Introduction to Six Sigma

Lean Six Sigma Yellow Belt Course

www.lean6sigma.com.hk

Common Misconceptions

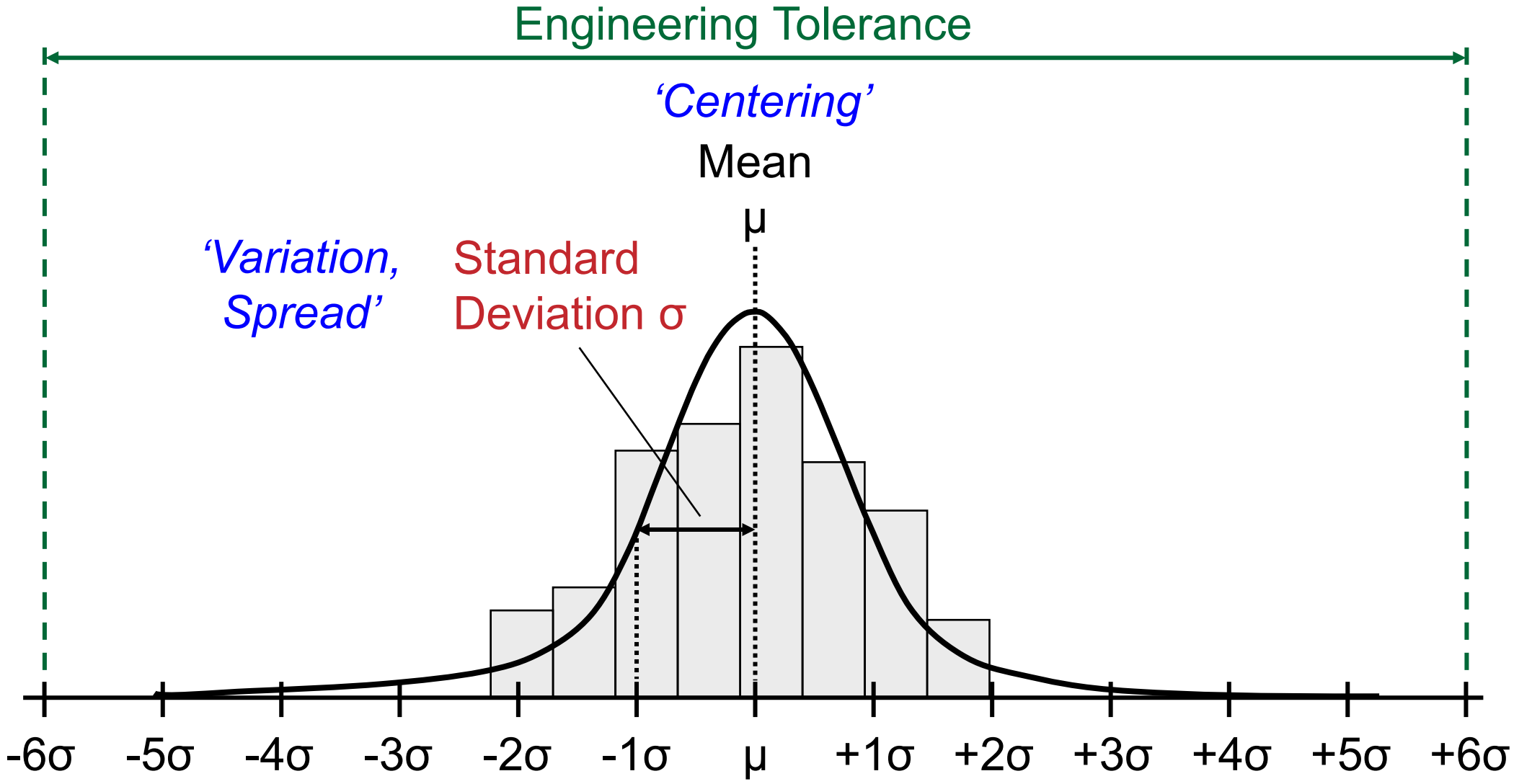
What Six Sigma is *not*:

1. A quality program
2. Just about statistics
3. Something for engineers only
4. Something for the manufacturing industry only
5. An outdated process improvement approach
6. The solution for all business problems
7. Useful even when the solution is known
8. Useful for firefighting

What is Six Sigma?

