DESIGN FOR LEAN SIX SIGMA

K.M.Eazhil
Assistant Professor
Department of Mechanical Engineering
SNS College of Engineering
Coimbatore

KEY SUCCESS FACTORS FOR SIX SIGMA

Committed leadership from top management

Integration with existing initiatives, business strategy, and performance measurement

Process thinking

Disciplined customer and market intelligence gathering

A bottom-line orientation and continuous reinforcement and rewards

Training

SIX-SIGMA METRICS – MEASURING DEFECT RATE

Defects per unit (DPU) = number of defects discovered ÷ number of units produced

Defects per million opportunities (DPMO) = number of defects discovered ÷ opportunities for error × 1,000,000

ESTIMATING DEFECT RATE – PROCESS CAPABILITY INDEX (CP)

USL/LSL : Upper & Lower Specification Limit

Cp = (USL –LSL) / (6σ)

Example : Time to process a student loan application (Standard = 26 working days)

Specification Limits : 20 to 32 working days

σ : 2 working days

Cp = (32 – 20)/ (6*2) = 1.00 (Three Sigma)

CP INDEX AND DPMO

Cp Index	DPMO
1	2,700
1.33	63
1.5	6.8
2	0.002

ESTIMATING PROCESS CAPABILITY INDEX FROM A SAMPLE - CPK INDEX

XBAR : average outcome from a sample

S : standard deviation from a sample

Cpk = min { (USL-XBAR) / (3S),

(XBAR-LSL) / (3S) }

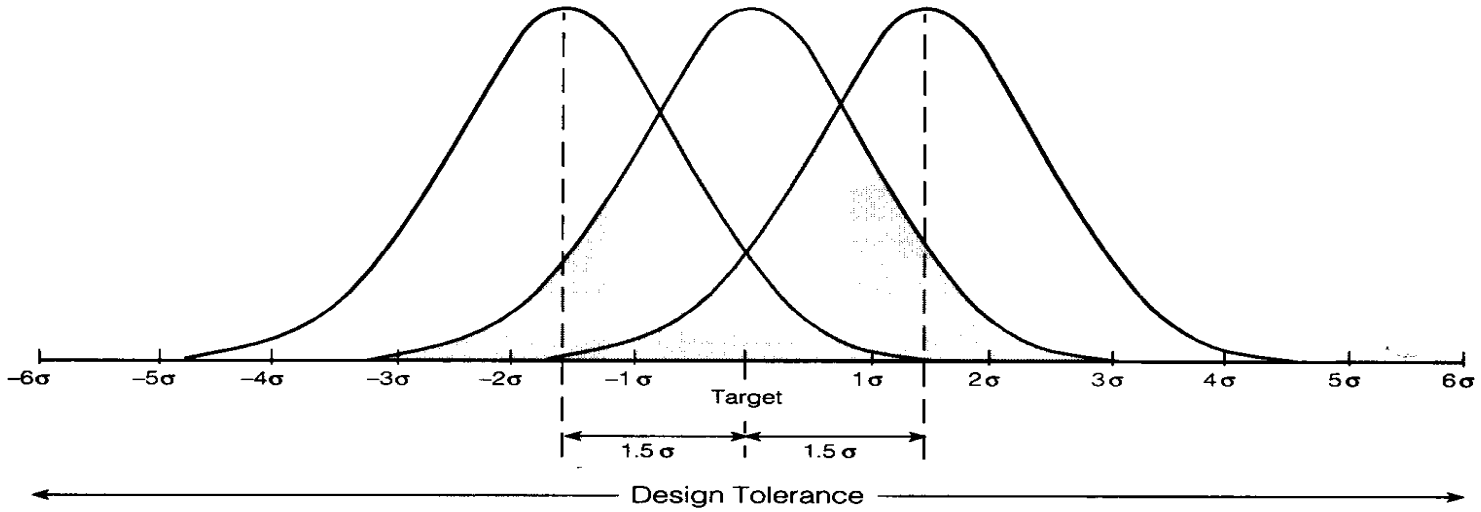
Example : XBAR = 25 days, S = 3 days

Cpk = min { (32-25)/(3*3), (25-20)/(3*3)}

= min {0.77, 0.55} = 0.55

Six-Sigma Quality (Cp =2 with Mean Shifting from the Center)

Ensuring that process variation is half the design tolerance (Cp = 2.0) while allowing the mean to shift as much as 1.5 standard deviations.



K-SIGMA QUALITY LEVELS

Six sigma results in at most 3.4 defects per million opportunities

	Quality Level						
Off-Centering	**3 sigma**	**3.5 sigma**	**4 sigma**	**4.5 sigma**	**5 sigma**	**5.5 sigma**	**6 sigma**
0	2,700	465	63	6.8	0.57	0.034	0.002
0.25 sigma	3,577	666	99	12.8	1.02	0.1056	0.0063
0.5 sigma	6,440	1,382	236	32	3.4	0.71	0.019
0.75 sigma	12,288	3,011	665	88.5	11	1.02	0.1
1 sigma	22,832	6,433	1,350	233	32	3.4	0.39
1.25 sigma	40,111	12,201	3,000	577	88.5	10.7	1
1.5 sigma	66,803	22,800	6,200	1,350	233	32	3.4
1.75 sigma	105,601	40,100	12,200	3,000	577	88.4	11
2 sigma	158,700	66,800	22,800	6,200	1,300	233	32

REFERENCES

1. https://www.youtube.com/watch?v=s2HCrhNVfak&feature=emb_rel_end

2. LACEY, ROBERT, Ford: The Men and The Machine, Boston, MA, Little Brown, 1986.