Leaning Lean Six Sigma for Results

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A Quick Look Back & Updates on Recent IFPUG / ISMA Presentations

2009	***Leaning Lean Six Sigma for Results;*** **ISMA; September, 2009** ***When Did Six Sigma Stop Being a Statistical Measure?; CrossTalk, April 2006*** ***Lean Six Sigma - Real Stories from Real Practitioners*****; Albuquerque, N.M.; N.M. SPIN; August 2005** ***Six Sigma & Software Engineering: Complement or Collision*****; Albuquerque, N.M.; N.M. SPIN; August, 2004**
2008	***Estimating Latent Defects Using Capture-Recapture: Lessons from Biology; Arlington, VA.; 2008 International Software Measurement and Analysis (ISMA) Conference; September 18, 2008*** ***Beyond Defect Removal: Latent Defect Estimation with Capture Recapture Method*****; CrossTalk, August 2007 (reprinted in IFPUG's MetricViews, Winter 2008)** ***Latent Defect Estimation - Maturing Beyond Defect Removal using Capture-Recapture Method*****; QAI QAAM Conference; September 10, 2008**
2007	***'Manda, Panda, and the CMMI(R)*****; Las Vegas, NV.; 2007; ISMA Conference; September 14, 2007**
2006	***Defect Collection & Analysis – The Basis of Software Quality Improvement*****; ISMA Conference, September, 2006** ***Defect Management through the Personal Software Process℠; CrossTalk, September 2003*** ***The Team Software Process℠ – Experiences from the Front Line*****; Software Quality Forum; Arlington, Virginia, March; 2003** ***Measuring Software Process Improvement - How to Avoid the Orange Barrels*****; System Development, December 2001** ***Usable Metrics for Software Improvement within the CMM*****; Software Quality Forum 2000; Santa Fe, N.M.; April, 2000**
2004	***Applying Lean Six Sigma to Software Engineering;*** **IFPUG Conference; September, 2004**
2003	***Amplified Lessons from the Ant Hill – What Ants and Software Engineers Have in Common*****; IFPUG Conference, Sept., 2003** ***Lessons from the Ant Hill - What Ants and Software Engineers Have in Common*****; Information Systems Management, Winter 2003**
2002	***Counting KLOCs – Software Measurement's Ultimate Futility (I can't do this anymore, or who am I fooling?, or why not count ants?);*** **IFPUG Conference; September, 2002** ***Lines of Code - Statistically Unreliable for Software Sizing?*****; Computer Aid, Inc.; Webinar; October 14, 2008** ***The Statistical Case Against the Case for using Lines of Code in Software Estimation;*** **4th World Congress on Software Quality; Bethesda, MD.; September 17, 2008** ***The Statistically Unreliable Nature of Lines of Code;*** **CrossTalk, April 2005 (Reprinted at least twice, cited by NIST *Metrics and Measures* http://samate.nist.gov/index.php/Metrics_and_Measures)** ***A Practical, Statistical, and Criminal Look at the Use of Lines of Code as a Software Sizing Measure*****; N.M. SPIN; March, 2004**

And here we go . . .

Primary points of this discussion include:

- Reported successes with Lean Six Sigma processes
- Which Lean Six Sigma?
- Lean Six Sigma does not result in six sigma results
- Comparing Six Sigma to six sigma
- Beware of the brain trust (storming) – demand results
- In "the event" we trust . . .
- Improvement – likely; *disruptive* innovation – not so likely
- Align Lean Six Sigma with CMMI® (v1.2)
- ~~Design for Six Sigma~~ Requirements for Six Sigma

References
Lean Six Sigma – Challenges and Conquests, CAI Webinar, May 12, 2009
When Did Six Sigma Stop Being a Statistical Measure?; CrossTalk, April 2006
Lean Six Sigma - Real Stories from Real Practitioners; Albuquerque, N.M.; N.M. SPIN; August 2005

Special thanks to Rick Sherwood, a Master Black Belt for his insights that improved the content and expression of ideas in this material.

Success with Six Sigma / LSS

- Allied Signal makes similar claims of cost savings in just five years. [1]
- General Electric reports $1B in savings in just two years by cutting re-work 50 percent. [1]
- Raytheon states savings of $.5M on one project. [2]
- Textron saved $5M in six months. [2]
- Northrop Grumman reports that LSS has helped in its CMMI® progress.
- Motorola claims to have reduced manufacturing costs by $1.4B over seven years and $15B over an eleven year span. [3]

References
[1] Basic Statistics, Kiemele, et al; Air Academy Press; 2000
[2] CIO Magazine, *Targeting Perfection*, 12/1/2003, pg. 62
[3] *Six Sigma Costs And Savings*, Charles Waxer,
http://www.isixsigma.com/library/content/c020729a.asp

Most Lean / Six Sigma programs are based on: Define, Measure, Analyze, Improve, Control (DMAIC)

The following five steps are associated most with Six Sigma *events* or activities targeting existing processes:

- ***D****efine* customer-driven improvement goals
- ***M****easure* the current process
- ***A****nalyze* the collected measures and process flows while considering customer needs
- ***I****mprove* the process using empirically-tested tools and statistical methods
- ***C****ontrol* process deviations prior to creation and release of defects

Reference

Body of Knowledge for IFPUG's Certified Software Measurement Specialist (CSMS); The Six Sigma Way Team Fieldbook: An Implementation Guide for Process Improvement Teams