1. A virtually error-free process performance and quality standard.
   - Greek letter σ (Sigma) indicating process variation
   - Six Sigma quality / Six Sigma process performance
2. A management system bringing scientific reasoning into business.
   - Cadres (YB, GB, BB, MBB)
   - Set of tools and methods
   - Project management approach
   - Working style

Sigma as Process Variation



Six Sigma as a Quality/Performance Level

Sigma Level	e.g. spelling errors in books
1. One Sigma	170 misspelled words per page in a book
2. Two Sigma	25 misspelled words per page in a book
3. Three Sigma	1.5 misspelled words per page in a book
4. Four Sigma	1 misspelled word in 30 pages
5. Five Sigma	1 misspelled word in a set of encyclopedias
6. Six Sigma	1 misspelled word in all books of a small library

Sigma Level and Related Parts per Million

Sigma Level, PPM, and '% Defective' are related:

Sigma Level	PPM	% Defective
2	308'537	30.8%
3	66'807	6.7%
4	6'210	0.6%
5	233	0.02%
6	3.4	0.0003%

Exercise

You own an apartment with 120 sqm of carpet.

If you have it cleaned, how much carpet would be dirty with a …

Sigma Level	% Defective	sqm	L × W
2	30.8%	36.96	6 m × 6 m
3	6.7%	8.04	2.8 m × 2.8 m
4	0.6%	0.72	85 cm × 85 cm
5	0.02%	0.024	15 cm × 15 cm
6	0.0003%	0.00036	1.9 cm × 1.9 cm

Six Sigma Belt System

Six Sigma Yellow Belt

- Basic Understanding and awareness of Six Sigma ideas and tools

Six Sigma Green Belt

- Can act as PM for smaller scale 6σ projects
- Often part-time process improvement experts

Six Sigma Black Belt

- Can act as PM for larger scale 6σ projects
- Often full-time process improvement experts

6σ Master Black Belt

- 6σ trainer, coach, mentor
- Supports company-wide implementation
- Assists in supervising 6σ projects

Six Sigma Tools and Methods

Six Sigma Yellow Belt

- Kano Model
- Six Sigma Metrics
- Process Capabilities
- Quality Function Deployments
- Balanced Scorecard
- Non-Parametric Statistics
- …

Six Sigma Green Belt

- Flow Charts
- Histograms
- Check/Tally Sheets
- Ishikawa Diagrams
- Pareto Chart
- Scatter Diagram s
- Control/Shewhart Charts
- …

Six Sigma Black Belt

- Failure Mode and Effects Analysis (FMEA)
- Measurement System Analysis (MSA)
- Hypothesis Testing
- Analysis of Variance (ANOVA)
- Design of Experiments (DOE)
- Multiple Regression
- …

6σ Master Black Belt

- Conjoint Analyses
- Cluster Analyses
- Discrete Event Simulations (DES)
- Machine Learning/Artificial Intelligence
- Data Warehousing
- …

Six Sigma as a Project Management Approach

Scientific Method

1. Ask a question
2. Do some background research
3. Construct a hypothesis
4. Test the hypothesis with an experiment
5. Analyze the data and draw conclusions
6. Communicate results

Six Sigma Method

Define

Measure

Analyze

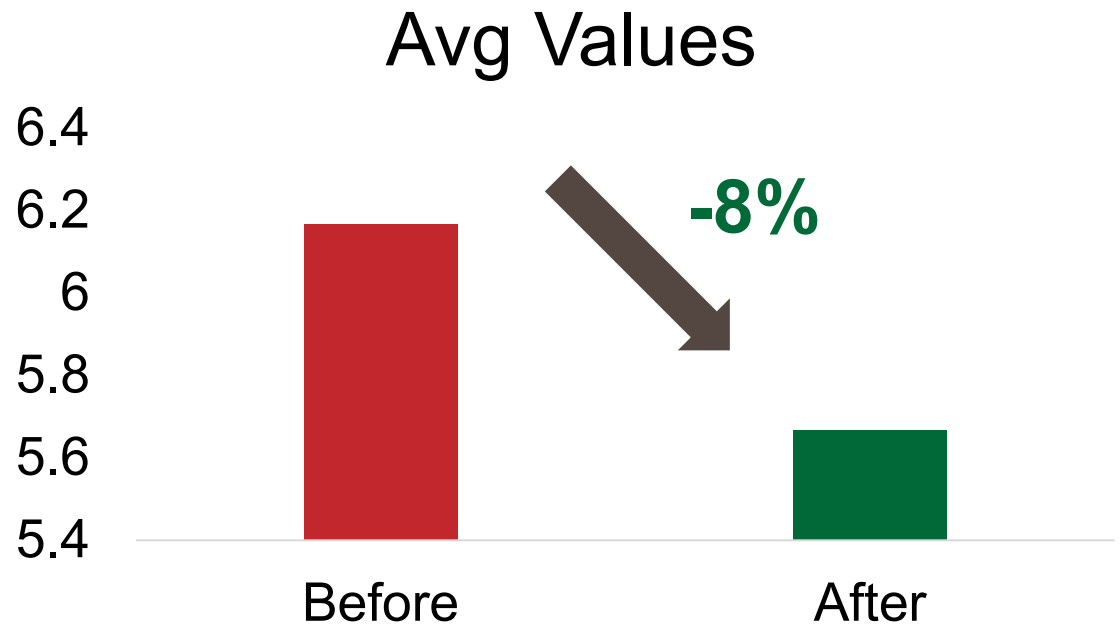
Improve

Control

Frequently Observed Working Style

A project manager presents the following status:

