would probably fall apart.

Ex. An undercooked hamburger cannot be used (consumed) by the customer. Other items (unevenly browned fries, underweight hamburger, too much ice in a drink) have flaws or defects, but you can still sell them and customers can still consume them. They do not need to be scrapped, so they are not truly defective.

What are DPU, DPO, and DPMO?

Using DPU, DPO, and DPMO to assess defects

DPU, DPO, and DPMO are metrics that express how your product or process is performing, based on the number of defects. Choosing the appropriate quality metric helps you assess performance against customer expectations. You can also develop project baselines and improvement goals, as well as communicate the level of conformance to your customers.

What is defects per unit (DPU)?

Defects per unit (DPU) is the number of defects in a sample divided by the number of units sampled.

Example of calculating DPU

Your printing business prints custom stationary orders. Each order is considered a unit. Fifty orders are randomly selected and inspected and the following defects are found.

- Two orders are incomplete
- One order is both damaged and incorrect (2 defects)
- Three orders have typos

Six of the orders have problems and there are a total of 7 defects out of the 50 orders sampled; therefore DPU = 7/50 = 0.14. On average, this is your quality level and each unit of product on average contains this number of defects.

What is defects per opportunity (DPO)?

Defects per opportunity (DPO) is the number of defects in a sample divided by the total number of defect opportunities.

Example of calculating DPO

Each custom stationary order could have four defects - incorrect, typo, damaged, or incomplete. Therefore, each order has four opportunities. Fifty orders are randomly selected and inspected and the following defects are found.

- Two orders are incomplete
- One order is both damaged and incorrect (2 defects)
- Three orders have typos

Six of the orders have problems, and there are a total of 7 defects out of the 200 opportunities (50 units * 4 opportunities / unit); therefore DPO = 7/200 = 0.035.

What is defects per million opportunities (DPMO)?

Defects per million opportunities (DPMO) is the number of defects in a sample divided by the total number of defect opportunities multiplied by 1 million. DPMO standardizes the number of defects at the opportunity level and is useful because you can compare processes with different complexities.

Example of calculating DPMO

Each custom stationary order could have four defects - incorrect, typo, damaged, or incomplete. Therefore, each order has four opportunities. Fifty orders are randomly selected and inspected and the following defects are found.

- Two orders are incomplete
- One order is both damaged and incorrect (2 defects)
- Three orders have typos

There are a total of 7 defects out of the 200 opportunities. Therefore, DPO = 0.035 and DPMO = 0.035 * 1000000 = 35,000. If your process remains at this defect rate over the time it takes to produce 1,000,000 orders, it will generate 35,000 defects.

KARPAGAM ACADEMY OF HIGHER EDUCATION

SUBJECT CODE:16BPU603A SUBJECT: MANAGING BUSINESS PROCESS 2

Unit 3

Question	**option A**	**option B**	**option C**	**Option D**		**Answer**
who is accountable for six sigma business results	apex council	Champions	Process owner	Black belt		apex council
who is responsible to develop a strong case for six sigma	apex council	Champions	Process owner	Black belt		apex council
who will plan and actively participate in implementation	apex council	Champions	Process owner	Black belt		apex council
who will create a vision and market change	apex council	Champions	Process owner	Black belt		apex council
who will set SMART objectives	apex council	Champions	Process owner	Black belt		apex council
who will communicate the results	apex council	Champions	Process owner	Black belt		apex council
who will help to quantify the impact of six sigma efforts on bottom line	apex council	Champions	Process owner	Black belt		apex council
who will oversee a six sigma project	apex council	Champions	Process owner	Black belt		Champions
who is accountable to the apex council	apex council	Champions	Process owner	Black belt		Champions
who sets rationale and goal for project	apex council	Champions	Process owner	Black belt		Champions
who is responsible to find resources	apex council	Champions	Process owner	Black belt		Champions
who helps team overcome roadblocks, smoothen implementation	apex council	Champions	Process owner	Black belt		Champions
who will focus on data driven management	apex council	Champions	Process owner	Black belt		Champions
who implements solutions through black belts and project teams	apex council	Champions	Process owner	Black belt		Process owner
who will provide resources and helps resolve conflicts	apex council	Champions	Process owner	Black belt		Process owner
who owns end to end process and does project review	apex council	Champions	Process owner	Black belt		Process owner
who will advise and mentor Black belts and teams	apex council	Champions	Process owner	Master Black Belt		Master Black Belt
who will deal with resistance to six sigma	apex council	Champions	Process owner	Master Black Belt		Master Black Belt
who will resolve team conflicts	apex council	Champions	Process owner	Master Black Belt		Master Black Belt
who will estimate, measure and validate savings	apex council	Champions	Process owner	Master Black Belt		Master Black Belt

who will document overall progress of six sigma	apex council	Champions	Process owner	Master Black Belt		Master Black Belt
who will lead six sigma projects	apex council	Champions	Process owner	Black belt		Black belt
who has the ability to train, develop, coach and lead multiple cross functional improvement teams	apex council	Champions	Process owner	Black belt		Black belt
who use tools to quickly and efficiently drive improvement	apex council	Champions	Process owner	Black belt		Black belt
who will facilitate to keep team focused on the project objective	apex council	Champions	Process owner	Black belt		Black belt
who will spread six sigma awareness throughout the organization	apex council	Champions	Process owner	Black belt		Black belt
who will train and develop green belts	apex council	Champions	Process owner	Black belt		Black belt
Function of six sigma Y=	F(a)	F(b)	F(y)	F(x)		F(x)
______is the stage in which project team is formed and the team synergy is evaluated	Define	measure	analyse	improve		Define
feedback taken from the customer is known as	Voice of customer	Voice from customer	Voice to customer	Voice for customer		Voice of customer
______aims in providing the customers with the best in class service/ product quality	Voice of customer	Voice from customer	Voice to customer	Voice for customer		Voice of customer
______is a term used to depict the expressed and implicit needs to prerequisites of the client.	Voice of customer	Voice from customer	Voice to customer	Voice for customer		Voice of customer
_____ are spoken needs or requirements of customer translated into measurable and meaningful business term	Critical to quality	Critical to quantity	Critical for quality	Critical for quantity		Critical to quality
______identifies CTQ characteristics by which customers evaluate our product	Critical to quality	Critical to quantity	Critical for quality	Critical for quantity		Critical to quality
______gives explanation of why to do the project	Business case	project scope	milestone	problem statement		Business case
______is the description of the problem or opportunity	Business case	project scope	milestone	problem statement		problem statement
_____gives the process dimension and available resources	Business case	project scope	milestone	problem statement		project scope

______are key steps and dates to achieve goals	Business case	project scope	milestone	problem statement		milestone
______links a project to the strategic priorities of the business	Business case	project scope	milestone	problem statement		Business case
The purpose of ______ is to describe what is wrong	Business case	project scope	milestone	problem statement		problem statement
______ defines the team's improvement objective	Goal statement	Business case	milestone	problem statement		Goal statement
______defines what improvement the team is seeking to accomplish	Goal statement	Business case	milestone	problem statement		Goal statement
______should include a measurable target and a completion date	Goal statement	Business case	milestone	problem statement		Goal statement
______is a high-level project plan with dates	Business case	project scope	milestone	problem statement		milestone
Any related, recurring sequence of events, steps, activities which result in desired outcome is called______	process	project scope	milestone	problem statement		process
_____is a high level process map	flow chart	swim lane	SIPOC	value stream		SIPOC
_____is effective in gaining focus of the team in understanding the key elements of the process	flow chart	swim lane	SIPOC	value stream		SIPOC
______are the individuals or groups or organizations who are both actively involved in improvement and influenced by the execution of the project	Stake holder	apex council	Champions	Process owner		Stake holder
_____ is the key to overcome resistance	Critical to quality	Communication	flow chart	Stake holder		Communication
______phase reviews various measures to acquire good data	Define	measure	analyse	improve		Define
______is defined as collection of facts such as measurements or values	Data	Communication	definition	tools		Data
There are ____ types of data used to measure a process	5	3	2	4		2
_______is data that can be measured and broken down into smaller parts	Continuous	Discrete	Historic	Present		Continuous
______is data that is based on count, ordered categories or finite number of vales	Continuous	Discrete	Historic	Present		Discrete

________is a concept that guides the team in thinking on what to measure and how to measure	Operational definition	Operational intelligence	Business case	Goal statement		Operational definition
______removes ambiguity in data	Operational definition	Operational intelligence	Business case	Goal statement		Operational definition
______identifies what to measure	Operational definition	Operational intelligence	Business case	Goal statement		Operational definition
______identifies how to measure	Operational definition	Operational intelligence	Business case	Goal statement		Operational definition
______is the process of drawing one or more observations form a larger collection of population	data	sampling	measurement	tools		sampling
______is how narrow you want the range to be for an estimate of a characteristic	tools	data	precision	measurement		precision

UNIT IV

SYLLABUS

Six Sigma II
Balse lining Methodology – MSA – Use of Normal Probability distribution - Estimation of Six Sigma value - Process capability - Sampling- α and β error - Use of Hypothesis Testing for process management - Use of correlation and regression – control charts - Control Plan.

