Welcome to Lean and Six Sigma Training

Module 1: Six Sigma Overview

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Lean and Six Sigma
Attitude and Discipline

- Customer Focus
  - View Quality externally from the customer's perspective
  - Measure the same way that the customer does
- Meet customer expectations every time
  - Continuous improvement cycle
    - Systematic
    - Scientific
    - Fact-based
    - Data-driven
  - Process focus

Customers Have All The Votes Concerning Extent Of Satisfaction And Value

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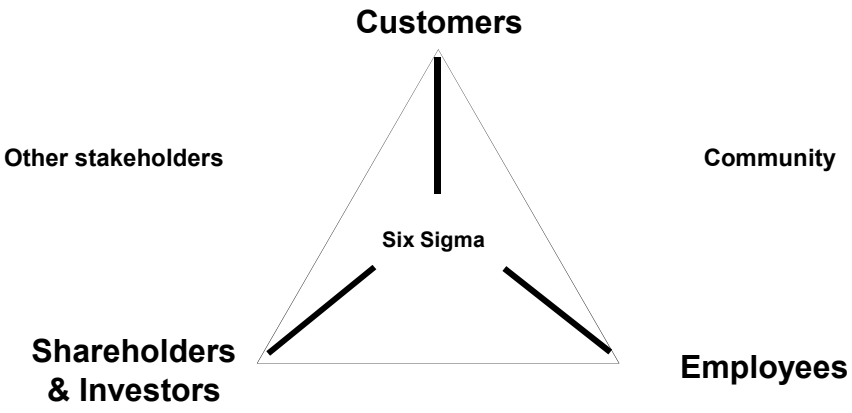
Commitments

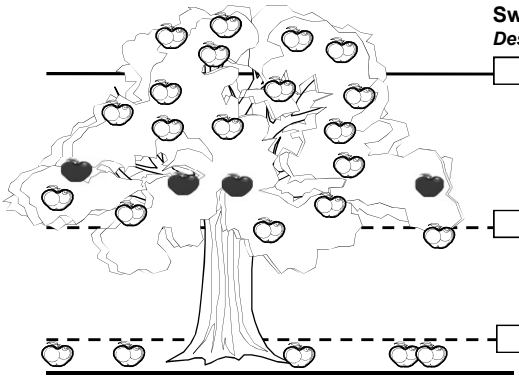


Operational Excellence

- "Eighty-five percent of the reasons for failure to meet customer expectations are related to deficiencies in systems and processes, not to the fact that our employees are not up to the challenge…"
- "The Manager's role is to promote process improvement."

DEMING

Harvesting the Fruit of Six Sigma



Sweet Fruit
Design for Six Sigma

5σ Wall, Improve Designs

Bulk of Fruit
Process Characterization and Optimization

4σ Wall, Improve Processes

Low Hanging Fruit
Seven Basic Tools

3σ Wall, Beat Up Suppliers

Ground Fruit
Logic and Intuition

Many organizations in the world have achieved huge savings and improved bottom lines by implementing Six Sigma

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Roles & Responsibilities

- **Owns vision, direction, integration, results**
- **Leads change**

Leadership/ Sr. Executive

- **Support Six Sigma**
- **Ensure success of GB/BB projects**

Yellow Belts

- **Develops deployment and Strategy**
- **Supports cultural change**

Champion / Sponsor

- **Owns the process in which GB/BB works**
- **Challenges GB findings**

Process Owner

All Employees (White Belts)

- **Understand vision**
- **Apply concepts to their job and work area**

- **Supports Black Belts by participating on project teams**

Green Belts

- **Apply Breakthrough Strategy to specific projects, lead and direct teams to execute projects**

Black Belts

- **Trains and coaches Black Belts , Green Belts and leaders**

Master Black Belt

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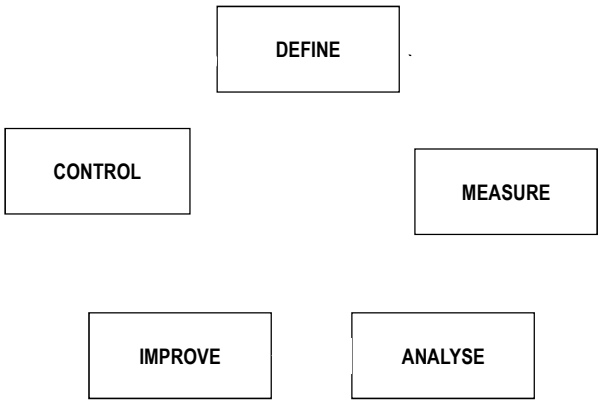
DMAIC : An Improvement Methodology



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DMAIC : An Improvement Methodology

- **DEFINE**: Set direction for improvement
- **MEASURE**: Collect reliable data to understand current process performance
- **ANALYSE**: Identify problem's root causes through process and data analysis
- **IMPROVE**: Determine new improved process design
- **CONTROL**: Ensure improvement effectiveness over time

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Module 2: Define Phase

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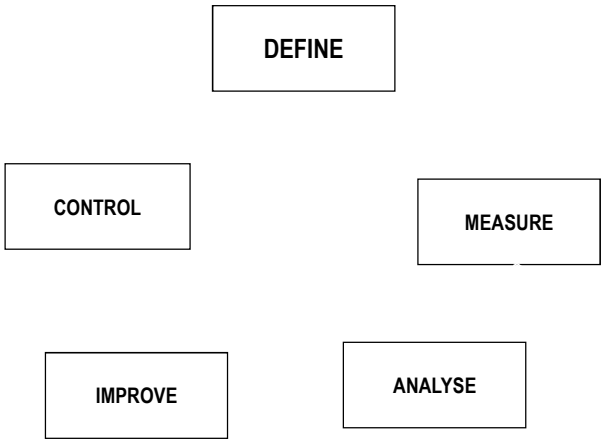
DMAIC : An Improvement Methodology



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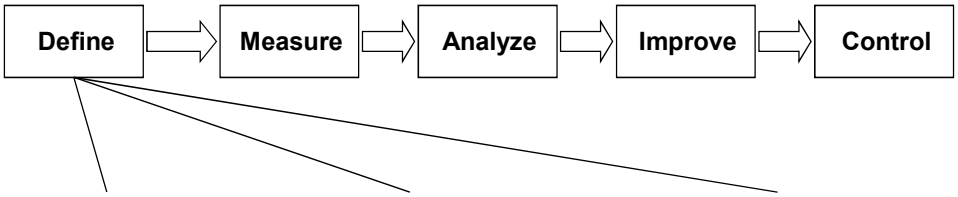
DEFINE *Roadmap*



High Level Process Map (SIPOC)

- Process Definitions
- Connecting the Customer to Your Process

Customer CTQs

- Types of customers
- Methods of collecting customer requirements
- Translate customer needs into specific requirement
- Customer requirements analysis and prioritization

Project Charter

- Business Opportunities
- Preliminary Problem Statement
- Goal statement
- Project Scope
- Milestones
- Roles

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Define

Objectives :

- Set direction for improvement

Steps

- Have a high level view of the process
  - SIPOC
- Know the customers' needs and identify their key performance requirements
  - CTQs
- Formalise the charter of the improvement project
  - Charter

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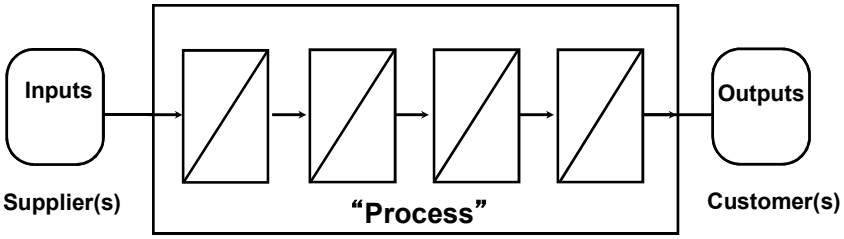
What is a process ?

A set of activities that takes one or more inputs and transforms them into outputs that are of value to the customer



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DEFINE ***Identify the Process***

The 5 Key Elements of a Process

Supplier	The provider of inputs to your process
Input	Materials, resources or data required to execute your process
Process	A collection of activities that takes one or more kinds of input and creates output that is of value to the customer
Output	The products or services that result from the process
Customer	The recipient of the process output

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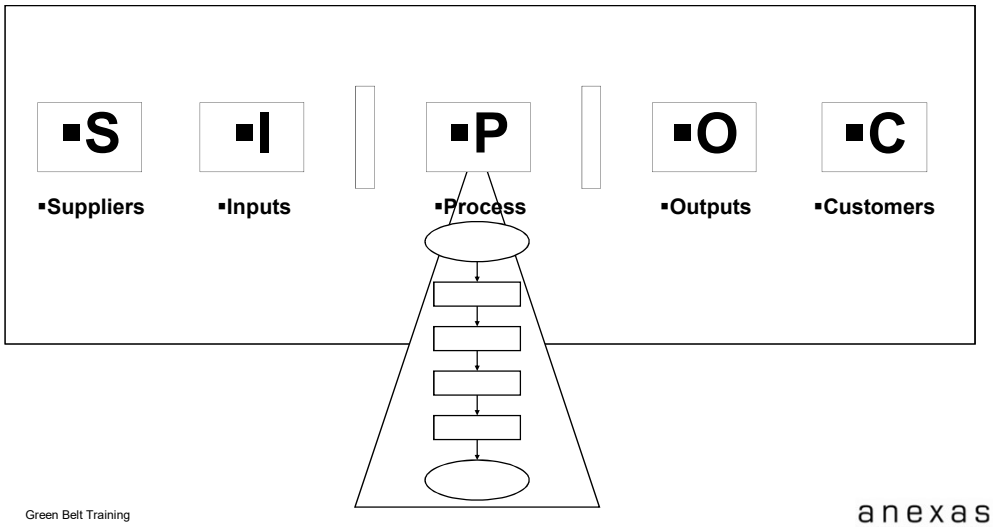
DEFINE — *Identify the Process*

High Level Process Mapping



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DEFINE — *Determine CTQs*

What is a CTQ?
(Critical to Quality)

Any measurable product / service

characteristics that is

important to the customer

from the customer's point of view.