Before	After
6	5
5	6
7	4
6	7
5	6
8	6



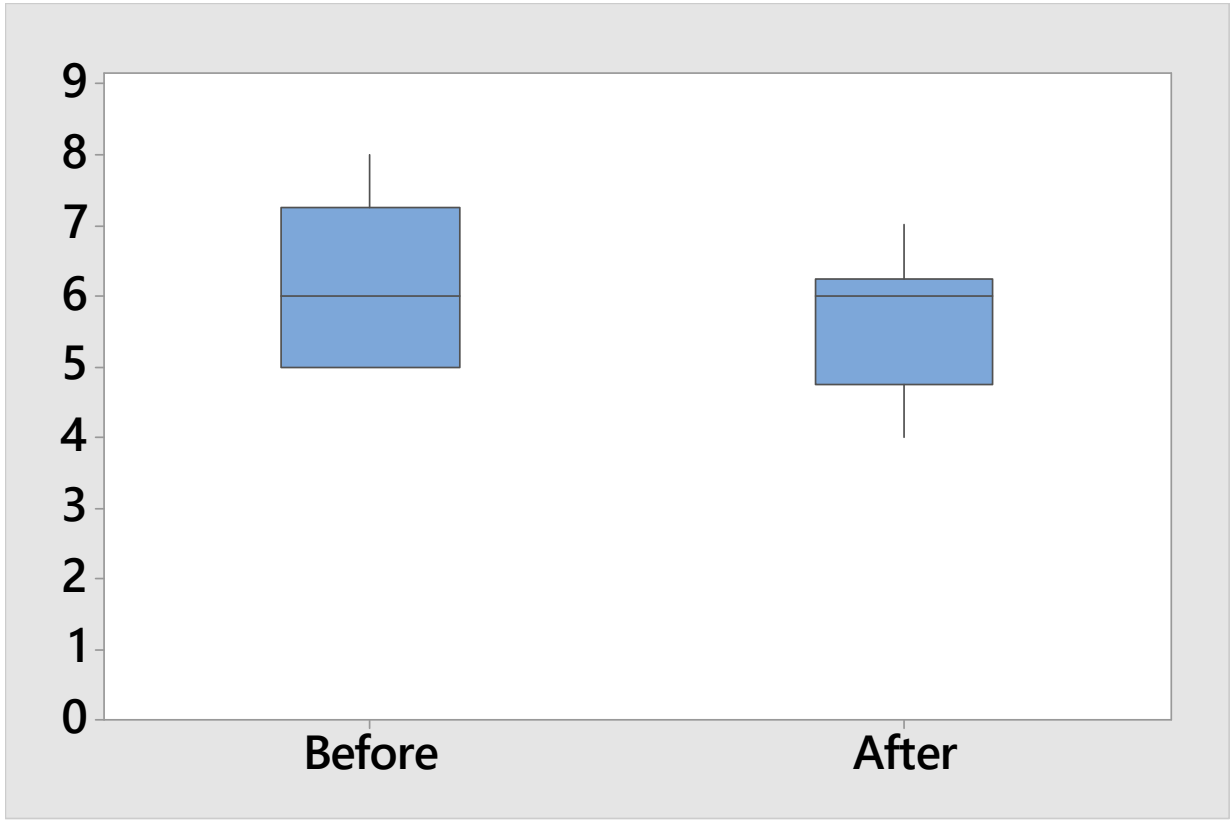
‘We have achieved an 8 percent improvement.’

Six Sigma Working Style

A Six Sigma project manager may present the status as follows:

#	Before	After
1	6	5
2	5	6
3	7	4
4	6	7
5	5	6
6	8	6
Avg	6.2	5.7
Med	6	6

Wilcoxon one-sided SRT:
V = 13.5, p-value = 0.2949



'We can't see any statistically valid improvement at this point in time.'

Six Sigma Attitude

1. Show me the data
2. How do you know?
3. Has it been verified? (=does it conform to specifications?)
4. Has it been validated? (=does it meet the needs?)
5. I can’t see any test statistics
6. What measurement scale did you use?

…

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