Baseline Measurement or **Base lining** as it is shortly called is the process of establishing the starting point of any process/metric, from which the improvement or impact of any change measure is calculated. It is used to gauge how effective an improvement or change initiative is.

Where do we use Baseline Measurement?

- In Improvement initiatives like Six Sigma, LEAN, KAIZEN, etc.
- In Change initiatives like automation, Business Process Reengineering, Mergers & Acquisitions etc.
- In medical field for measuring treatment effectiveness
- Product improvement and modification
- Software version changes

How to do a Baseline Measurement?

1. The first thing to look at is scope of the initiative: the departments /teams it is going to cover, the product lines, the scenarios being considered etc.
2. The next thing is to set the objective/Goal of the initiative & its unit of measurement. For example, if a medical research team is going to measure the impact of a medicine that reduces fever, the goal should be the normal body temperature.
3. The next step is to collect historical data of the measure. The best way is to collect the past data. In cases where all of the data cannot be collected, an appropriate sampling method can be applied. Care should be taken to ensure the sample is a representative of the original data lying behind. Some scenarios require 'Surveying' customers to collect data. Some other scenarios require data of competitive product or industry average. Employing and involving experts who can judge the right approach for data collection is the key to success of this activity.
4. Estimate the baseline with appropriate statistical method. Sometimes it would be simply enough to plot a line graph and then arrive at the baseline. Some methods simply require averaging of the past data. Some complex scenarios require cleansing of the data for abnormal scenarios or advanced statistical techniques. User should adapt an appropriate method for arriving at the baseline.

Baselines are measurements that indicate the level at which a process functions. Six Sigma baseline is the level at which the process functions, or the number of defects or variations from the recommended range before applying Six Sigma interventions. It denotes the starting point of Six Sigma interventions. Such measurements take the shape of capability, yield, or Sigma levels.

Definition of Measurement System Analysis (MSA):

An experimental and mathematical method of determining how much the variation within the measurement process contributes to overall process variability. There are five parameters to investigate in an MSA: bias, linearity, stability, repeatability and reproducibility.

According to AIAG (2002), a general rule of thumb for measurement system acceptability is:

- Under 10 percent error is acceptabl.
- >10 percent to 30 percent error suggests that the system is acceptable depending on the importance of application, cost of measurement device, cost of repair, and other factors.
- Over 30 percent error is considered unacceptable, and you should improve the measurement system. AIAG also states that the number of distinct categories the measurement systems divides a process into should be greater than or equal to 5.

In addition to percent error and the number of distinct categories, you should also review graphical analyses over time to decide on the acceptability of a measurement system.

The normal distribution is generally credited to Pierre-Simon de LaPlace. Karl Gauss is generally given credit for recognition of the normal curve of errors. This curve is also referred to as the *Gaussian Distribution*.

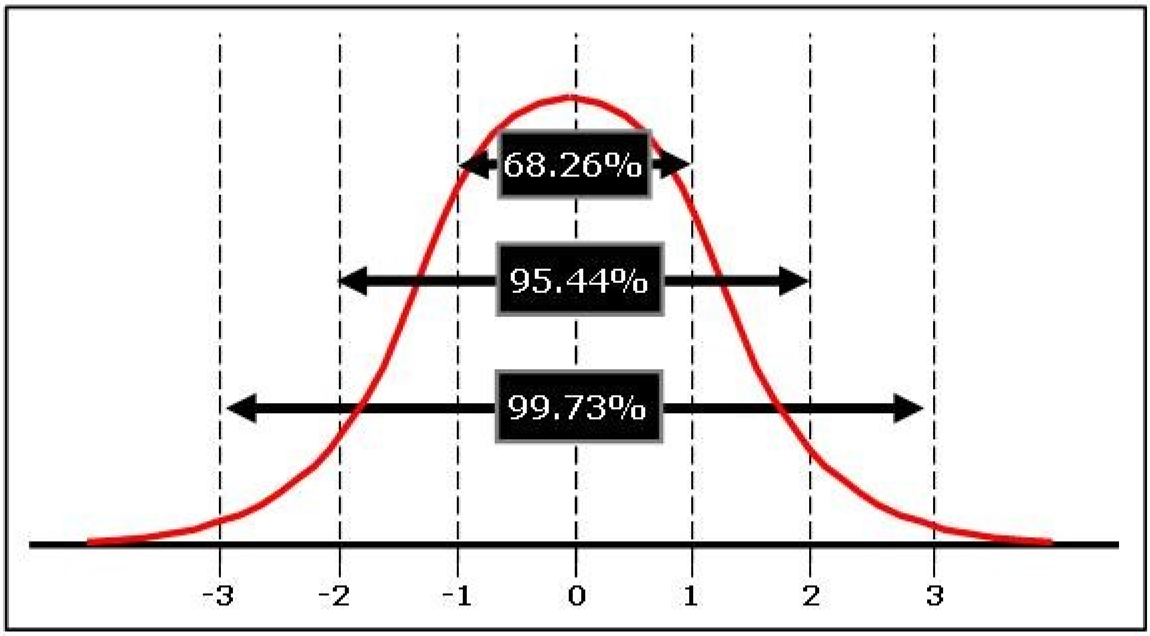
Manufacturing processes and natural occurrences frequently create this type of distribution, a unimodal bell curve. The distribution is spread symmetrically around the central location. This occurs when occurrences can occur equally above and below an average.

A normal distribution exhibits the following:

68.3% of the population is contained within 1 standard deviation from the mean.

95.4% of the population is contained within 2 standard deviations from the mean.

99.7% of the population is contained within 3 standard deviations from the mean.



These three figures should be committed to memory if you are a Six Sigma GB/BB.

These three figures are often referred to as the *Empirical Rule* or the 68-95-99.5 Rule as approximate representations population data within 1,2, and 3 standard deviations from the mean of a normal distribution.

Over time, upon making numerous calculations of the cumulative density function and z-scores, with these three approximations in mind, you will be able to quickly estimate populations and percentages of area that should be under a curve.

Most Six Sigma projects will involve analyzing normal sets of data or assuming normality. Many natural occurring events and processes with "common cause" variation exhibit a normal distribution (when it does not this is another way to help identify "special cause").

This distribution is frequently used to estimate the proportion of the process that will perform within specification limits or a specification limit (NOT control limits - call that specification limits and control limits are different).

However, when the data does not meet the assumptions of normality the data will require a transformation to provide an accurate capability analysis. We will discuss that later.

The ***mean*** is used to define the central location in a normal data set and the median, mode, and mean are near equal. The area under the curve equals all of the observations or measurements.

Throughout this site the following assumptions apply unless otherwise specified:

P-Value < alpha risk set at 0.05 indicates a non-normal distribution although normality assumptions may apply. The level of confidence assumed throughout is 95%.

P-Value > alpha risk set at 0.05 indicates a normal distribution.

The z-statistic can be derived from any variable point of interest (X) with the mean and standard deviation. The z-statistic can be referenced to a table that will estimate a proportion of the population that applies to the point of interest.

Recall, one of two important implications of the **Central Limit Theorem** is, regardless distribution type (unimodal, bi-modal, skewed, symmetric), the distribution of the sample means will take the shape of a normal distribution as the sample size increases. The greater the sample size the more normality can be assumed.

Some tables and software programs compute the z-statistic differently but will all get the correct results if interpreted correctly.

Some tables incorporate single-tail probability and another table may incorporate double-tail probability. Examine each table carefully to make the correct conclusion.

The bell curve theoretically spreads from negative infinity to positive infinity and approaches the x-axis without ever touching it, in other words it is asymptotic to the x-axis.

The area under the curve represents the probabilities and the whole area is estimated to be equal to 1.0 or 100%.

The normal distribution is described by the *mean* and the *standard deviation*. The formula for the normal distribution density function is shown below (e = 2.71828):

Due to the time consuming calculations using integral calculus to come up with the area under the normal curve from the formula above most of the time it is easier to reference tables.