CTQ is also known as KPI

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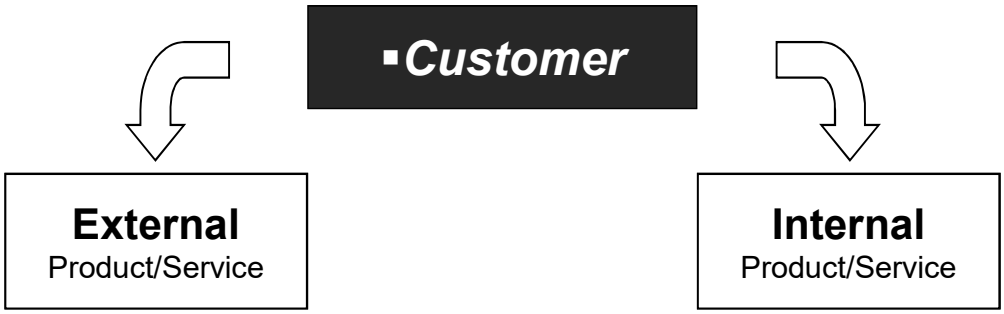
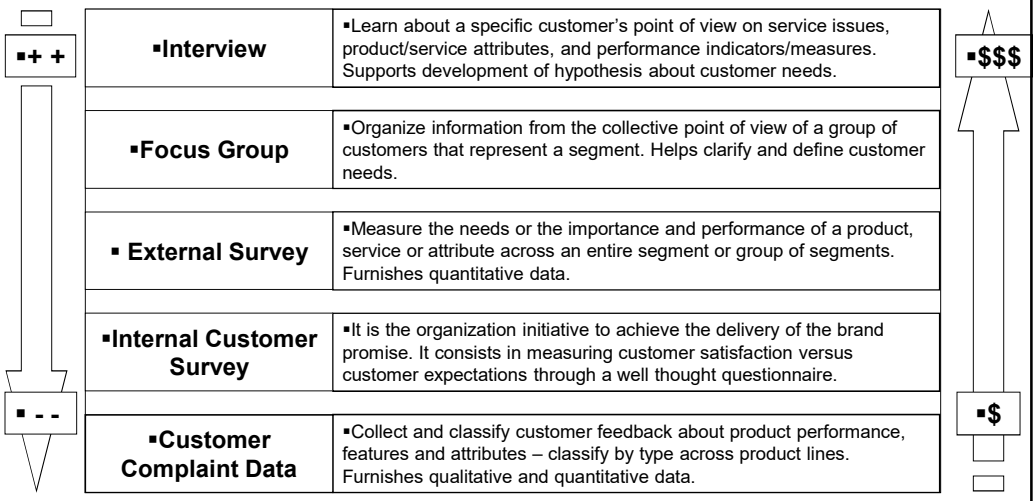
Who is a Customer?

Customers are recipients of products and/or services.



DEFINE Determine CTQs

Different Ways to Listen to the Voice of the Customer



▪**Interview**	▪Learn about a specific customer's point of view on service issues, product/service attributes, and performance indicators/measures. Supports development of hypothesis about customer needs.
▪**Focus Group**	▪Organize information from the collective point of view of a group of customers that represent a segment. Helps clarify and define customer needs.
▪ **External Survey**	▪Measure the needs or the importance and performance of a product, service or attribute across an entire segment or group of segments. Furnishes quantitative data.
▪**Internal Customer Survey**	▪It is the organization initiative to achieve the delivery of the brand promise. It consists in measuring customer satisfaction versus customer expectations through a well thought questionnaire.
▪**Customer Complaint Data**	▪Collect and classify customer feedback about product performance, features and attributes – classify by type across product lines. Furnishes qualitative and quantitative data.

Green Belt Training

DEFINE — *Determine CTQs*

Voice Of Customer Translation Matrix

VOC High-Level Need	Service/ Quality Issue	Specific Needs Statement	Output Characteristic
Example: "It takes too long to get my audit completed"	Speed	I want to complete audit within 10 days it is initiated	Turnaround time from audit initiation to audit completion

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DMAIC Project Charter

Project No.:_____

Project Name:	**Process :**
Resource Plan	**Team Members**
Champion / Sponsor: **Green / Black Belt:** **Functional Managers/Process Owner:** **Coach / Master Black Belt:**	*Text*
Problem Statement	**Scope**
Text	*Text*
Goal Statement	**Customer CTQ's**
Text	*Text*
Estimate Financial Opportunities / Intangible Benefits	**High Level Project Milestone**
Text	*Text*

Validation

Green / Black Belt	Master Black Belt	Process Owner
CEO	Financial Analyst	Champion / Sponsor

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Formalise the improvement project charter

Key elements :

- What is the problem statement?
- What goal statement do we set for ourselves?
- What are the estimated financial benefits ?
- What is or is not included in the project?
- What are the milestones for the project ?
- Who are the players concerned and what is their role ?

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Problem and Goal Statements: Definitions

The purpose of the problem statement is to describe what is wrong

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The goal statement defines the team's improvement objective

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Problem Statement: Description of the Problem

- What is wrong in not meeting our customer's needs?
- When and where does the problem occur?
- How big is the problem?
- What's the impact of the problem?
- What, Where, Since When, How big, How it impacts
- Do not write Why? And Who is responsible for the problem

DEFINE *Project Charter*

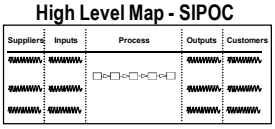
Goal Statement

- Defines what improvement the team is seeking to accomplish, i.e., what do we want the defect rate to be?
- Tends to start broadly – eventually should include measurable target or specification limit and completion date
- Must not assign blame, presume cause, or prescribe solution
- Has four parts:
  - Starts with a verb (reduce, eliminate, control, increase)
  - Focus of project (cycle time, accuracy)
  - Target (by 50%, by 75%)
  - Deadline
- Needs to be SMART

DEFINE SUMMARY

Purpose: **To set set direction for improvement project** by developing a team charter. By defining the customers and their requirements (Critical To Quality = CTQs), mapping the high level business process to be improved.

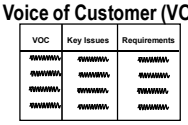
High Level Map - SIPOC



•Complete high level "as-is" process map, identifying suppliers, inputs, 5-7 high level activities, outputs & customers

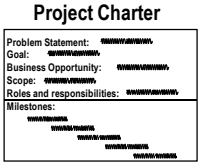
Use Survey or Focus Groups?

Voice of Customer (VOC)



•Gather and display data verifying customer requirements (CTQs)

Project Charter



•Develop charter to include:
- Problem statement
- Goal for improvement
- Business opportunity
- Scope of project
- Milestones for completion
- Roles

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Module 3: Measure Phase

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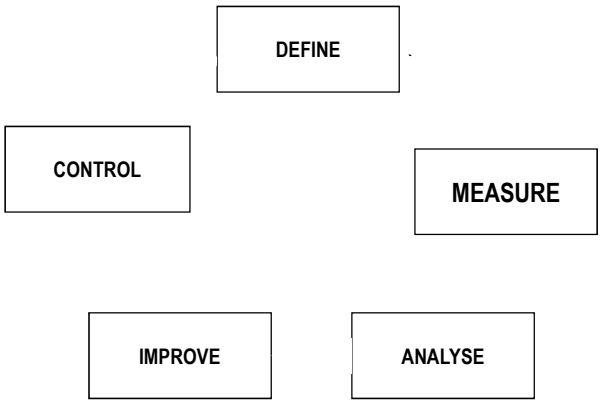
DMAIC : An Improvement Methodology



Measure

Objective :

- Collect reliable data to understand current process performance

Steps :

➔ Choose the data to be collected (output measures, process and input measures)

➔ Organize the data collection plan (What ? Why ? When? Who? How? How many ?)

➔ Study process variation

➔ Understand the capability of the process

Choose the data to be collected

Input measures	Process measures	Output measures
The key quality and delivery expectations from your suppliers. (performance predictors)	Internal process measures predict the end performance when correlated to output measurements.	Output measurements enable you to verify that the process satisfies the expected performance level

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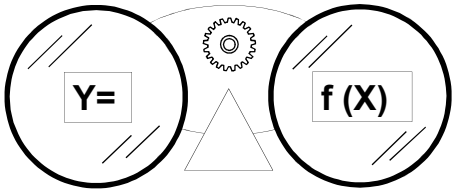
Key principles for investigation



Response
- Y
- Dependent
- Output

- Effect
- Symptom
- Monitor

Predictor
- $X_1 ... X_N$
- Independent
- Input-Process variables

- Cause
- Problem
- Control

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Data Types

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Attribute Data

- Attribute (category) data is labeled
- Qualitative
- Measured on nominal or ordinal scales
  - Nominal – data placed in categories
    - Examples Heads/Tails on coin flip
      Facility A, B, or C
  - Ordinal – data placed in categories that have order
    - Examples Low, Medium, High
      Freshman, Sophomore, Junior
      1st, 2nd, 3rd
- Attribute data can be represented as Discrete numbers or counts e.g. Males =45, Females =25

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Variable Data (Continuous data)

- Variable data can be represented on a scale or number line.
- The scale might have
  - decimal places
  - continuous and unlimited levels
    - Examples: Cycle time, distance, temperature, height, weight

Sampling

Sampling Considerations

- **Sampling is a procedure for selecting units to estimate a characteristic of the population**
  - **Representative of the population**
  - **Sufficient size**
    - **Risk**
    - **Variation**
  - **Cost**
  - **Ability to continue data collection**

