

GREEN BELT ABBREVIATIONS AND OTHER SUMMARY:

1. **VOC** – Voice of Customer
2. **CTQ** - Critical to Quality (Characteristics)
3. **CTP** - Critical to Process (Inputs & Factors)
4. **RCO Prevention**
 - Reduce Chance of Occurrence: Does not Allow defect to occur.
5. **ICD Prevention**
 - Increase Chance of Detection:
Warning arrangement to warn us before defect occurs.
6. **C.A.:** Corrective Action
7. **P.A.:** Preventive Action
8. **Q (PQ + SQ):** Quality (Product Quality + Service / Support Quality)
 - C:** Cost
 - D (S):** Delivery (Schedule).
9. **DMAIC:** Define – Measure – Analyze – Improve – Control.
10. **SIRPORC (SIPOC):**
 - Supplier – Input – Requirements (of Process) – Process Substep –Output – Requirements (of Customer) – Customer
11. **MSA:**
 - Measurement System Analysis for calibration before measurement / collection of data.
12. **RVA:** Real Value Addition
 - BVA:** Business Value Addition
 - NVA:** Non Value Addition
13. **SOP:** Standard Operating Procedure
14. **WI:** Work Instruction
15. **PDCA:** Plan – Do – Check – Act (Developed by Dr. Deming)
16. **Tollgate Review:**
 - Review carried out jointly by Champion, BB, GBs during the DMAIC phases.
17. **FMEA:** Failure Mode & Effect Analysis
(Used for Risk Assessment & Risk Reduction).

a) **Central Tendency:**

* **Mean:**

The mean is the **average reading of the** values within a data set.

* **Median:** is the Midpoint of the distribution of the data
i.e. 50% readings above and 50% readings below.

- If number of **data points (n) is even**,
then median is the average of the $n/2$ th and $(n/2 + 1)$ th reading.
- If number of **data points (n) is odd**, then median is the $(n + 1)/2$ th reading.

* **Mode:** The most often occurring value in the data set.

b) Range = $(X \text{ max} - X \text{ min})$ represents = **spread** of the distribution.

c) Standard Deviation represented by **Greek letter Sigma (σ)** or "**s**":

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

for a **Population** data.

Where: **N** = number of observations (population size).

$$s = \sqrt{\frac{(x_1 - \bar{X})^2 + (x_2 - \bar{X})^2 + \dots + (x_n - \bar{X})^2}{(n - 1)}}$$

for a **sample** data.

where, x_1 , x_2 , x_n are the observations

and **n** = number of observations (sample size).

d) **Defects Per Unit (DPU) and DPMO:**

DPU is the number of defects in a given unit of product or process.

$$\text{DPU} = \frac{\text{No. of defects}}{\text{No. of units processed}}$$

Defects Per Million Opportunities (DPMO):

$$\text{DPMO} = \text{DPU} \times \frac{1,000,000 \text{ (1.0 Million)}}{\text{Opportunities for error in that unit}}$$

e) Total Cost of Quality:

TOTAL COST OF QUALITY			
Cost of Non-Conformance (Cost of POOR Quality)		Cost of Conformance	
Internal Failure Cost	External Failure Cost	Cost of Appraisal	Cost of Prevention
+ Hidden Cost	+ Hidden Cost	---	---

f) Seven Tools of Quality:

FLOWCHART – MAKES PROCESS STEPS VISIBLE

- VALUE ANALYSIS, APPRAISAL, PREVENTION

CHECKSHEET – DATA RECORDING DEVICE (COUNT DATA)

PARETO CHART – PRIORTIZATION TOOL (COUNT DATA)

- VITAL FEW, TRIVIAL MANY
- HELPS TO FIND ROOT CAUSES
- HELPS TO FIND CTQs and CTPs

HISTOGRAM – FREQ. OF DATA DISTRIBUTION (FOR CONTINUOUS DATA)

- CENTRAL TENDENCY: MEAN / MEDIAN / MODE
- RANGE
- MULTI MODES.