With pre-populated values based on a given value for "x", the probabilities can be assessed using a conversion formula (shown below) from the z-distribution, also known as the standardized normal curve.

The **z-distribution** is a normal distribution with:

- Mean = 0
- Standard Deviation = 1

A z-score is the number of standard deviations that a given value "x" is above or below the mean of the normal distribution.

PROCESS SIGMA TABLE

SIGMA LEVEL	DEFECT RATE	YIELD
2σ	308,770 dpmo	69.10000%
3σ	66,811 dpmo	93.33000%
4σ	6,210 dpmo	99.38000%
5σ	233 dpmo	99.97700%
6σ	3.44 dpmo	99.99966%

Process Capability

Cp and Cpk are called Process Capability. Pp and Ppk are called Process Performance. In both cases we want to try to verify if the process can meet to meet Customer CTQs (requirements).

Cp, and Cpk are used for Process Capability. Generally you use this when a process is under statistical control. This often happens with a mature process that has been around for a while. Process capability uses the process sigma value determined from either the Moving Range, Range or Sigma control charts

Pp and PPk are used for Process Performance. Generally you use this when a process is too new to determine if it is under statistical control. Ex. there is a short pre-production run or you are piloting a new process. Because there is not a lot of historical data we take large samples from the process to account for variation. Process Performance generally uses sample sigma in its calculation.

In theory Cpk will always be greater than or equal to Ppk. There are anomalies seen when the sample size is small and the data represents a short amount of time where estimating using R will overstate standard deviation and make Cpk smaller than Ppk. It is not real, there can never be less variation in the long term since the long term is using all of the data not just two pieces of data from every subgroup.

Evaluating process capability with Cp & Cpk mirror what is done (and why it is done) when following the Pp & Ppk approach. The main difference is that you use Cp & Cpk after a process has reached stability or statistical control.

Cp vs Cpk

The ‘k’ stands for ‘centralizing factor.’ The index takes into consideration the fact that your data is maybe not centered.

Cpk vs Ppk

C_{pk} tells us what a process is capable of doing in future, assuming it remains in a state of statistical control.

P_{pk} tells us how a process has performed in the past and you cannot use it predict the future because the process is not in a state of control.

If a process is in statistical control;

The values for C_{pk} and P_{pk} will converge to almost the same value because sigma and the sample standard deviation will be identical (use an F test to determine).

In other words, if Cpk == Ppk, the process is likely in statistical control.

Alpha and Beta Risks

Alpha Risk

Alpha risk is the risk of incorrectly deciding to reject the null hypothesis. If the confidence interval is 95%, then the alpha risk is 5% or 0.05.

For example, there is a 5% chance that a part has been determined defective when it actually is not. One has observed or made a decision that a difference exists but there really is none. Or when the data on a control chart indicates the process is out of control but in reality the process is in control.

Alpha risk is also called False Positive and Type I Error.

Confidence Level = 1 - Alpha Risk

Alpha is called the significance level of a test. The level of significance is commonly between 1% or 10% but can be any value depending on your desired level of confidence or need to reduce Type I error. Selecting 5% signifies that there is a 5% chance that the observed variation is not actually the truth.

The most common level for Alpha risk is 5% but it varies by application and this value should be agreed upon with your BB/MBB.

In summary, it's the amount of risk you are willing to accept of making a Type I error.

If a carbon monoxide alarm goes off indicating a high level alert but there is actually not a high level then this is Type I error.

If conducting a 2-sample T test and your conclusion is that the two means are different when they are actually not would represent Type I error:

Beta Risk

Beta risk is the risk that the decision will be made that the part is not defective when it really is. In other words, when the decision is made that a difference does not exist when there actually is. Or when the data on a control chart indicates the process is in control but in reality the process is out of control.

If the power desired is 90%, then the Beta risk is 10%.

There is a 10% chance that the decision will be made that the part is not defective when in reality it is defective.

Power = 1 - Beta risk

Beta risk is also called False Negative and Type II Error.

The Power is the probability of correctly rejecting the Null Hypothesis.

The Null Hypothesis is technically never proven true. It is "failed to reject" or "rejected".

"Failed to reject" does not mean accept the null hypothesis since it is established only to be proven false by testing the sample of data.

Guidelines: If the decision from the hypothesis test is looking for:

- Large effects or LOW risk set Beta = 15% (which is Power of 0.85)
- Medium effects, MEDIUM risk but not catastrophic, legal or safety related the set Beta = 10%
- Small effects, HIGH risk, legal, safety, or critical set Beta from 5% to near 0%.

If conducting an F-test and your conclusion is that the variances are the same when they are actually not would represent a Type II error.

Same note of caution as for Alpha, the assumption for Beta should be agreed upon with your BB/MBB.

Hypothesis Testing Steps

1. Define the Problem
2. State the Objectives
3. Establish the Hypothesis (left tailed, right tailed, or two-tailed)
4. State the Null Hypothesis (Ho)
5. State the Alternative Hypothesis (Ha)
6. Select the appropriate statistical test

7. State the Alpha Risk level
8. State the Beta Risk level
9. Establish the Effect Size
10. Create Sampling Plan, determine sample size
11. Gather samples
12. Collect and record data
13. Calculate the test statistic and/or determine the p-value

If p-value is < than alpha-risk, reject Ho and accept the Alternative, Ha

If p-value is > than alpha-risk, fail to reject the Null, Ho

Try to re-run the test (if practical) to further confirm results. The next step is to take the statistical results and translate it to a practical solution.

It is also possible to determine the critical value of the test and use to calculated test statistic to determine the results. Either way, using the p-value approach or critical value provides the same result.

Correlation and Regression Analysis in Six Sigma

As a Six Sigma team moves into the Analyze stage of the DMAIC process, it looks more closely at the variables and variable interrelationships identified during the Measure stage. As part of the analysis, a scatter diagram of dependent and independent variables is drawn to visualize the form, strength, and direction of their relationships. By determining their correlation coefficient, a linear relationship can be quantified and identified as positive, negative, or neutral. Then, using regression analysis, a model is developed to describe the relationship as a linear equation and then used for predictions and estimations. However, it is essential to analyze the uncertainty in the estimate, to test that the relationship between variables is statistically significant, and that the model is valid.
This course discusses two important tools – correlation and regression analysis for measuring and modeling relationships between variables. In terms of correlation, it takes learners through examples of scatter diagrams for two variables, the calculation and interpretation of the correlation coefficient, and the interpretation of its confidence interval. The course also draws learners' attention to some key considerations in correlation analysis, such as correlation and causation. In terms of regression analysis, the course discusses the simple linear regression model, how to create it using sample data, interpret and use it, and conduct a hypothesis test to check that the relationship between the variables is statistically significant. Finally, the course looks into how residual analysis is used to test the validity of

the regression model. This course is aligned with the ASQ Certified Six Sigma Black Belt certification exam and is designed to assist learners as part of their exam preparation. It builds on foundational knowledge that is taught in SkillSoft's ASQ-aligned Green Belt curriculum.

Objective

Correlation Analysis

- calculate and interpret the correlation coefficient r
- recognize the characteristics exhibited by a given scatter diagram
- recognize key considerations related to correlation analysis

Regression Analysis

- calculate and interpret the equation for the line of least squares in a given scenario
- use the p-value method to validate a hypothesis test for a given regression equation
- interpret graphs used to perform a residual analysis

What is a Control Chart?

As a matter of fact, we have variations everywhere, no process is without variation. This means that there can be no common cause variation or special cause variation. In the control charts, we see how these variations impact our process over a period of time, whether our process will be in control or will cross the process boundaries. Control charts help us in visualizing this variation. Control charts have one central line or mean line (average), and then we have the Upper Control Limit (UCL) and Lower Control Limit (LCL). The upper control limit and lower control limit are three standard deviation distance from the center line in both sides. We can have the upper warning line and lower warning limit also. Now the question is which is the two standard deviation in distance from the central line? The one which alarms us if data points crossing this limit, this can make the process unstable.

You may also like: ***DMAIC – A Six Sigma Process Improvement Methodology***

Significance & Objective of a Control Chart in Six Sigma

We use a control chart to see the special cause variation. Special cause variation does not always indicate the negative part of the process, sometimes it reflects a good indication for the process too. If we have some special cause due to that we have process variation, we can adopt the preventive actions to avoid those special cause variation in the future. Likewise, if we get late due to a flat tire, we could take some preventive actions to avoid such situations in the future. The special cause is also called as the assignable cause as it is avoidable, while the common cause is inevitable.