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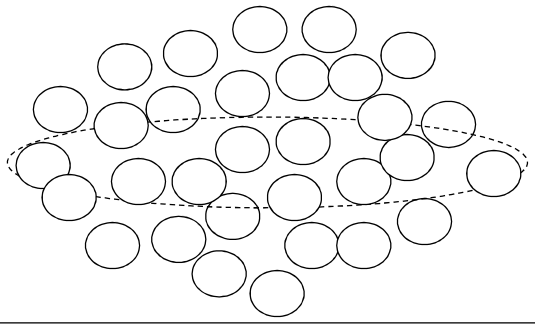
Simple Random Sampling

Example: To estimate the average height of the people in a company, select 10 people at random. Calculate the average height of the sample



Each item has equal probability of being selected

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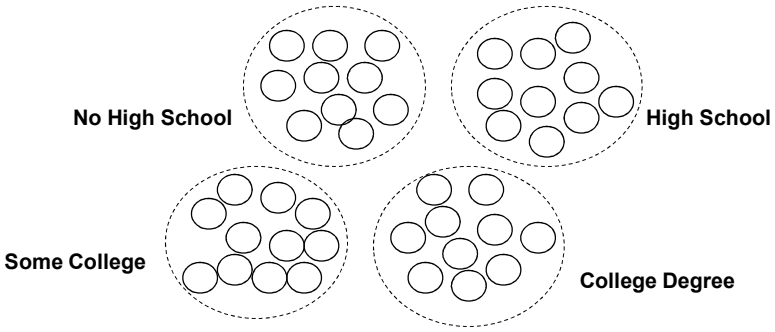
Stratified Random Sampling

Example: To estimate the average income of people in Dubai break the population of Dubai into levels of education. Then sample randomly within each education group



Population is "stratified" into groups with random selection within each group

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Systematic Random Sampling

Example: I ask every 10th person their opinion on state of the economy.

Every "nth" item is sampled for study

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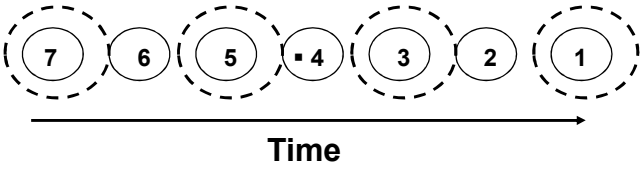
Subgroup Sampling

Example: I need to know how the TAT of a job varies over time in my process.



Every "nth" item is sampled for study at each time period

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Data Collection

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Sampling Plan Worksheet

Questions	Measure 1	Measure 2	Measure 3	Measure 4
What ?				
Why ?				
When ?				
Who ?				
How ?				
How many ?				

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Measure

Objectives :

- Collect reliable data to understand current process performance

Steps :

- Choose the data to collect (output measures, process and input measures)
- Organise the data collection plan (What ? Why ? When? Who? How? How many ?)

➔**Study process variation**

➔**Understand the capability of the process**

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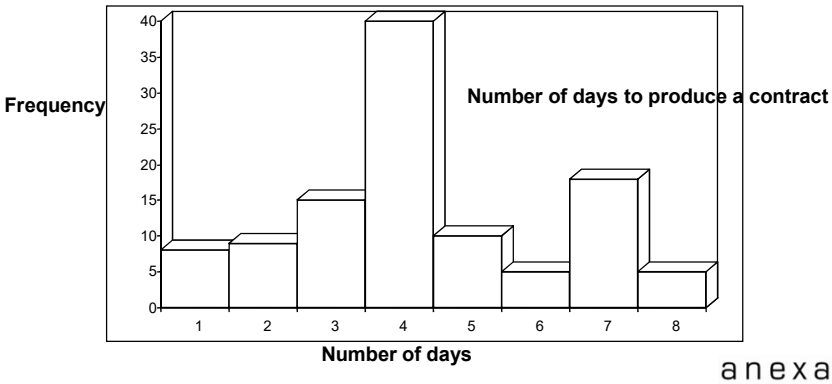
Variation over a period of time : histogram

Definition

The histogram illustrates the shape (or distribution) of the data by indicating how often different values appear

Example



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Interpretation of the histogram

Key Questions :

- **What is the shape of the distribution ?**
- **What is the central trend ("center") of the distribution ?**
- **What is the variation ("spread") of the distribution ? Is the curve wide or narrow?**

➔ Are we confronted with a problem of "process centring" within the limits of customers' expectations or do we have a problem of "too much variation" ?

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Basic Statistics

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Measures of Location (Central Tendency)

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Measures of Location
(Central Tendency of data)

Mean: Average of a set of values

Median: Midpoint in a string of data, where 50% of the observations, or values, are below and 50% are above

Mode: The most frequently occurring value

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Measures of Spread (Variation)

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Range

- Range is the difference between the largest and the smallest observations
- Its purpose is to measure the dispersion between the highest and lowest values of a data set

Range = Maximum Observation – Minimum Observation

Deviation

- Deviation is the distance between a data point and the mean
- Its purpose is to measure and describe the variation in a set of data

Standard Deviation

Measure of the average distribution about the mean

Standard Deviation (σ) Formula for the Population

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N} (X_i - \mu)^2}{N}}$$

$\sum_{i=1}^{N}$ **= Sum all values from the first to last**

Standard Deviation

Measure of the average distribution about the mean

Standard Deviation (s) Formula for samples

$$s = \sqrt{\frac{\sum_{i=1}^{N} (X_i - \bar{X})^2}{N - 1}}$$

$\sum_{i=1}^{N}$ **= Sum all values from the first to last**

Distributions

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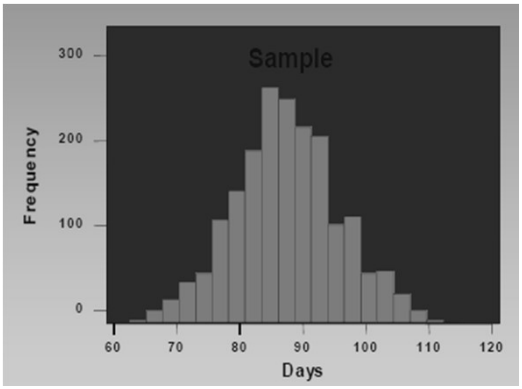
Data Frequency Plot

- A data frequency plot is a visual display of a set of measurements showing:
  - General location
  - Spread
  - General shape of data distribution



600 observations of aging in account receivables

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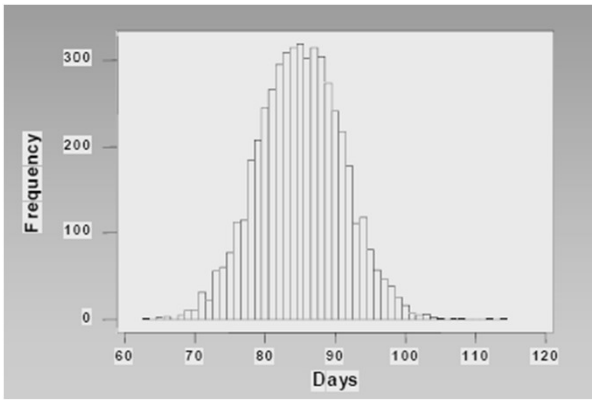
Approaching a Continuous Distribution



5,000 observations of aging in account receivables

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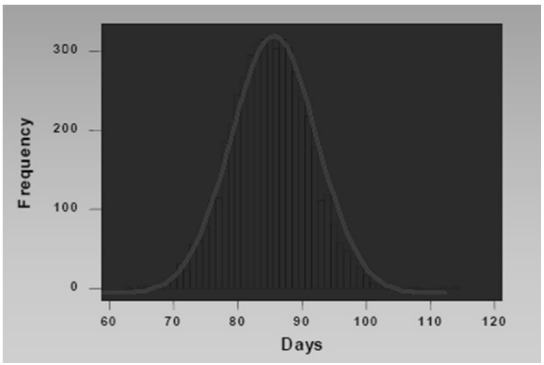
Approaching a Continuous Distribution

Imagine the grouping interval in the histogram to be made smaller and smaller until the distribution becomes continuous…



5,000 observations of aging in account receivables

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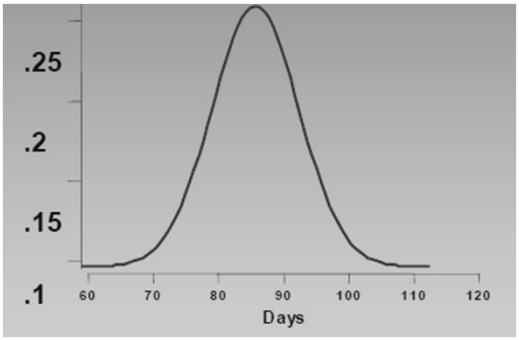
Probability Distribution

Area under curve can be used to estimate the occurrence probability of an *"event".*



The area under the curve is 100%

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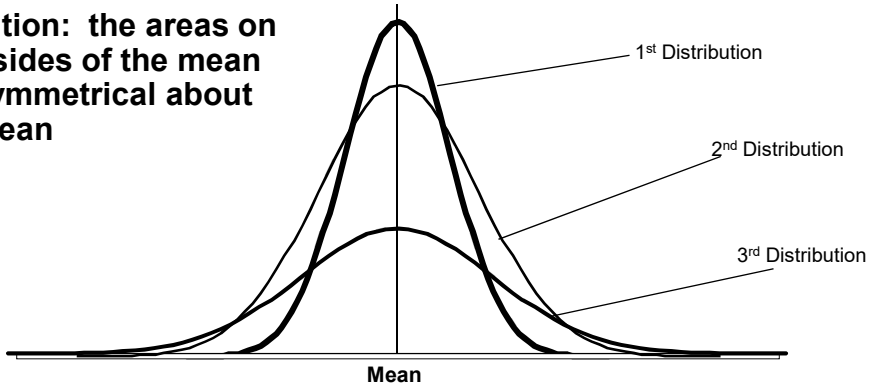
Normal Distribution