FISHBONE DIAGRAM – BRAIN STORMING

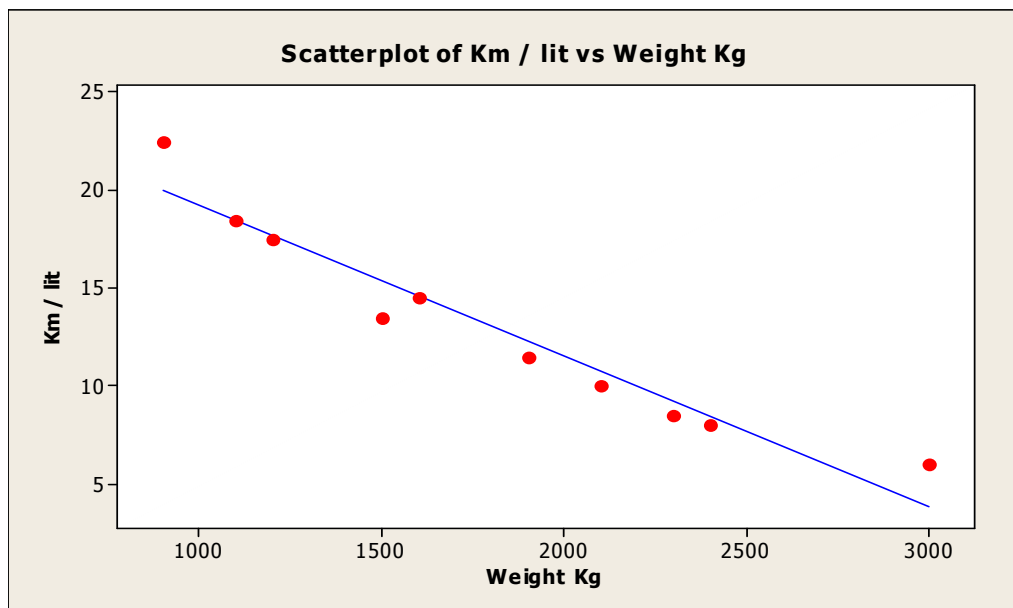
- ROOT CAUSE ANALYSIS
- MULTI-VOTING (NOMINAL GROUP TECHNIQUE)

CONTROL CHART – TO CHECK IF PROCESS IS CAPABLE

- TO CHECK IF PROCESS IS IN CONTROL.

SCATTER DIAGRAM – CORRELATION BETWEEN TWO VARIABLES
[RELATION OF CTQ WITH CTP(s)]

- CORRELATION COEFFICIENT (r).



g) Co-relation Coefficient – How to Interpret:

Strong Co-relation	Weak Co-relation	No Co-relation
Most of the points in Scatter Diagram are very close to the best fitting line.	Most of the points in Scatter Diagram are far from the best fitting line.	You cannot draw any type of best fitting line.
Co-relation Coefficient 'r' lies between - 0.7 to -1.0 OR 0.7 to 1.0	Co-relation Coefficient 'r' lies between - 0.3 to – 0.69 OR 0.3 to 0.69	Co-relation Coefficient 'r' lies between 0.0 to – 0.29 OR 0.0 to 0.29
CTP	NOT CTP	NOT CTP

h) Short Term Process Capability Index:

$$C_p = SW / PW = SW / 6\sigma$$

Where: Specification Width (**SW**) = USL – LSL

$$\text{Process Width (**PW**)} = UCL – LCL = 6\sigma$$

PROCESS IS SAID TO BE CAPABLE ONLY IF Cp IS > 1.

i) Long Term Capability Index:

Cpk = Minimum (Lower) of:

$$\frac{\text{USL} - \text{Mean}}{3\sigma} \quad \text{OR} \quad \frac{\text{Mean} - \text{LSL}}{3\sigma}$$

PROCESS IS SAID TO BE CAPABLE ONLY IF Cpk IS > 1.

j) Kano Model:

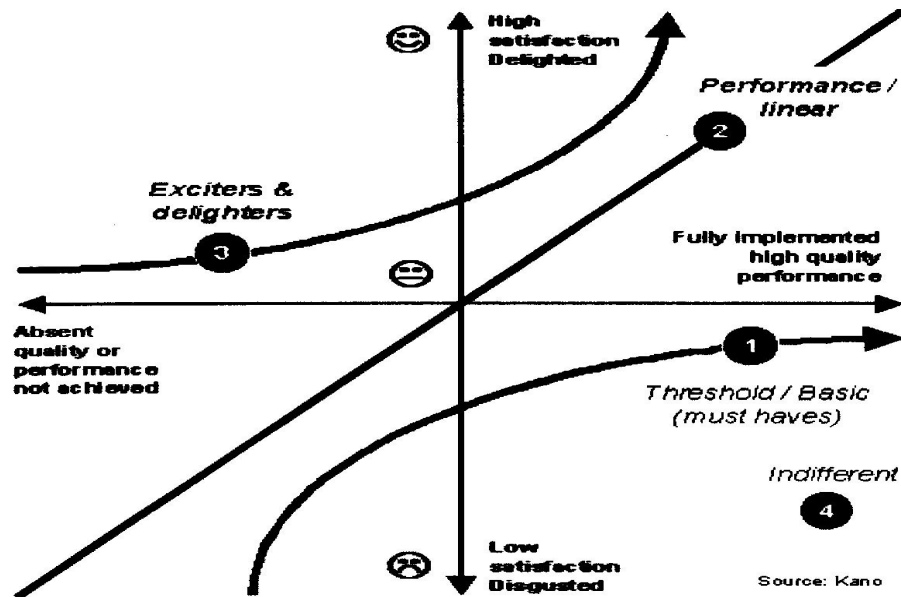


Figure -1: the Kano model

Method:

Kano developed a structured user-questioning methodology to help characterize different features and remove ambiguity by ensuring that categorization is based on user research.

k) F.M.E.A.:

Risk Priority Number (RPN) = Severity x Occurrence X Detection

Rating Scale:

Very High → Very Low:

- * Severity : 10 → 1
- * Chances of Occurrence : 10 → 1
- * Chances of Detection : 1 → 10