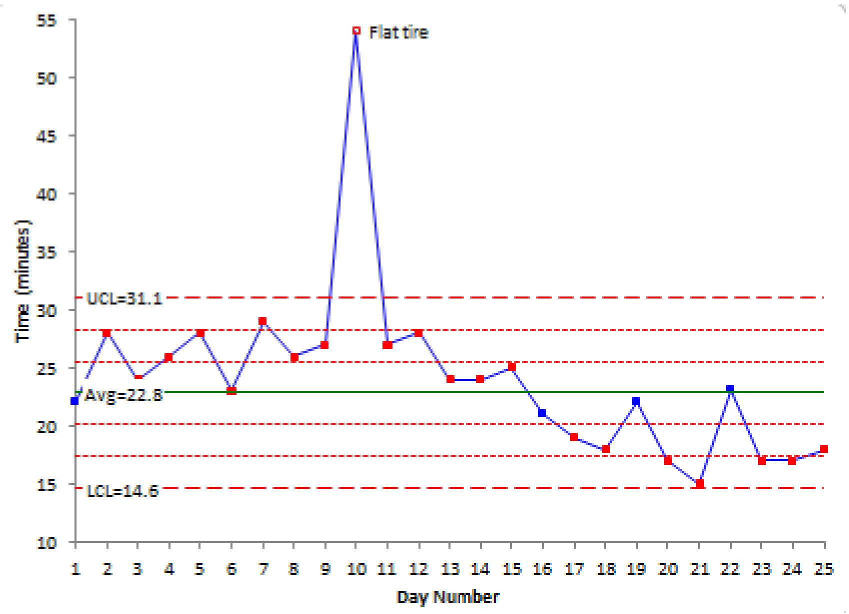


Image Source: https://www.spcforexcel.com

One of the reasons to use a control chart is to see whether our process is stable or not if we find the process as unstable, we need to work on this. It even gives the discern between the assignable or unassignable causes for variations. The control chart tends to make a process simple while skipping the assignable causes.

It helps to detect the process average, and estimate the variation (the spread in the histogram). We need to understand that the process in control is more important. Also, you need to check the process mean, and all the data points should fall between the Upper and Lower Control Limits. By doing this, we can judge whether our process is capable enough or not and also what we want to do with our process.

Where can we check the Process Capability by Cp and Cpk?

While using the control chart, we could see the process improvement, while seeing the process average and we can compare it with the earlier process mean. This gives us the information about how much our process is in control. Like as a normal chart here in control chart, we have the same rules, 68% of data points should fall under the 1st standard deviation, and 95% data points should be within the 2nd standard deviation, and 99.7 % data should be within 3rd standard deviation.

Apart from these, there are other points too. They are:

- When do we need to predict the outcomes range?
- How to check the stability?
- When do we need to see the pattern of process variations?
- When & How does quality improvement help in understanding the specific problem and preventing them?

You may also like: ***How to measure Process Capability and Process Performance?***

How to create and use a Control Chart?

We can create a control chart while using the Minitab, we need to enter the data in Minitab and use the control chart as per data types.

If we do not have a Minitab, we can make it in Excel. In Excel, we need to enter all the data points and take out the average of data points, then find out the standard deviation with standard deviation formula. We go on till we reach 3rd standard deviation and then use the graph.

The above example is for a simple I-MR chart, which we can make and use it for continuous data types.

When to use a Control Chart?

- We can use a Control Chart, at the starting of a project or whenever we want to see the VoP. While seeing the VoP we can even find the reason for running the project.
- We can see process improvement too by using a Control Chart towards the end of the project. This would also help in determining whether the project is successful or not.
- A Control Chart also helps in checking the process stability and verifying whether the process is stable enough to improve and make necessary improvements in the process wherever required.

Four Process States in a Control Chart

The 4 process states in a Control Chart are discussed below:

1. The **Ideal** state: This is where the process is in control and all the data points fall under the control limits. There is no non-conformance.
2. The **Threshold** state: Although data points are in control, or the process is stable, however, some non-conformance happen over a period of time.
3. The **Brink of Chaos** state: In this, the process is in control; however, it is on the edge of committing errors.
4. And the fourth stage is when the process is **Out of Control** and we have unpredictable non-conformance.

You may also like: ***Process Maps: What are its Different Types and their Application?***

Types of Control Charts

Control Charts are basically of 7 types, as it all depends upon the data type. If we have a continuous data type, then we can use 3 types of Control Charts i.e. **I-MR Chart, X Bar R Chart,** and **X Bar S Chart**.

If we have a discrete data type, then we use the 4 types of Control Charts: **P, Np, C,** and **U Charts**. All these types are described as below:

- **I – MR Chart**

We use the I-MR charts when we cannot do the subgrouping of the data, due to not much data points, or maybe the product takes long cycle time to produce, then we can use the I-MR chart, which means **Individual Moving Range Chart**. Here, at first we see the data points in the Control Chart and then their difference in the chart.

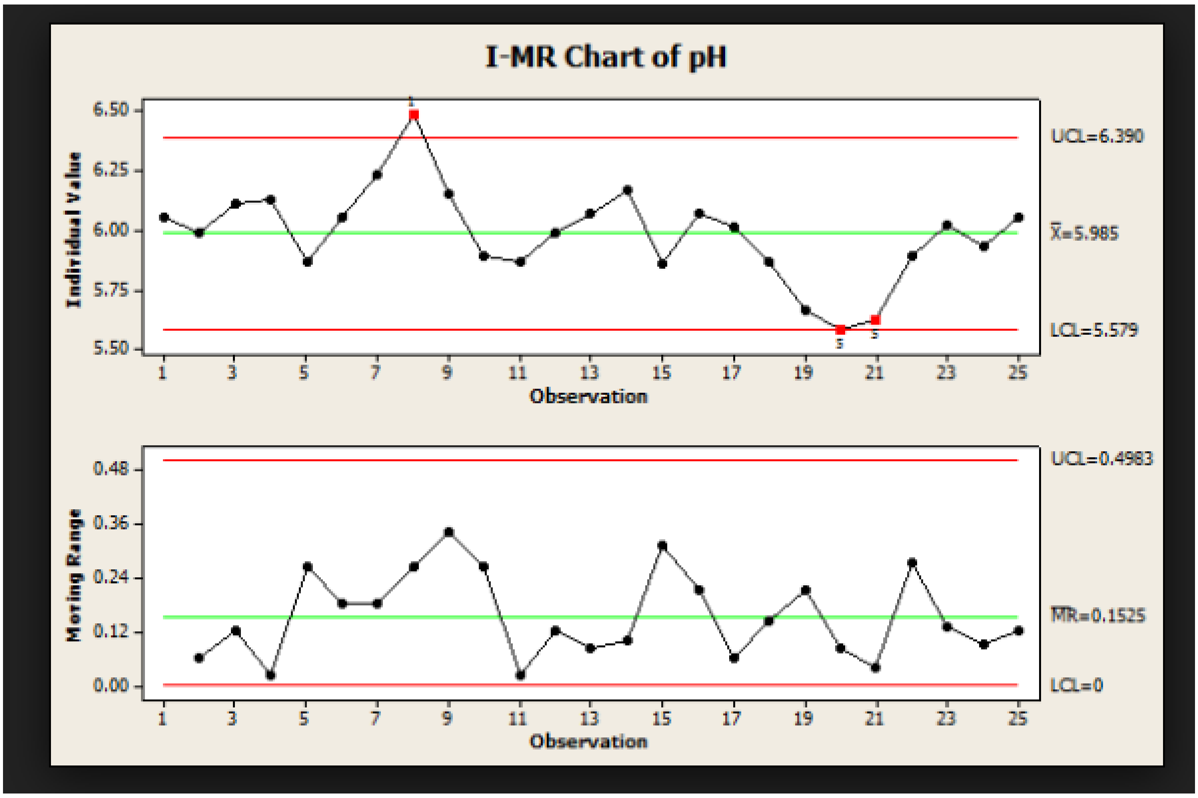


Image Source: https://leansixsigma.community

- **X-Bar R Chart**

When we have 2 or more than 2 subgroup size then, this is being used for continuous data. The standard chart for variables data, X-bar and R charts help to determine if a process is stable and predictable. In the X bar chart, X indicates the mean of all the subgroups in the chart, whereas R indicates the range of all subgroups in the chart.