Definition: the areas on both sides of the mean are symmetrical about the mean



The means are the same but the standard deviations differ

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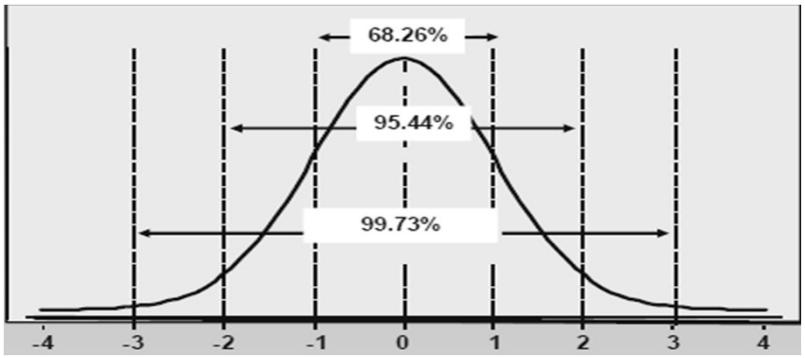
The Standard Normal Curve

The standard normal curve is a special case of the normal distribution where the mean = 0 and the standard deviation = 1



95% of the population is within approximately +/- 2 standard deviations of the mean

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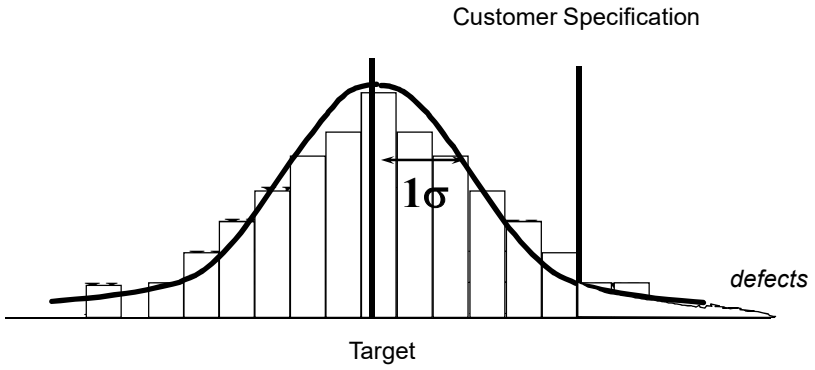
The sigma of the process

Every human activity has variability....



Comparing process variation and customer specification is the essence of Six Sigma

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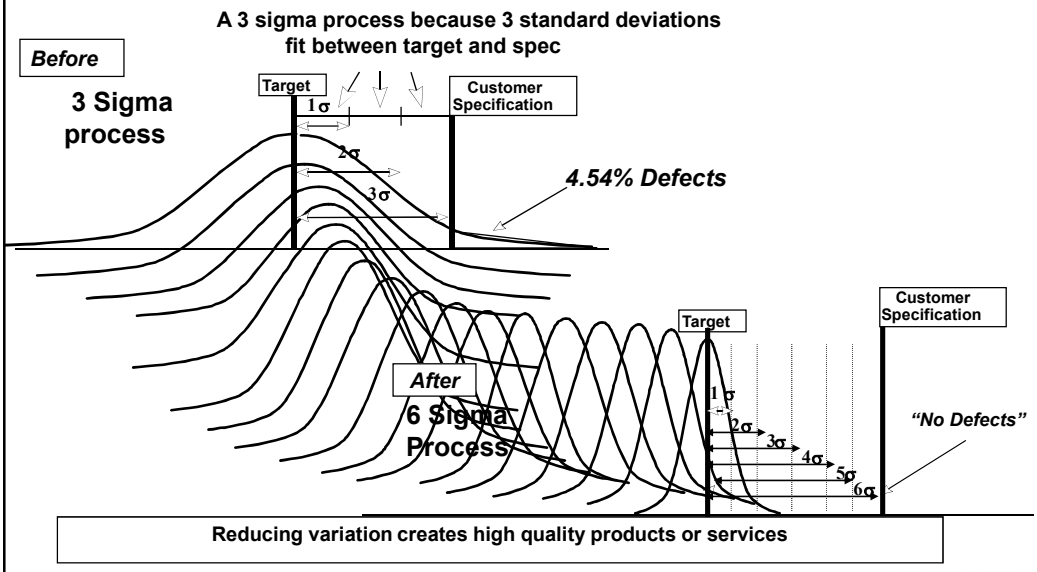
The six sigma concept



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What is 6 sigma ?

- A measurement scale which compares the output of a process to the customer's requirements

Process Sigma	2	3	4	5	6
Defects Per Million Opportunities (DPMO)	308 537	66 807	6 210	233	3.4

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Compute Process Sigma

Key Definitions

Unit: the item produced or processed

Form

Defect: any event that does not meet the specification of a CTQ as defined by the customer

Critical field with missing Information

Defect opportunity: any event which can be measured that provides a chance of not meeting a customer requirement (specification)

 # Critical fields on the form

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Calculate process sigma : formula

Calculate the number of Defects Per Million Opportunities

$$DPMO = \frac{\text{(No. of Defects)}}{\text{No. Of Units x No. of opportunities}} \times 1\,000\,000$$

In the Sigma table, look at the Sigma value relating to the DPMO determined

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Conversion Table

Long term Yield Rendement Long terme	Process Sigma Sigma du processus	Defects per 1,000,000 Défauts par 1.000.000	Long term Yield Rendement Long terme	Process Sigma Sigma du processus	Defects per 1,000,000 Défauts par 1.000.000
99.99966%	6.0	3.4	93.320%	3.0	66,800
99.9995%	5.9	5	91.920%	2.9	80,800
99.9992%	5.8	8	90.320%	2.8	96,800
99.9990%	5.7	10	88.50%	2.7	115,000
99.9980%	5.6	20	86.50%	2.6	135,000
99.9970%	5.5	30	84.20%	2.5	158,000
99.9960%	5.4	40	81.60%	2.4	184,000
99.9930%	5.3	70	78.80%	2.3	212,000
99.9900%	5.2	100	75.80%	2.2	242,000
99.9850%	5.1	150	72.60%	2.1	274,000
99.9770%	5.0	230	69.20%	2.0	308,000
99.9670%	4.9	330	65.60%	1.9	344,000
99.9520%	4.8	480	61.80%	1.8	382,000
99.9320%	4.7	680	58.00%	1.7	420,000
99.9040%	4.6	960	54.00%	1.6	460,000
99.8650%	4.5	1,350	50%	1.5	500,000
99.8140%	4.4	1,860	46%	1.4	540,000
99.7450%	4.3	2,550	43%	1.3	570,000
99.6540%	4.2	3,460	39%	1.2	610,000
99.5340%	4.1	4,660	35%	1.1	650,000
99.3790%	4.0	6,210	31%	1.0	690,000
99.1810%	3.9	8,190	28%	0.9	720,000
98.930%	3.8	10,700	25%	0.8	750,000
98.610%	3.7	13,900	22%	0.7	780,000
98.220%	3.6	17,800	19%	0.6	810,000
97.730%	3.5	22,700	16%	0.5	840,000
97.130%	3.4	28,700	14%	0.4	860,000
96.410%	3.3	35,900	12%	0.3	880,000
95.540%	3.2	44,600	10%	0.2	900,000
94.520%	3.1	54,800	8%	0.1	920,000

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Exercise

In plenary.

Calculate the Sigma of your process assuming the problem statement to be correct

- DPMO
- **Process Sigma =**

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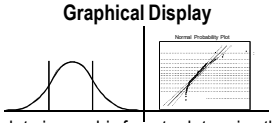
MEASURE

Purpose : **To measure and understand baseline performance** for the current process by collecting reliable data (quantitative & qualitative)

Data Collection

•Develop a data collection plan
- Operational definition
- Sampling

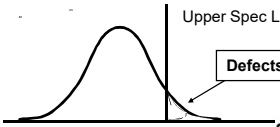
Graphical Display



•Display data in graphic form to determine the type of distribution, the metrics to understand variation and set goals for the improvement strategy.
- Normal Distribution described by Mean and Standard deviation
- Skewed Distribution described by Q1 (or Q3) and Inter Quartile Range
- Long tailed distribution described by Median and Span 5-95

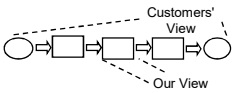
Calculate Process Sigma

Defects "Outside" Spec Limit



•Compute baseline sigma

Customer oriented mindset



•Select the measure your customer uses to judge your performance (Key Output Measure Y)
•Plan to collect CONTINUOUS data

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Module 4: Analyse Phase

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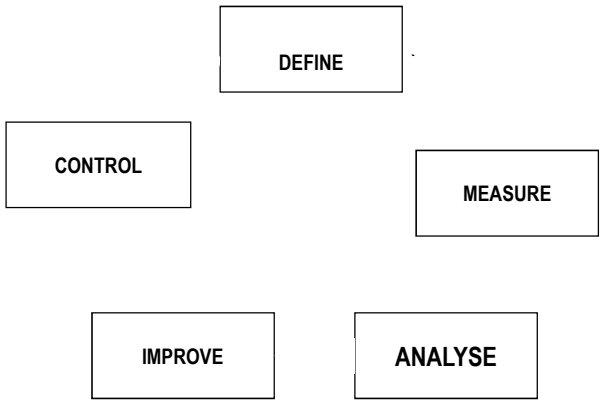
DMAIC : An Improvement Methodology



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Analyse Phase

Objective :

- Identify problem's root causes through process and data analysis

Steps :

- Cause and Effect Diagram
- Control Impact matrix
- Pareto chart
- Value analysis in using process map

