SPC - in Six Sigma.

From Page [14]

(4) Rules for interpreting Control Chart

→ Process Considered out of Control or likely To go out of Control if

① → one point outside UCL or LCL

② → Seven (or nine) points in the same side of Centre line

③ → Six (or eight) points all increasing or decreasing

(These are indication for assignable Causes)

Control chart acts as ICD

(6) Shift the Mean. (of UCL-LCL)

→ This can happen due to assignable Causes.

→ Cpk is used to indicate This (long Term capability index)

→ Cp (Short Term Capability index) (non shifted process)

$Cpk = \min$ of $\frac{USL - Mean}{3\sigma}$ or $\frac{Mean - LSL}{3\sigma}$

Cpk > 1 process is capable of in shift of mean. (for shifted process)

→ Motorola Targeted much higher level of process Capability

- They reduced PW to $\frac{1}{2}$ SW

So $CP = \frac{SW}{\frac{1}{2}SW} = 2$

- UCL = Mean + 6S

LCL = Mean - 6S

They Called Six Sigma Process.

- in case of CP = 1 → Sigma level = 3x1 = 3 ⇒ defect = 2700
- in case of CP = 2 → Sigma level = 3x2 = 6 ⇒ defect = 0.002
- if process shift 1.5 — Cpk = 1.5 — CP = 3 — Sigma level = 6 → defect = 3.4

Notes

- if no shift in the means Cpk = Cp
- in all other Cases Cpk < Cp

Cpk cannot be greater than Cp

→ Continual improvement

- Process out of control
- Point out of UCL/LCL

or

- Process likely to go out of Control

or

- mean has shifted

Cpk ≠ Cp

→ action :-

Remove assignable Causes using Corrective and Preventive action

→ Breakthrough improvement

- CP ≤ or = 1

Process is not capable to meet requirement

Variation due to inherent Causes is high

→ action :-

Reduce SD which directly depends on non assignable Causes

(16) Chapter 12 Map.

DMAIC Methodology

(A)(A) Page 17 (3)

(1) Six Sigma Methodologies.

(1) Discipline (Ford)
- Problem solving
- RCA, Permanent Corrective Action systemic action
- Continual improvement

(2) DMAIC
1. Problem solving
2. Procen improvent
3. Continual improvent
4. Breakthrough improvent

(3) Design for Six sigma DFSS
- Design for new project / procen
- Redesign of existing product / procen
- design with fewer defect, start with 4.5 sigma level.

(2) DMAIC Procen.

(1) Define.
- Purpose
  - Prepare Plan
  - over Procen
  - map SIRPORC
  - assign Responsibilities.
- Phase
  - Define Customer and CTQ
  - Develop project Charter
  - high level Map
  - assig responsibilities → Roles of the Team
- Step / Tools
  - Voc Kano CTQ definition
  - Problem statement
    - Goal statement
    - Bussiness need
    - Scop / Boundaries
    - Constraints
    - Resources
    - Team Guidelines
    - Preliminary Time line
  - SIRPORC (SIPOC)

check list to Review and go next step.

(2) Measure
- Purpose
  - Gather data for Current / baseline
  - understand the Procen.
- Phase
  - Define defect opportunity unit
  - Identify CTP
  - develop data collecting Plan, Formats to Collect data for CTQ, CTP
  - Validate Measurment Sysiem
  - Collect data / Tabulate present in graph or Charts
  - Calculat Procen Capability / sigma Baseline.
- Steps / Tools
  - CTQ
    - Procen knowledg
    - Benchmarking
  - Pareto
    - Correlation
    - CT Matrix
  - Questionnaires
    - Sampling Plans
  - MSA (Measurment System Analysis)
    - Calibration
  - Check sheet
    - Data sets.
  - CP, CPK, sigma level

review (check list) move to next step

(A) next page (3) 17

chapter 2 map-

① MAIC Methodology.

from Page 16 ③

③ Page 18

from Page 16

Analysis-

- Purpose
  - find Root Cause
  - And
  - Cause and effect relationship
  - analyze process maps.
- Phase
  - Identify Value - Non Value, Critical Point
  - Identify Sources and understand Nature of Variation
  - determine Root Causes.
  - determine vital few Xs
  - Prepare Action plan to explore various Solution for the Cause
- Step/Tools
  - Value analysis
  - review process map
  - flow chart
  - Histogram
  - control chart
  - Box & whisker Plot
  - Cause and effect
  - fishbone
  - ask 5 whys
  - Pareto to Pareto-
  - Correlation analysis
  - regression
  - Design for experiment
  - Hypothesis Test
  - Brain storming
  - SWOT

validate to move to next step

IMPROVE

- Purpose
  - Finalize solution after FMEA
  - Pilot Test
  - implement the Solution
- Phase
  - Develop potential ideas and solution
  - Assess FM of Potential Solution
  - Reduce Risk
  - Plan and execute Solution on pilot
  - Fine Tune
  - Implement complete Solution
  - Check performance after improvement
- Step/Tools
  - Brain storming Dos
  - FMEA
  - Mistake proofing Poka Yoke.
  - Verification
  - Brain storming
  - Validation
  - CP, CPK, DPMO Sigma level.

Validate for next step.

Control

- Purpose
  - Ensure improvement
  - gain and sustained.
- Phase
  - Authenticate calculation for saving achieved.
  - develop and implement Document Plan
  - develop and implement Training Plan
  - Develop and implement Control Plan
  - Plan the audit schedule and Audit requirement
  - Transfer of project to process owner
- Steps/Tools
  - Determine improvement in CP, CPK, Sigma level.
  - Standardized work (SOP, flow chart, etc)
  - Develop new Competencies.
  - control chart to monitor CTQ, CTP,
  - PDCA.

Validate.

(18) Chapter 12

DMAIC Methodology.

(x)(+) from Page 17

(3)

Project charter

a) → problem statement :-
- → quantified description
  - which we faced in proces
  - → include Baseline data
    - example 40% of our delivery
      - is not meeting the Customer requirment
        - 23% reject, 17% late deliver.

b) → Goal statement :
- to be ~~smart~~ SMART
  - ~~S~~mart → Specific
    - Reduce error
    - Cut rework
  - Measurable
    - by 60%
    - by 50%
  - Achievable
  - ~~Rele~~ Realistic
  - Time Bound.
    - with 5 months

c → Bussiness need.
- effecting our Bussineas and costing us SAR XXXX per months and will effect our position as leader in market

d → Scope Boundries
- → in scope
  - delivered to Corporate client
  - → out scope
    - delivered to clients other Than Corporate client

e) → Constraint
- our Team only available 3 days per week

f → Team guidline
- meet at least once per week
- decisions will be Taken by Consensus
  - if not reach, Team leader will make final call.

g → Team Member
- → Mr. --- Champion
- → Mr --- BB
- Mr --- GB

h → Preliminary Plan
- → Defm 3 weeks
- → Measure 4 weeks
- ⋮
- → Control 3 weeks

(4)

Samples for check list to validate each phase (check Book Page 90