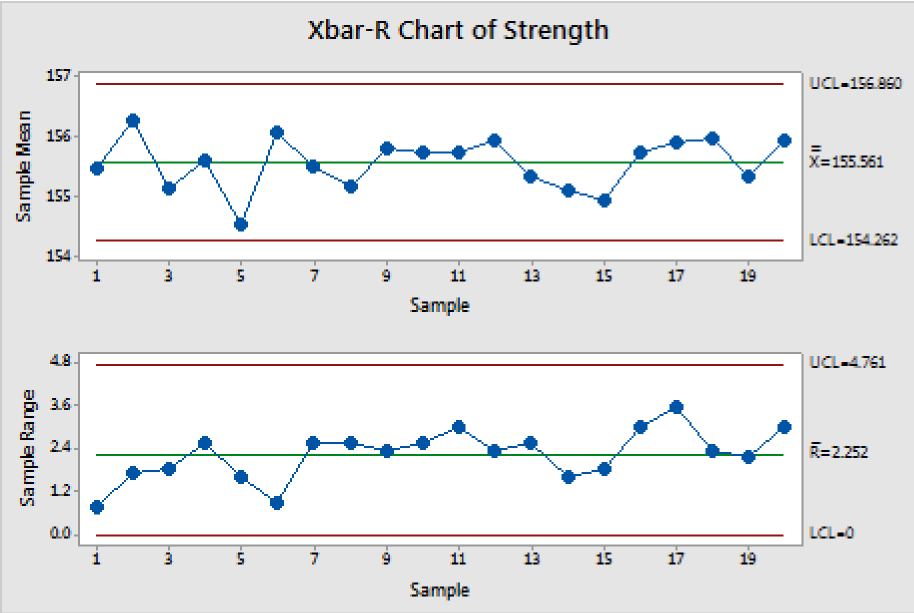


Image Source: https://sixsigmastudyguide.com

- **X Bar S Chart**

In the X Bar S chart, we use it to check the mean of the subgroups and the variation of the process. It is being used for more than 2 subgroups size and can also be used for more than 10 subgroups.

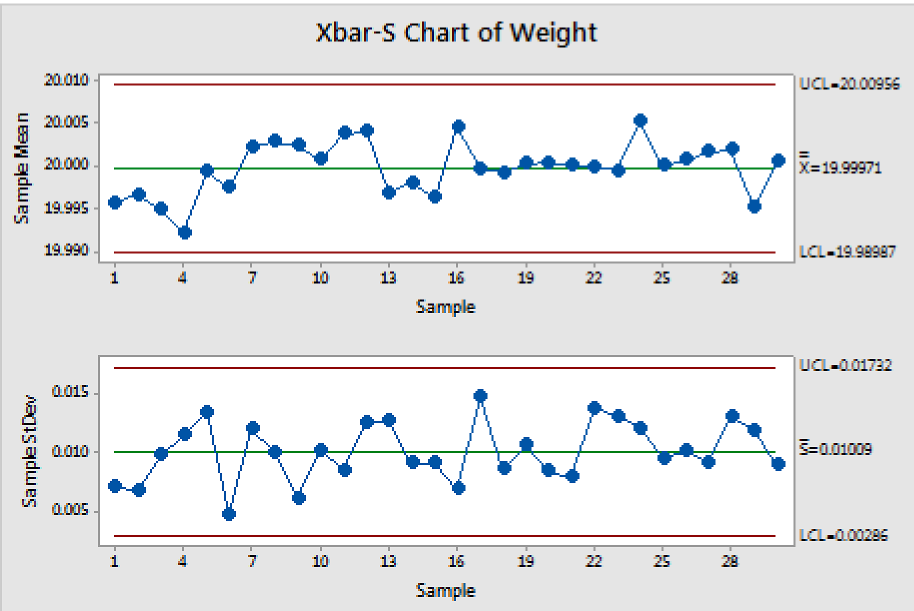


Image Source: https://support.minitab.com

The above-mentioned charts are being used for continuous data. Let's now move on to discrete data. For discrete data, we have 4 types of charts, since discrete data is segregated into two parts, (i) defects and (ii) defective and it varies depending upon the constant subgroup size.

You may also like: ***Demystifying the difference between Lead Time, Takt Time and Cycle Time***

- **P and Np Control Charts**

The P and Np charts are used for defective data to check the process stability while seeing the defective data points. The main difference between the P and Np is P chart is used when sample size varies, whereas Np chart is used when the sample is constant.

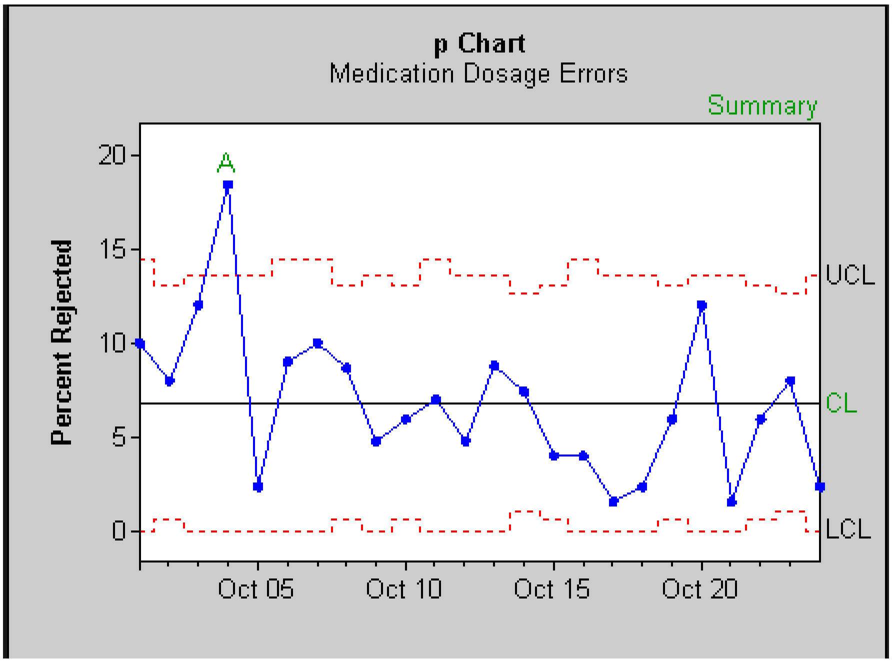


Image Source: http://www.statit.com

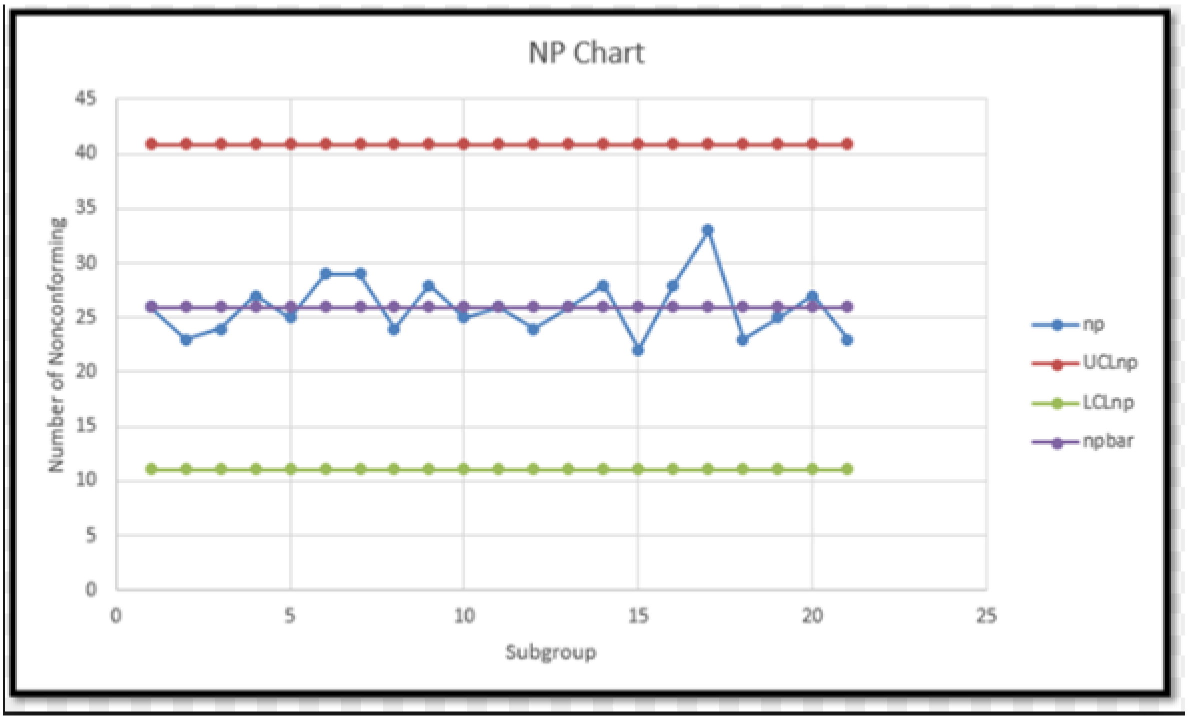


Image Source: http://myweb.wit.edu/powersw1/WIT/Manufacturing/P-NP_Charts.htm

- **C and U Control Charts**

The C and U charts help to check the stability in a single unit, which might have more than one defect. For example, the number of defects in one pen. Here also, we can see the defects on the same size of the sample or it can vary on other samples.