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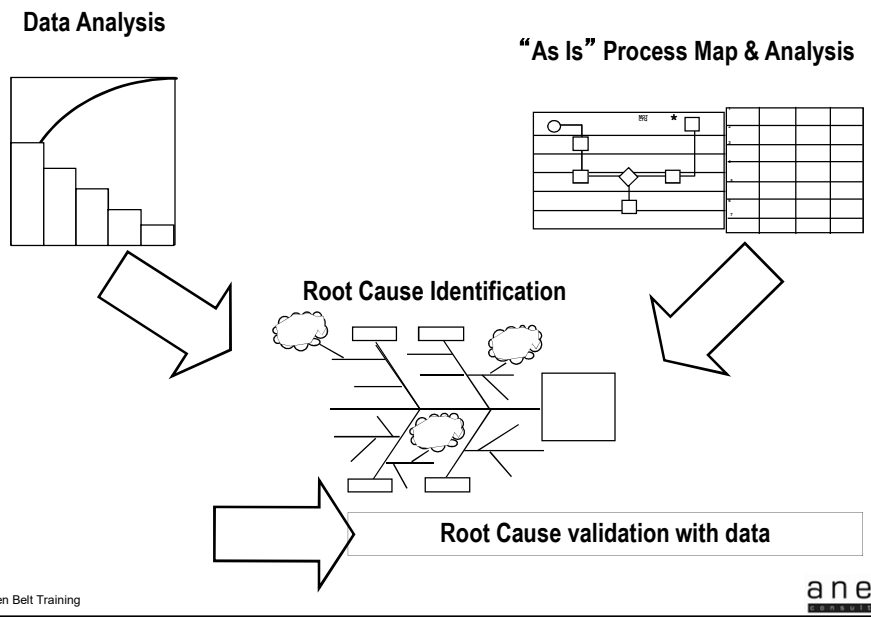
Analyse roadmap



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Analyse Phase

Consolidating the analyses prior to root causes validation

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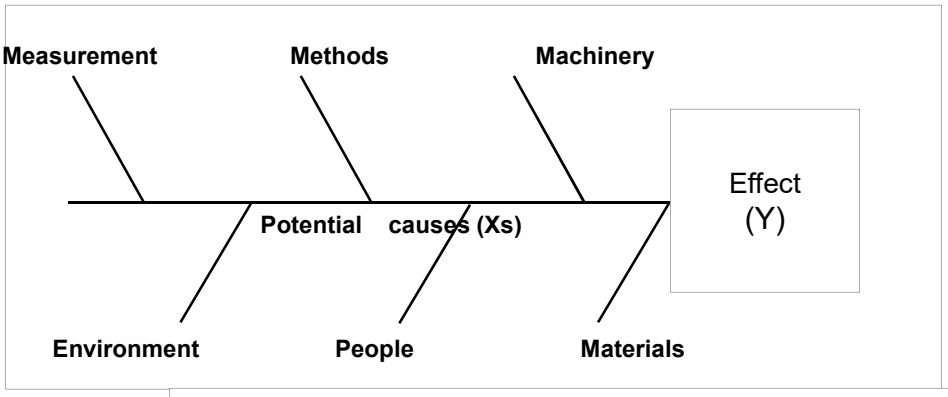
Cause & effect diagram



- Summarise potential causes
- Allows identification of root causes
- Potential root causes need to be validated by data

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Prioritisation of Xs: Control / Impact Matrix

Y=f (X1, X2, …, Xn)

CONTROL	IMPACT: High	IMPACT: Medium	IMPACT: Low
In Our Control			
Out Of Our Control			

- Classify your Xs coming from your C/E Diagram (Fishbone Diagram).

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Analyse

Usage of Graphs in Minitab: Following Rules apply

- *Analysing Single Column:*
  - Continuous / Variable Data: **Graphical summary (Histogram)**
  - Attribute Data: **Pareto Chart**
- *Analysing Two Columns:*
  - Continuous + Attribute: **Box Plot, ANOVA, 1-t, 2t,paired t**
  - Continuous + Continuous: **Scatter Plot, Regression**
  - Attribute + Attribute: **Pareto Chart, Chi Square, 1-p, 2-p**

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Analyse

Analyse data : Pareto chart

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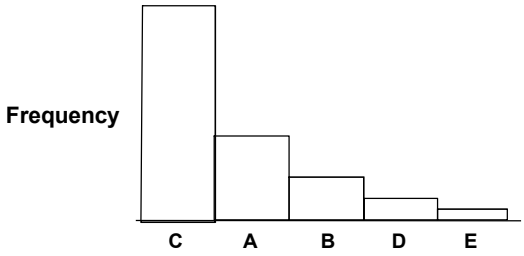
Pareto chart

Definition

A tool to graphically represent the discrete data in categories and identify the few causes basic to most of the defects (the 80 / 20 principle)



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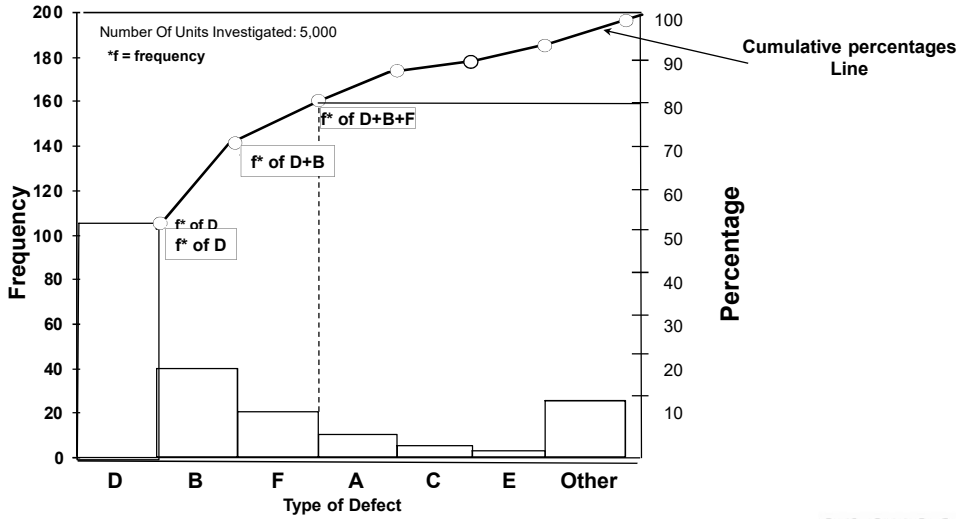
Example

Pareto chart example



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Analyse

Analyse process mapping

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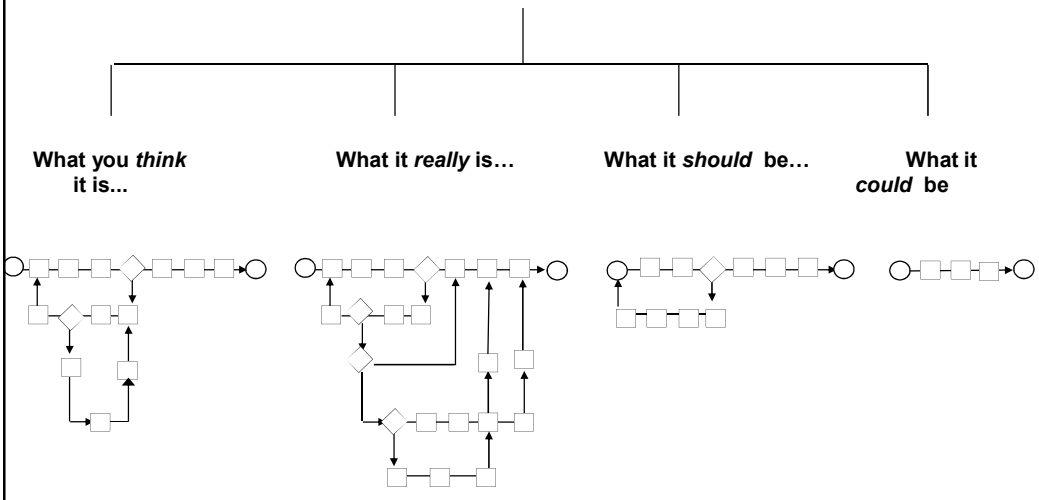
Versions of a process



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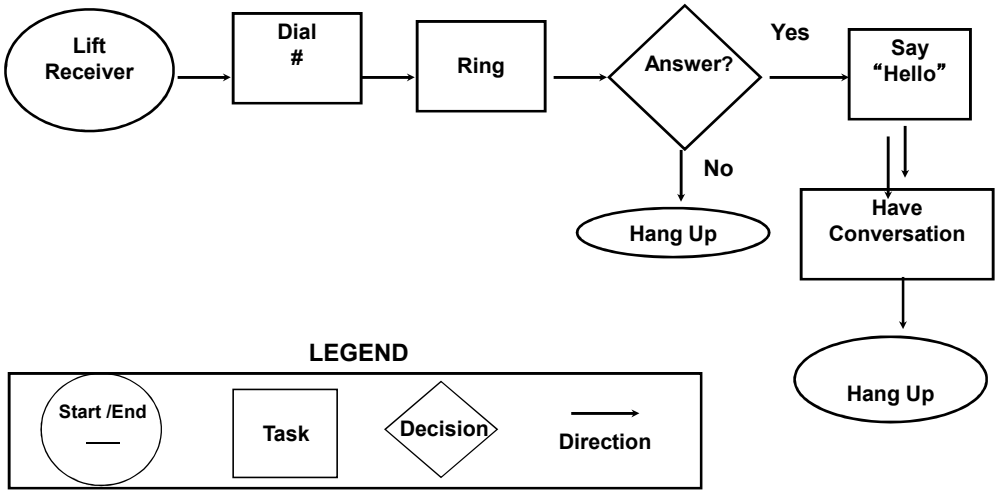
Process flowchart conventions



Green Belt Training

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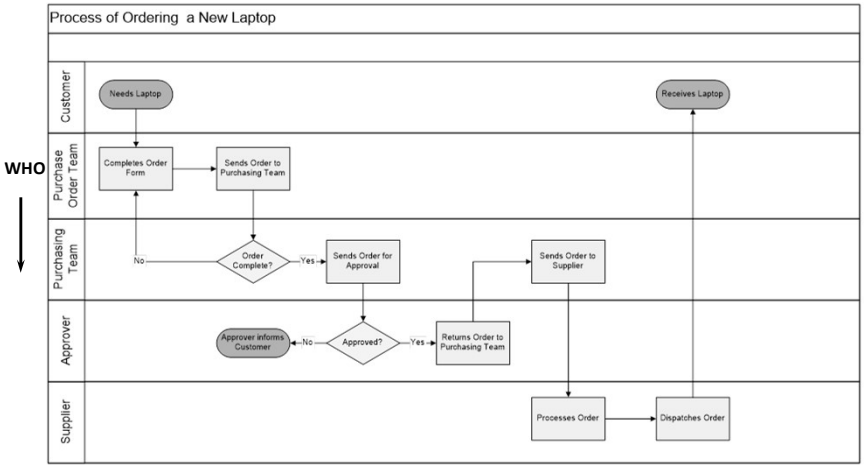
Analyse

Process Mapping

Cross Functional Flowchart



Define | Measure | Analyse | Improve | Control

Green Belt Training

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Process mapping analysis

Types of analysis

- Moments of truth
  - At what moment does the customer get an impression about the process?
- Nature of work
  - Which tasks really add value?
- Work flow
  - How much active time and waiting time in the process?

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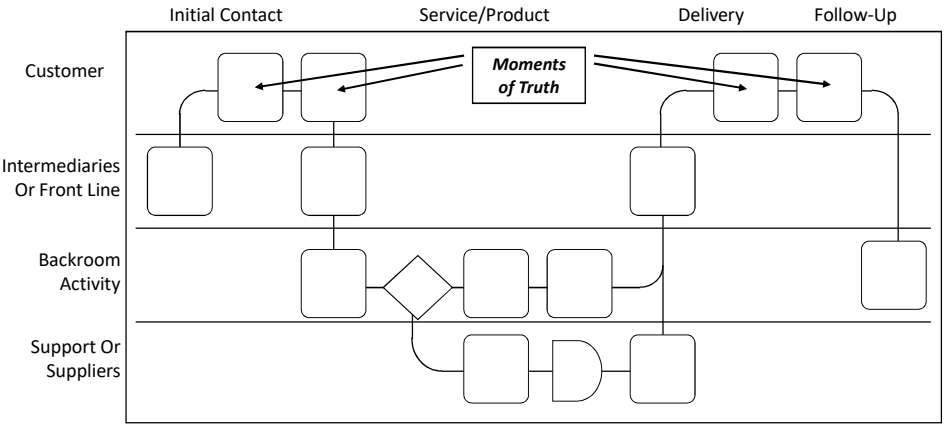
Process Mapping: Moment of Truth

Analyse

Process Analysis

A Typical Deployment Flow Chart



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Analyse
Process Mapping: Flow of Work

Process Time

+ **Delay Time**

Cycle Time

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Analyse
Process Mapping

Cycle Time = 1719 minutes

▪Processing Time: Total 39 minutes

20 mins	5 mins	10 mins	4 mins	▪0 mins
Review file and approve for payment	**Team Leader authorises payment**	**Print and fulfil cheque**	**Post cheque**	**▪Customer receives**

480 mins | 240 mins | 120 mins | 840 mins

+ Delay Time: 1680 minutes

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Analyse
Process Mapping: Nature of Work (Value Added/ Non Value Added Activity)

3 criteria to qualify a task “with added value” from the customers' point of view

- The step transforms the input (product or service) and brings it closer to completion
- The step is performed right the first time
- The customer is willing to pay for this step

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7 (8) Wastes (Muda)

- Intellect
- Scrap / Rework / Defect/ Errors
- Waiting
- Inventory
- Motion / Movement
- Transportation
- Over processing
- Overproduction

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Analyse

- Wastes

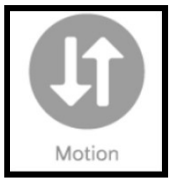
8 Wastes- Examples

Unnecessary movement of products and materials

Example: *Movement of first set of approvals documents from one location to another within or outside office premises*

Excess materials that the customers or employees do not need right now

Example: *Approval Files and documents awaiting to be processed*



Unnecessary movement by people

Example: *BMs hand carrying first set of documents for approval to Hub*

Wasted time waiting for next steps in process

Example: *BM Waiting for Fast Track application to retrieve information*

Production that is more than needed or before it is needed

Example: *Collection of more approval paperwork for an F&I loan*

More work or higher quality than is required by the customer

Example: *Follow-ups and costs associated by coordination between Hub and Banks*

Efforts caused by rework, scrap and incorrect information

Example: *Rejected and returned documents due to lack of complete set of documents from Hub to BM*

Underutilising people' s talents, skills and knowledge

Example: *Employing people in the wrong position*

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ESCAP Analysis

All the process steps are evaluated based ESCAP criteria.

It is checked if following can be done to any of the steps :

- Eliminate
- Simplify
- Combine
- Automate
- Parallel

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Module 5: Improve Phase

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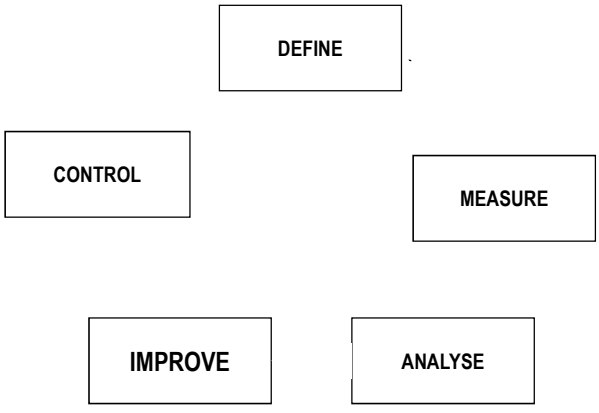
DMAIC : An Improvement Methodology



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Improve

Objective :

Determine new improved process design

Steps :

Generate solutions

Select and test solutions

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Idea Generation: Creativity approaches

- Process benchmarking
  - Compare the performance of an existing process against other companies' "best in class" practices (same market or not)
  - Determine how those companies are organised to deliver these performance level
- Best practices
  - Use company data
- Brainstorming
  - Brainstorming with post it notes, channelled brainstorming, anti-solution etc

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Brainstorming

Pre-requisites of Brainstorming

- Purpose of Brainstorming
- Participants (From the process / not from the process)
- Facilitator
- Stationery
- Selection of tool of brainstorming
- Meeting room
- Facilities
- Communication to participants about time, venue, topic in advance

Brainstorming

Rules of Brainstorming

- **Equal opportunity to everyone to participate**
- **Capture all the ideas (Document)**
- **Leave your designation and ego along with your shoes outside meeting room**
- **Non threatening environment to be created**
- **Ensure that there are no disturbances**
- **Focus on the topic (Create parking lot)**
- **Fantasize freely (Do not put breaks on your thoughts)**
- **Watch your time!**
- **Defer evaluation (Do not discuss ideas)**
- **Generate Quantity, do not worry about Quality**

Brainstorming

Types of Brainstorming

- **Round Robin**
- **Anti Solution**
- **6-3-5**
- **6 Thinking Hats**

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Brainstorming Methods

1. Round Robin

- Everyone gets a chance to put forth his/her idea If they do not have to contribute an idea, they just say pass.
- This goes on till all the participants have exhausted their ideas.

2. Anti Solution

- Team brainstorms on how to increase the problem rather than solving it.
- The brainstormed ideas are reversed to get the solution.

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3. 6-3-5

- The 6-3-5 method is another brainstorming technique
  - that generates and develops ideas
  - by asking up to six participants to write, within five minutes, three ideas on separate cards or pieces of paper.
  - These cards or paper are then passed along to other participants for further refinement or additional ideas.
- Each round lasts for 5 minutes and the 6 participants are asked to generate up to 3 ideas per round.

Six Thinking Hats

- In his book, Six Thinking Hats, Edward de Bono asks you to imagine six colored hats.
- Each hat represents a role your mind plays in the critical thinking process.
- By switching from one hat to another as you think about your topic, you are forced to look at your topic from a variety of perspectives.

Six Thinking Hats

- For the exercise, start with six sheets of paper, one for each hat.
- Select a topic or problem that you would like to think about or work on.
- Decide which of the hats would be good to start with and work your way through all six, jotting down notes on the thoughts that come to you with each hat.
- The key point is that a hat is a direction to think rather than a label for thinking.

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Six Thinking Hats

Hat	Characteristics	Questions
White hat:	Used to think about facts, figures, and other objective information (think of a scientist's white lab smock).	What facts would help me further in making a decision? How can I get those facts?
Red hat:	Used to elicit the feelings, emotions, and other non-rational but potentially valuable senses, such as hunches and intuition (think of a red heart). The red hat gives full permission to a thinker to put forward his or her feelings on the subject at the moment.	How do I really feel? What is my gut feeling about this problem?
Black hat:	Used to discover why some ideas will not work, this hat inspires logical negative arguments (think of a devil's advocate or judge robed in black). The black hat is used to point out why a suggestion does not fit the facts, the available experience, the system in use, or the policy that is being followed. The black hat must always be logical.	What are the possible downside risks and problems? What is the worst-case scenario?
Yellow hat:	Used to obtain the positive outlook, this hat sees opportunities, possibilities and benefits (think of the warming sun). Why something will work and why it will offer benefits.It can be used in looking forward to the results of some proposed action, but can also be used to find something of value in what has already happened	What are the advantages? What would be the best possible outcome?
Green hat:	Used to find creative new ideas, alternatives, proposals, what is interesting, provocations and changes (think of new shoots sprouting from seeds).	What completely new, fresh, innovative approaches can I generate? What creative ideas can I dream up to help me see the problem in a new way?
Blue hat:	Used as a master hat to control the thinking process (think of the overarching sky, or a "cool" character who's in control). It looks not at the subject but at the 'thinking' about the subject. 'Putting on my blue hat, I feel we should do some more green hat thinking at this point.'	Review my thoughts. Sum up what I've learned and think about what the next logical step is

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Solution Selection Matrix
Select among Possible Solutions Using Objective Criteria

	Criteria	Weight	Solution A		Solution B		Solution C	
			Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
1				0		0		0
2				0		0		0
3				0		0		0
4				0		0		0
5				0		0		0
6				0		0		0
	TOTAL			0		0		0

Where **weight** and **scores** on following scale : High = 9, Medium = 3 and Low = 1.