C Control Chart is used when there is more than one defect and the sample size is fixed. While U Control Chart is used for more than one defect and if the sample size is not fixed.

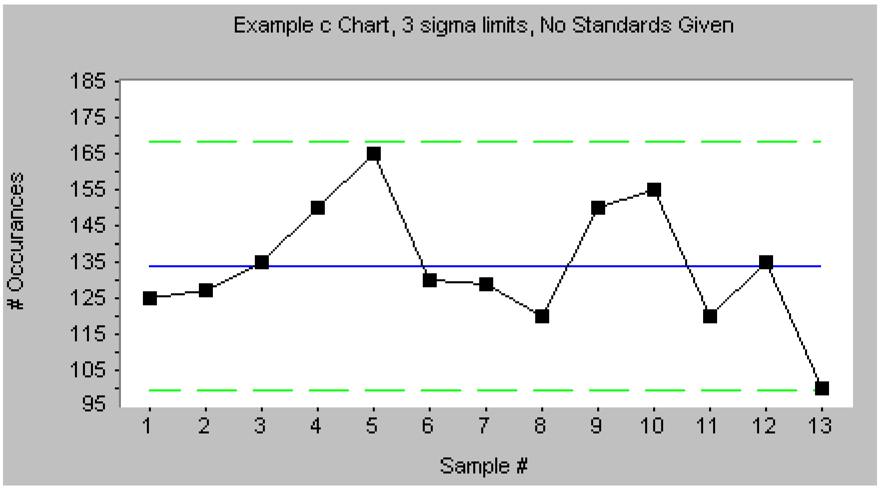


Image Source: http://www.skymark.com/resources/tools/control_charts.asp

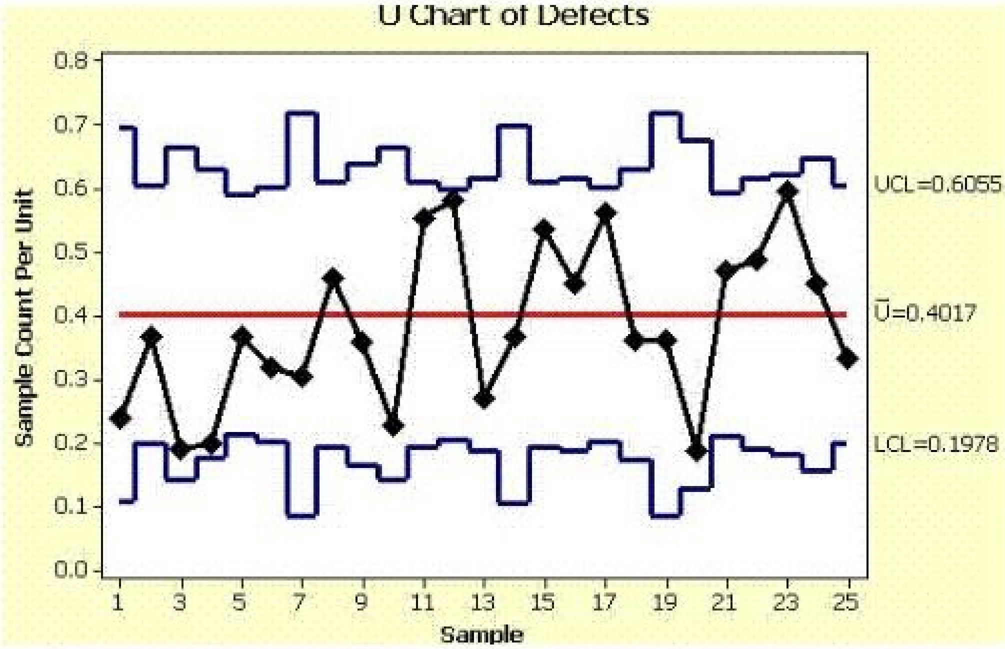


Image Source: http://www.six-sigma-material.com/U-Chart.html

What Is A Six Sigma Control Plan?

In the world of quality management, a control plan is a written summary of the process that lays out in detail the steps to be taken to maintain a process or a device operating at the current level of performance. Control plans include a description of each step in the process, and the parameters that need to be kept in check to ensure there are no excessive deviations from mean performance or variation in a batch of products.

What Is The Purpose Of A Six Sigma Control Plan?

According to the American Society For Quality (ASQ), 'the purpose of the control plan is to ensure that performance improvements made by the project team are sustained over time.'

The plan is created during the improve phase of the define, measure, analyze, improve, control (DMAIC) approach or a similar phase of other methodologies.

In essence, a Control Plan would present a summary of all the information relevant to a given project so that the quality specialist is able to ascertain if the project is on track and, in case of deviations, delays, and wasteful overheads, is able to take corrective action. As such, the Control Plan is kept updated to reflect *any* changes to the process, including (but not limited to):

- tweak or change to a step in the process
- Addition or removal of a step in the process

- Changes to human resources and training requirements
- Addition or removal of equipment utilized in the process
- Changes to capital and funding inflows and outflows

The Control Plan template is devised at the beginning of the project, and is prepared after consultation with or with participation from all the stakeholders involved in a given project, beginning with the process or product owner.

Why Use A Control Plan?

A Control Plan provides a single point of reference for understanding process characteristics, specifications, and standard operation procedures -also known as SOP- for the process. A CP allows for assignment of responsibility and allocation of accountability for each activity within the process. This ensures that the process is executed smoothly and is sustainable in the long run.

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Unit 4

Question	**option A**	**option B**	**option C**	**Option D**		**Answer**
______brings objectivity in decision making	sampling	measurement	tools	data collection		data collection
A good ______ simplifies the problem solving effort	sampling	measurement	tools	data collection		data collection
______forms the basis of any defect calculation	Specification Limit	base line	Data	sampling		Specification Limit
______is the value that separates acceptable performance form unacceptable	Specification Limit	base line	Data	sampling		Specification Limit
______refers to a reference point from where the improvement would be measured	Specification Limit	base line	Data	sampling		base line
_______ translates customer needs into measurable characteristics	Performance standard	Specification Limit	base line	Data		Performance standard
The goal of _____is to translate the customer need into measurable characteristics	Performance standard	Specification Limit	base line	Data		Performance standard
______helps to translate voice of customer to the voice of process	Performance standard	Specification Limit	base line	Data		Performance standard
______is representation of steps, events, operational and relationships of process with in a process	Procedure	Process mapping	Dumping	sampling		Process mapping
______provides the ability to graphically depict steps, events, operations and relationships of resources with in a process	Procedure	Process mapping	Dumping	sampling		Process mapping
______is a structure for thinking through a complex process in a simplified and visible manner	Procedure	Process mapping	Dumping	sampling		Process mapping
______gives an ability to see the entire process as a team	Procedure	Process mapping	Dumping	sampling		Process mapping
______provides information on non value added areas in the process	Procedure	Process mapping	Dumping	sampling		Process mapping

______helps to identify gaps present in the As-Is process as against standard process	Procedure	Process mapping	Dumping	sampling		Process mapping
______helps to identify bottlenecks which are impacting efficiency of the process	Procedure	Process mapping	Dumping	sampling		Process mapping
______are high level maps which gives overview on entire process	Macro	Micro	Hyper Micro	Magma		Macro
______maps provides practical links between inputs and outputs, operational measures and controls	Macro	Micro	Hyper Micro	Magma		Micro
______maps provides details into operator methods, material, specification and system functionality	Macro	Micro	Hyper Micro	Magma		Hyper Micro
______ tends to introduce defects in your process	Hand-offs	Cycle time	Flow (volume)	Value		Hand-offs
______uses flow chart to understand how long each step requires	Hand-offs	Cycle time	Flow (volume)	Value		Cycle time
understanding___________ will help you determine where bottlenecks are in the process	Hand-offs	Cycle time	Flow (volume)	Value		Cycle time
MSA stands for	Measurement system analysis	Measure software analysis	Measurement system analytics	Measurement software analytics		Measurement system analysis
_______is a tool used to evaluate the statistical properties of process measurement system	Measurement system analysis	Measure software analysis	Measurement system analytics	Measurement software analytics		Measurement system analysis
______ include procedure to collect data, gages or equipment's and approach towards data collection	Measurement system analysis	Measure software analysis	Measurement system analytics	Measurement software analytics		Measurement system analysis
______helps to statistically verify what existing measurement system provide	Measurement system analysis	Measure software analysis	Measurement system analytics	Measurement software analytics		Measurement system analysis
_____is the sum of list numbers divided by the total number of numbers in the list	Mean	Median	Mode	Standard Deviation		Mean
_____is the 50% point or middle number	Mean	Median	Mode	Standard Deviation		Median