Conclusions:

Criteria are the requirements that you want your solution to meet. Some criteria are "must" criteria. Any solution that does not meet even one of the "must" criteria must be eliminated

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Solution Selection Matrix

	Criteria	Weight	Solution A		Solution B		Solution C	
			Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
1	cheap solution	3	3	9	9	27	9	27
2	quick to implement	3	9	27	1	3	3	9
3	high impact on CTQs	9	9	81	9	81	9	81
4	compliant	9	1	9	9	81	9	81
5				0		0		0
6				0		0		0
	TOTAL			126		192		198

Where **weight** and **scores** on following scale : High = 9, Medium = 3 and Low = 1.

Example(s):

Example :

Solution A = outsource all data processing

Solution B = development of our own software

Solution C = buy a software and adapt to our needs

It seems here that solution C is the most satisfying. B also can be considered as an option.

Criteria are the requirements that you want your solution to meet. Some criteria are "must" criteria. Any solution that does not meet even one of the "must" criteria must be eliminated

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Improve

Introduction to FMEA

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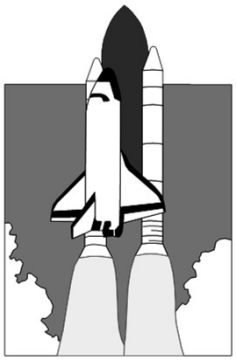
Failure Modes and Effects Analysis



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Definition - FMEA

- *A structured approach to:*
  - identifying the ways in which a product or process can fail
  - estimating the risk associated with specific causes
  - prioritizing the actions that should be taken to reduce the risk
  - evaluating the design validation plan (Product) or the current control plan (Process)
- *Primary Directive:* Identify ways the product or process can fail and eliminate or reduce the risk of failure

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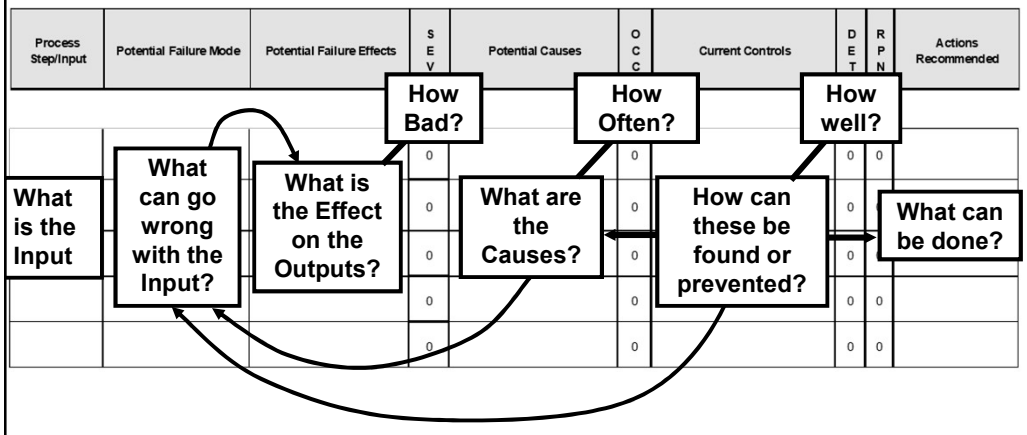
Overview



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Definition of Terms

- Failure Mode
- Effect
- Cause
- Current Controls
- Severity, Occurrence, Detection
- Risk Priority Number (RPN)

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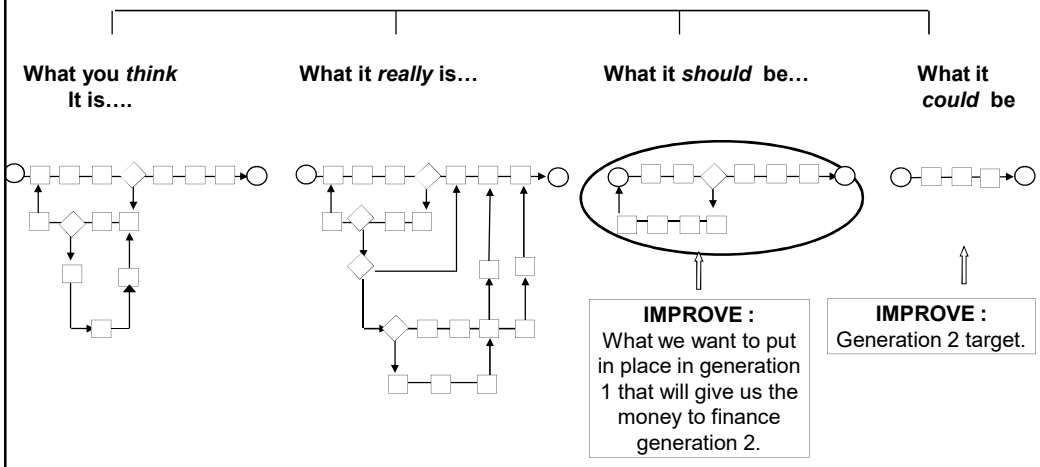
Continuous Improvement



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Benefits of doing a pilot

- Improve the solution that meets customer requirements
- Refine implementation plan
- Lower risk of failure by identifying and fixing possible problems ahead of time
- Confirming expected results and relations between predictive parameters and results (Xs on Y)
- Increase opportunities to receive feedback and buy-in
- Implement the solution earlier and faster for a particular customer segment

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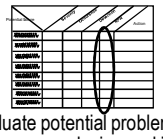
IMPROVE

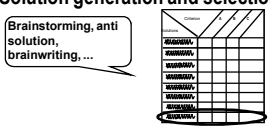
Purpose : **To determine new improved process design** through idea generation, selection, process design, solution testing , and improvements implementation.

Solutions Refinement



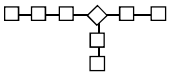
Evaluate potential problems in new process design and improve robustness of this design

Solution generation and selection



Generate solutions to address the root causes and develop criteria to screen and select solutions (including cost / benefit)

New Process



Develop a "should be" process map showing the impact of the solution

Pilot

Pilot the solution on a small scale to increase buy-in and improve overall implementation

Perform cost / benefit analysis of proposed solution

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Module 6: Control Phase

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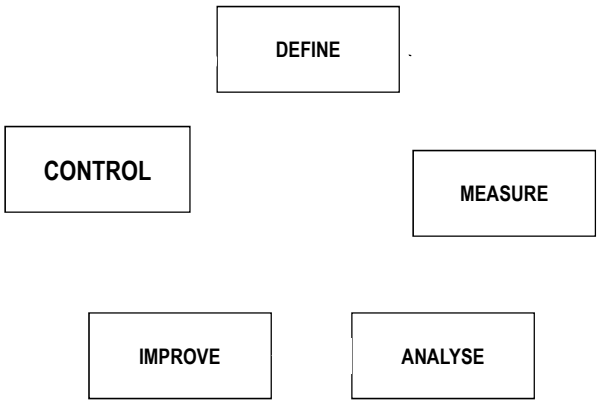
DMAIC : An Improvement Methodology



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Control

Objective :

- Ensure improvement over time

Steps :

- Create control tools (documentation and dashboard)
- Organise process reviews by Process Owner

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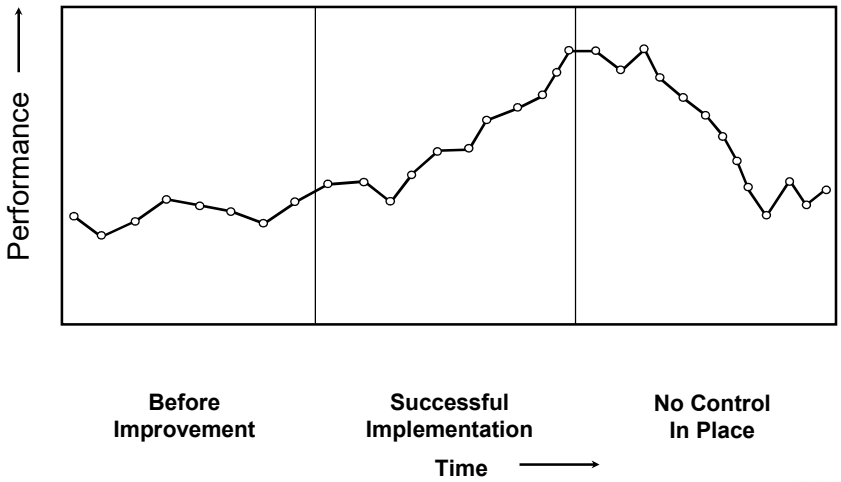
Control = ensure gains over time



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CONTROL = ensure gains over time

The CONTROL phase naturally leads to Process Management as the purpose of that phase is to deliver the tool set for ongoing management of the process performance by Process Owner.