_____is the value which occurs with highest frequency	Mean	Median	Mode	Standard Deviation		Mode
_____is the difference between maximum and Minimum value in the data set	Mean	Median	Mode	Range		Range
_____is the rage of middle 50% data points in a series	Mean	Median	Mode	Inter Quartile Range		Inter Quartile Range
______is the classic measure of dispersion and is based on all observations	Mean	Median	Mode	Standard Deviation		Standard Deviation
______measures how far on average the numbers are form their mean	Mean	Median	Mode	Standard Deviation		Standard Deviation
______is a bell shaped curve	Normal distribution	Median	Mode	Standard Deviation		Normal distribution
Any item produced or processed is known as a______	Unit	Defect	Defective	Defect Opportunity		Unit
_____is non conformance to customer specification	Unit	Defect	Defective	Defect Opportunity		Defect
_____is any unit with one or more defects	Unit	Defect	Defective	Defect Opportunity		Defective
Any event that is measurable and provides a chance of not meeting customer requirement is known as ________	Unit	Defect	Defective	Defect Opportunity		Defect Opportunity
DPU stands for	Defects per union	Defect per unit	Defect perform unit	Defect percentage unit		Defect per unit
DPMO stands for	Defects per million opportunity	Defects per milestone opportunity	Defects per measure opportunity	Defects percentage million opportunity		Defects per million opportunity
______ is inversely proportional to sample size	tools	data	precision	measurement		precision
A process is said to be stable when the distribution of all individual measurement is with in ±____ from the mean	3	4	5	2		3

_______study is used to determine whether a process is stable and capable	feasibility	capability	viability	implement ability		capability
A________ process produce a consistent level of performance with minimal variations	medium process	unstable process	stable process	inefficient process		stable process
_____is a creative process for generating several solutions	affinity diagram	brainstorming	analyse phase	multivari chart		brainstorming
_______is the natural flow of ideas by the team in brain storming	free wheeling	Round robin	Card method	multivari chart		free wheeling
Every team member takes turn in suggesting their ideas in Brainstorming this is called	free wheeling	Round robin	Card method	multivari chart		Round robin
In Brainstorming, there is no discussion, every member writes their ideas on cards	free wheeling	Round robin	Card method	multivari chart		Card method
______helps to group similar causes and categorize them	affinity diagram	brainstorming	analyse phase	multivari chart		affinity diagram
______phase reviews variation and significant contributors to the output	Design	Review	analyse	control		analyse
_____is used in the first stages of data analysis	main effect plot	multi vari chart	box plot	scatter plot		box plot
______ plot helps to understand effect of various levels in each factor on output variable	main effect plot	multi vari chart	box plot	scatter plot		main effect plot
_______plot information about averages based on different level of X	main effect plot	multi vari chart	box plot	scatter plot		main effect plot
_______are visual way of displaying of patterns of process variation	main effect plot	multi vari chart	box plot	scatter plot		multi vari chart
_______is used to identify possible X's or variation with in a subgroup, between subgroups, or over time.	main effect plot	multi vari chart	box plot	scatter plot		multi vari chart
_______is a tool for exploring the relationship between an independent input variable and output variable	main effect plot	multi vari chart	box plot	scatter plot		scatter plot

________is used to determine the relationship between continuous process and independent input factor	main effect plot	multi vari chart	box plot	Regression Analysis		Regression Analysis
_______is also known as 80-20 rule	Regression Analysis	Pareto	box plot	scatter plot		Pareto
______tool is used when the data type is discrete in nature	Regression Analysis	Pareto	box plot	scatter plot		Pareto
________Is a team tool to prioritize the key process input variable	Regression Analysis	Pareto	Cause and effect matrix	scatter plot		Cause and effect matrix
_______uses statistical tools to determine observed differences are due to random chance or true difference in the population	Regression Analysis	Pareto	Cause and effect matrix	Hypothesis testing		Hypothesis testing

Unit V
Syllabus

Risk Management
What is Risk? Risk Types – Operational Risk, Information Security Risk, Financial Risk, Strategic Risk - Risk Mitigation Plans.

Risk is the possibility of losing something of value. Values (such as physical health, social status, emotional well-being, or financial wealth) can be gained or lost when taking risk resulting from a given action or inaction, foreseen or unforeseen (planned or not planned). Risk can also be defined as the intentional interaction with uncertainty. Uncertainty is a potential, unpredictable, and uncontrollable outcome; risk is a consequence of action taken in spite of uncertainty.

Operational risk

Operational risk is the prospect of loss resulting from inadequate or failed procedures, systems or policies.

- Employee errors
- Systems failures
- Fraud or other criminal activity
- Any event that disrupts business processes

Most organizations accept that their people and processes will inherently incur errors and contribute to ineffective operations. In evaluating operational risk, practical remedial steps should be emphasized in order to eliminate exposures and ensure successful responses. Poor operational risk management can hurt an organization's reputation and cause financial damage.

What is Financial Risk

Financial risk is the possibility that shareholders or other financial stakeholders will lose money when they invest in a company that has debt if the company's cash flow proves inadequate to meet its financial obligations. When a company uses debt financing, its creditors are repaid before shareholders if the company becomes insolvent.

Financial risk also refers to the possibility of a corporation or government defaulting on its bonds, which would cause those bondholders to lose money.

Information security risk

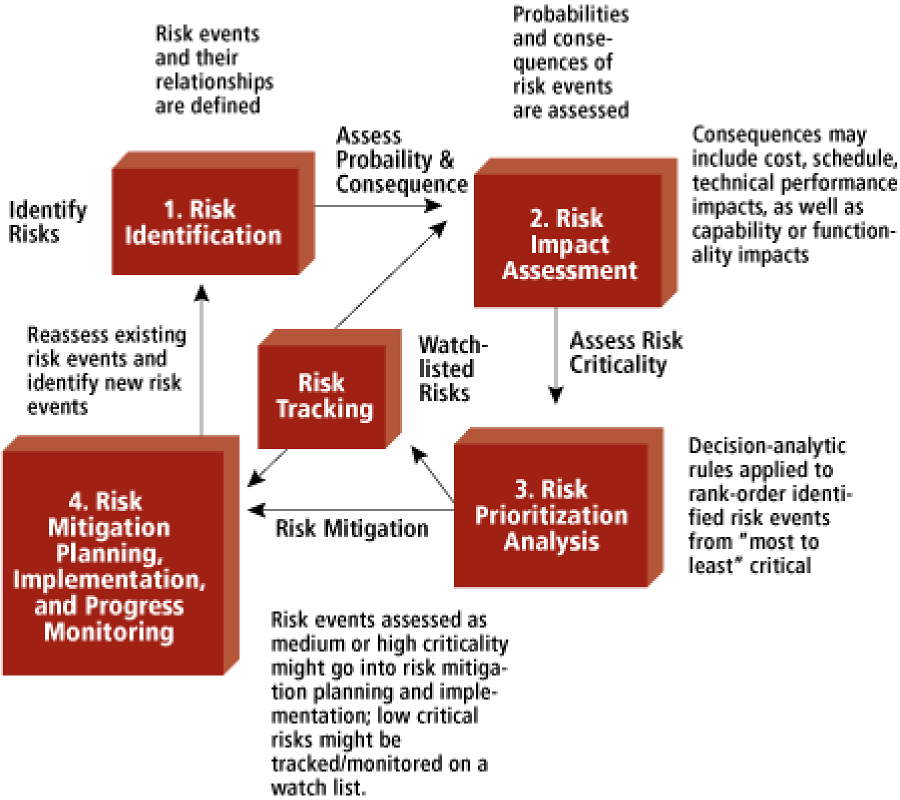
Information security risk management, or ISRM, is the process of managing risks associated with the use of information technology. It involves identifying, assessing, and treating risks to the confidentiality, integrity, and availability of an organization's assets. The end goal of this process is to treat risks in accordance with an organization's overall risk tolerance. Businesses shouldn't expect to eliminate all risks; rather, they should seek to identify and achieve an acceptable risk level for their organization.