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CONTROL = implement process management

- Process Management Chart
  - process owner's name
  - process documentation (process mapping, persons involved)
  - customer performance criteria
  - key measures to track, follow and analyse (output, process, input, financials)
- Dashboards
  - graphical display of measurements collected
- Process performance reviews
  - frequency according to process cycle time
- Response plan
  - quick fixing of special causes
  - opportunities for ongoing improvement, i.e. new DMAIC projects

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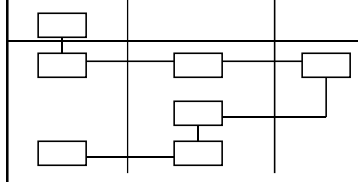
Process Management Chart **Example**

Process Owner Name: _____ Date:_____

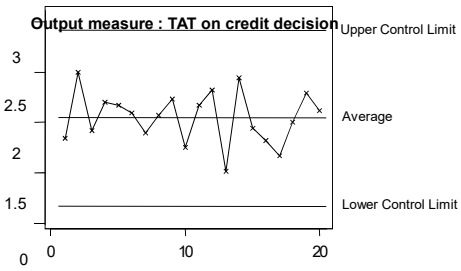
Process Name: New Account Opening

Process Map

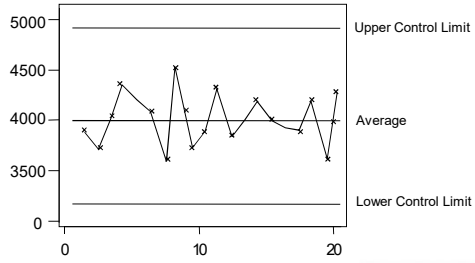


Check The Process			Act/Fix Problem	
Output, Process or Input Measure	Target	Data collection method	Immediate Control/Fix	Process/System Improvement
•TAT on credit decision	• < 2.5 min.		•Analyse if common cause or special cause variation. Make sure process is in control (within control limits) and capable (within customer specification limits)	•When process not in control, analyse variation and fix issues. •When process in control but no more capable, launch a new improvement project.
•% of approvals	• > 85%			
•# of applications per day	• > 3500			
•# Store team meetings / month	• > 3			
•# of training sessions / store staff	• > 3			

Output measure : TAT on credit decision



Input measure : # of applications per day



Green Belt Training

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Five S

Green Belt Training

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What Are The Five S's?

- Sorting
  - Selecting or separating
- Simplifying
  - Straighten and store
- Sweeping
  - Scrub and shine
- Standardizing
- Self discipline
  - Systematize

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Mistake Proofing (Poka-Yoke)

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What Is Mistake Proofing (Poka-Yoke)?

- Japanese phrase:
- Yokeru (to avoid), Poka (errors)
- A strategy for preventing errors in processes
- Makes it impossible for defects to pass unnoticed
- Corrects problems as soon as they are detected
- Technique detects defects
- Prevents defects from moving into next area
- Developed by Dr. Shigeo Shingo to achieve zero defects

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Statistical Process Control for Variables Data (SPC)

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Introduction to SPC

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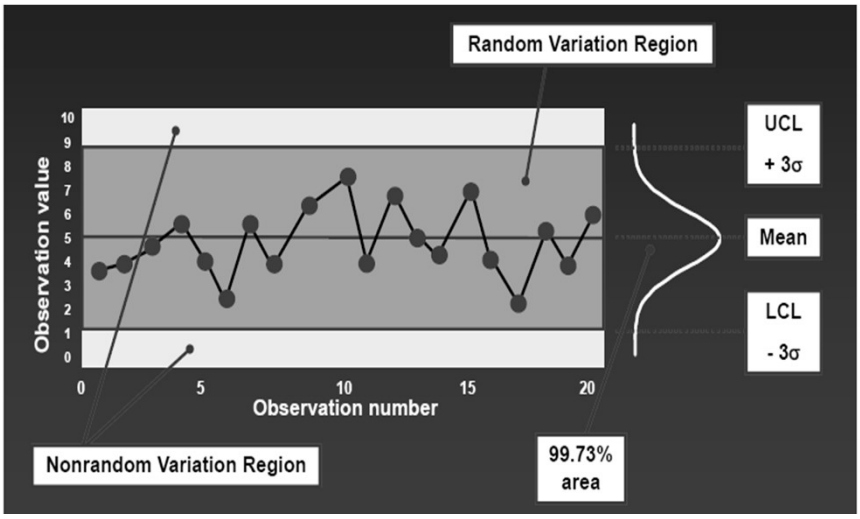
Statistics of a Control Chart



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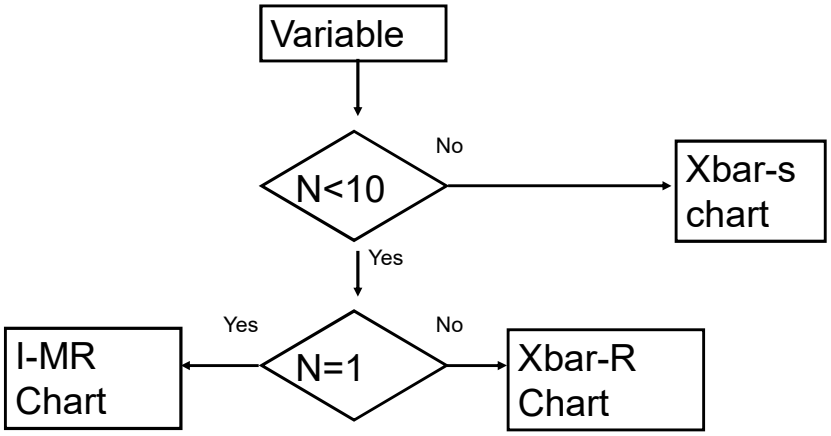
Control Chart Roadmap



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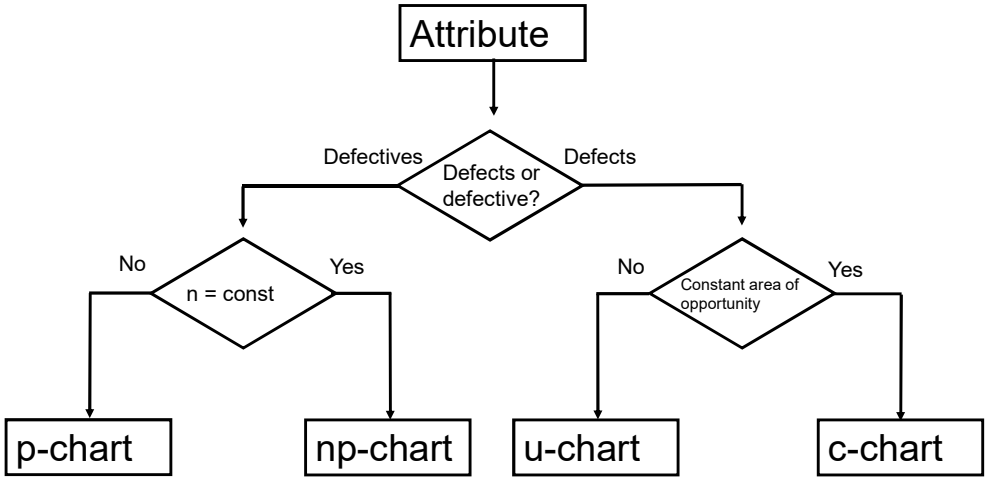
Control Chart Roadmap



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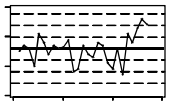
CONTROL

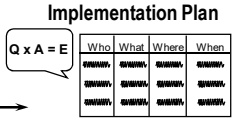
Purpose: **To ensure improvement effectiveness over time** by institutionalisation of the improvement and implementation of ongoing monitoring and reviews.

Monitoring Plan



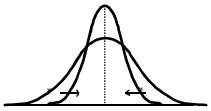
Develop a monitoring plan to insures gains are held over the long term

Implementation Plan



Develop a full implementation plan including project and change management elements

Process Capability



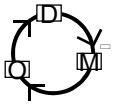
Monitor the process according to plan. Chart data as evidence that process is in control and meeting customer specifications

Documentation / Standardization

Document the process with process maps & procedures to assure the solution becomes part of daily work

Address appropriate changes to broader systems and structures to institutionalise the improvement

Continuous Improvement



- Process ownership to Process Owner (Process Management chart to facilitate transfer)
- Process Owner to held regular process reviews based on dashboards.
- Process Owner to take action when process does not deliver what is expected
- Process has entered Process Management = Define, Measure , Operate.

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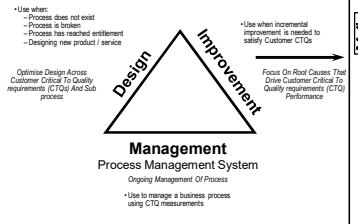
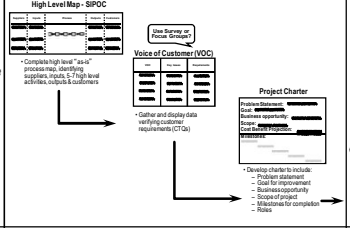
The DMAIC Storyboard : Six Sigma for Process Improvement

The Three Dimensions Of Process Focus



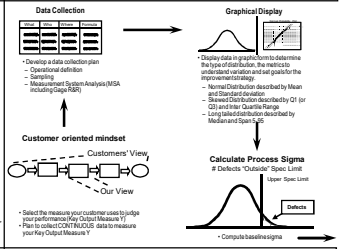
Define

Purpose: **To set set direction for improvement project** by developing a team charter. To defining the customers and their requirements (Critical To Quality = CTQs), mapping the high level business process to be improved.



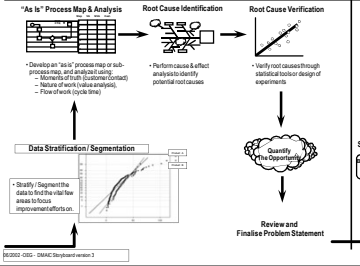
Measure

Purpose: **To measure and understand baseline performance** for the current process by collecting reliable data (quantitative & qualitative).



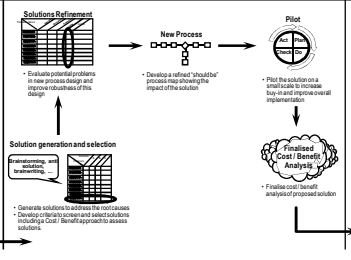
Analyse

Purpose: **To identify root causes of the problem and opportunities for improvement** by analysing the data and the process.



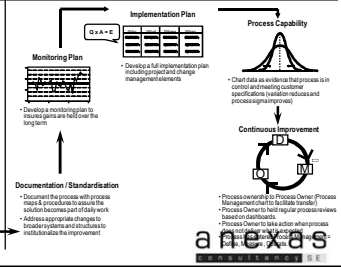
Improve

Purpose: **To determine new improved process design** through idea generation, selection, process design, solution testing , and improvements implementation.



Control

Purpose: **To ensure improvement effectiveness over time** by institutionalisation of the improvement and implementation of ongoing monitoring and reviews.



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