Strategic risk

Strategic risk is the risk that failed business decisions, or lack thereof, may pose to a company. Strategic risk is often a major factor in determining a company's worth, particularly observable if the company experiences a sharp decline in a short period of time. Due to this and its influence on compliance risk, it is a leading factor in modern risk management.

Risk Mitigation Planning, Implementation, and Progress Monitoring

Definition: Risk mitigation planning is the process of developing options and actions to enhance opportunities and reduce threats to project objectives . Risk mitigation implementation is the process of executing risk mitigation actions. Risk mitigation progress monitoring includes tracking identified risks, identifying new risks, and evaluating risk process effectiveness throughout the project .



Risk mitigation handling options include:

Assume/Accept: Acknowledge the existence of a particular risk, and make a deliberate decision to accept it without engaging in special efforts to control it. Approval of project or program leaders is required.

Avoid: Adjust program requirements or constraints to eliminate or reduce the risk. This adjustment could be accommodated by a change in funding, schedule, or technical requirements.
Control: Implement actions to minimize the impact or likelihood of the risk.
Transfer: Reassign organizational accountability, responsibility, and authority to another stakeholder willing to accept the risk.
Watch/Monitor: Monitor the environment for changes that affect the nature and/or the impact of the risk.

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SUBJECT CODE:16BPU603A **SUBJECT : MANAGING BUSINESS PROCESS 2**

Unit 5

Question	**option A**	**option B**	**option C**	**Option D**		**Answer**
_____is a threat or possibility that an action or event will adversely affect organization's ability to achieve its objective	Risk	six sigma	lean	control		Risk
______is the point at which you take at something which can either turnout better for you or could bring about a negative result	Risk	six sigma	lean	control		Risk
_____is defined as the effect of uncertainty on objective	Risk	six sigma	lean	control		Risk
______includes possible incidents and ambiguity caused by inadequate information	uncertainty	six sigma	lean	control		uncertainty
______is the possibility of organization failing to achieve its objective	Risk	six sigma	lean	control		Risk
Risk cannot me eliminated but _______	introduced	managed	induced	achieved		managed
Risk management has ____ steps	2	3	6	4		4
First step in Risk management is_____	Identification of risks	assessing the impact	Development of risk management tools	Development of an environment where everyone feels responsible for risk management		Identification of risks
______are risks that arises form adverse effects of high level business decisions	strategic risk	legal risk	financial risk	credit risk		strategic risk
______are risks that arises form violation of or failure to conform with laws, regulation or prescribed practices	strategic risk	legal risk	financial risk	credit risk		legal risk
______risk result in possible fine, criminal and civil monetary penalties	strategic risk	legal risk	financial risk	credit risk		legal risk
______risk arises due to non adherence of a regulation passed by government	strategic risk	Regulation risk	financial risk	credit risk		Regulation risk
_______are risks that arises form non compliance with the accounting policies	strategic risk	legal risk	financial risk	credit risk		financial risk
________risk includes risk of submitting inaccurate or misleading information	strategic risk	legal risk	financial risk	credit risk		financial risk

_____risk arises in maintaining appropriate staffing requirements for ensuring business stability	strategic risk	legal risk	organizational risk	credit risk		organizational risk
_____includes risk of inadequate capacity planning	strategic risk	legal risk	organizational risk	credit risk		organizational risk
_____is risk arising from inadequate knowledge regarding laws and regulations when business is shifted to other region or country	strategic risk	legal risk	organizational risk	Sovereign risk		Sovereign risk
______is risk that arises when certain changes in market tends to have an impact on the business	strategic risk	legal risk	Market Risk	Sovereign risk		Market Risk
Lack of right offerings to address customer needs is ____ risk	strategic risk	legal risk	Market Risk	Sovereign risk		strategic risk
If lease agreement for an office area is not renewed on time, it is a _____risk	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
Not passing entries in appropriate account leads to error in reporting which is a _________	strategic risk	legal risk	financial reporting risk	credit risk		financial reporting risk
capacity plan not in place for the organization is a ______risk	strategic risk	legal risk	organizational risk	credit risk		organizational risk
Incomplete or inaccurate evaluation of the credit rating of the external party leads to _______risk	strategic risk	legal risk	financial risk	credit risk		credit risk
Inadequate tracking of terms and condition with respect to insurance requirements leading to under insurance cover is a ____ risk	strategic risk	Insurance risk	financial risk	credit risk		Insurance risk
Margins being reduced impacting the profits due to economic recession is a ________risk	strategic risk	legal risk	Market Risk	Sovereign risk		Market Risk
_____ states that there is no difference exists between the population being studied	Null Hypothesis	Alternate hypothesis	Value	Probability		Null Hypothesis
_______states that a difference exists between the population being studied	Null Hypothesis	Alternate hypothesis	Value	Probability		Alternate hypothesis
According to ISO _____is the effect of uncertainty on objectives	Risk	six sigma	lean	control		Risk
In case of fire there is a possibility of losing lives and property , this is called	Risk	Threat	probability	impact		Threat
_____is usually associated with anticipation of benefits which may be tangible or intangible	Risk	six sigma	lean	control		Risk
which risk will arise if the agreements are not renewed on time	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk

Lack of offering of diversified services or products is a __________________	strategic risk	legal risk	Market Risk	Sovereign risk		strategic risk
If a company is submitting in appropriate accounts it will lead to _______	strategic risk	legal risk	financial risk	credit risk		financial risk
Risk arising due to competition is known as _______	strategic risk	legal risk	Market Risk	Sovereign risk		Market Risk
what type of risk a company will have they sell products that does not meet their customer expectations?	strategic risk	legal risk	Market Risk	Sovereign risk		strategic risk
If a company is not offering diversified products to its customers it will fall under what risk?	strategic risk	legal risk	Market Risk	Sovereign risk		strategic risk
Any agreement made for the company is not renewed or replenished, it will fall under what risk?	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
ICOFR stands for	Internal control over financial reporting	Internal cost of foreign rates	internal company on foreign rate	internal control on forex reporting		Internal control over financial reporting
Failing to plan right staff requirement will be categorised under	strategic risk	legal risk	organizational risk	credit risk		organizational risk
Organizational Risk is also called as_______	strategic risk	legal risk	staffing Risk	credit risk		staffing Risk
Franchise risk is categorised under______	strategic risk	legal risk	staffing Risk	credit risk		strategic risk
Compilance of financial statement risk is categorised under_________	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
when a company has no knowledge on laws and regulations of their new country will fall under _______	strategic risk	legal risk	organizational risk	Sovereign risk		Sovereign risk
Cross border risk is a form of	strategic risk	legal risk	organizational risk	Sovereign risk		Sovereign risk
when a firm takes under insurance due to inadequate knowledge of terms and conditions is a _____________	strategic risk	legal risk	organizational risk	Insurance risk		Insurance risk
some times cover for an asset is taken where it will not be in line with the risk event, this type of risk is called__________	strategic risk	legal risk	organizational risk	Insurance risk		Insurance risk
when a company does an inadequate credit rating of the issuers, it is categorised under__________	strategic risk	legal risk	financial risk	credit risk		credit risk
_______is mechanism where by risk can be compensated	Insurance	credit rating	market ranking	legal ranking		Insurance

__________includes risk of submitting inaccurate information	strategic risk	legal risk	financial risk	credit risk		financial risk
__________includes risk of submitting inadequate information	strategic risk	legal risk	financial risk	credit risk		financial risk
___________includes risk of failing to submit information on time	strategic risk	legal risk	financial risk	credit risk		financial risk
A control that ensure compliance with financial reporting requirements is categorized as_________	ICOFR	ICOFER	ICFORE	ISDFR		ICOFR
______will lead to provide misrepresentation of the company's financial condition to regulators.	strategic risk	legal risk	financial risk	credit risk		financial risk
Risk of having in adequate HR policies and procedures will lead to ___________	strategic risk	legal risk	staffing Risk	staffing Risk		staffing Risk
when a company gets effected because of non implementation of business decision will fall in___________	strategic risk	legal risk	staffing Risk	credit risk		strategic risk
when a company fails to regulate with rules and regulations, what type of risk will it have?	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
________will result in fine or penalties	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
_________will result in criminal and civil monetary penalty	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
______will result in damage of payments and avoiding of contracts	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk
_________arises due to non adherence of regulation passed by the government	strategic risk	legal risk	Market Risk	Sovereign risk		legal risk