Similarly, most Design for Six Sigma activities are based on:
Define, Measure, Analyze, Design, Verify (DMADV)

Targeting non-existing processes:

- ***D****efine* customer-driven design goals
- ***M****easure* the process needs – Critical to Quality (CTQs)
- ***A****nalyze* design alternatives to derive high-level high-quality design
- ***D****esign* optimizing details; simulate where needed
- ***V****erify* the design, establish needed pilot; transition to executers

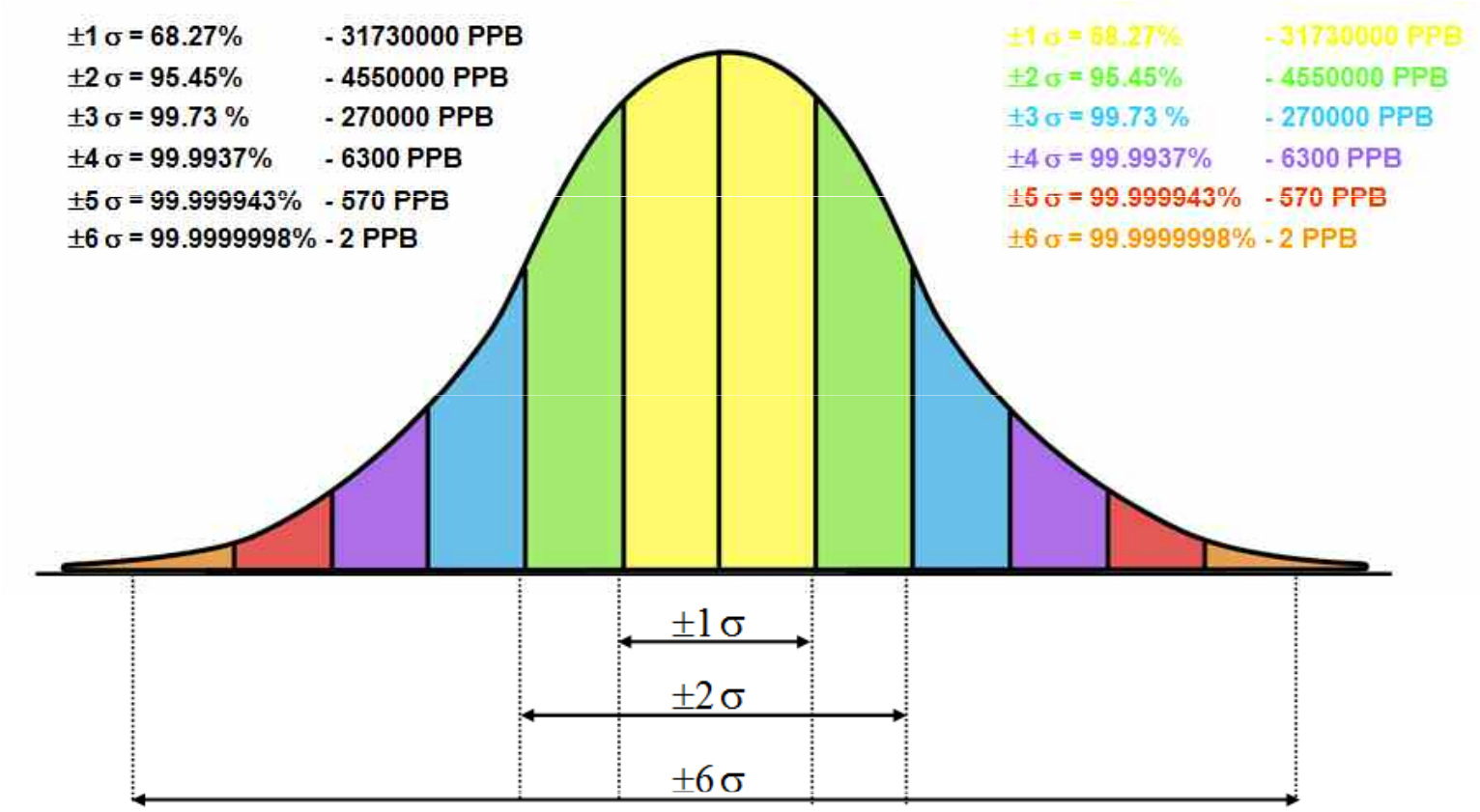
Six Sigma – as promoted

*Sigma	DPMO	% Yield
1	690,000	31
2	308,300	69.2
3	67,000	93.32
4	6,220	99.379
5	233	99.977
6	3.4	99.9997

From here we get the notion of the 3.4 defects per million opportunities

*Taking the 1.5 sigma shift into account
DPMO: Defects per million opportunities (to create a defect)

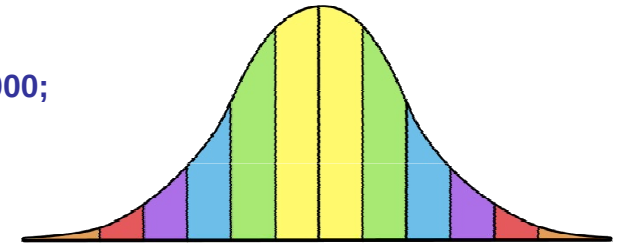
Six Sigma – calculated statistically



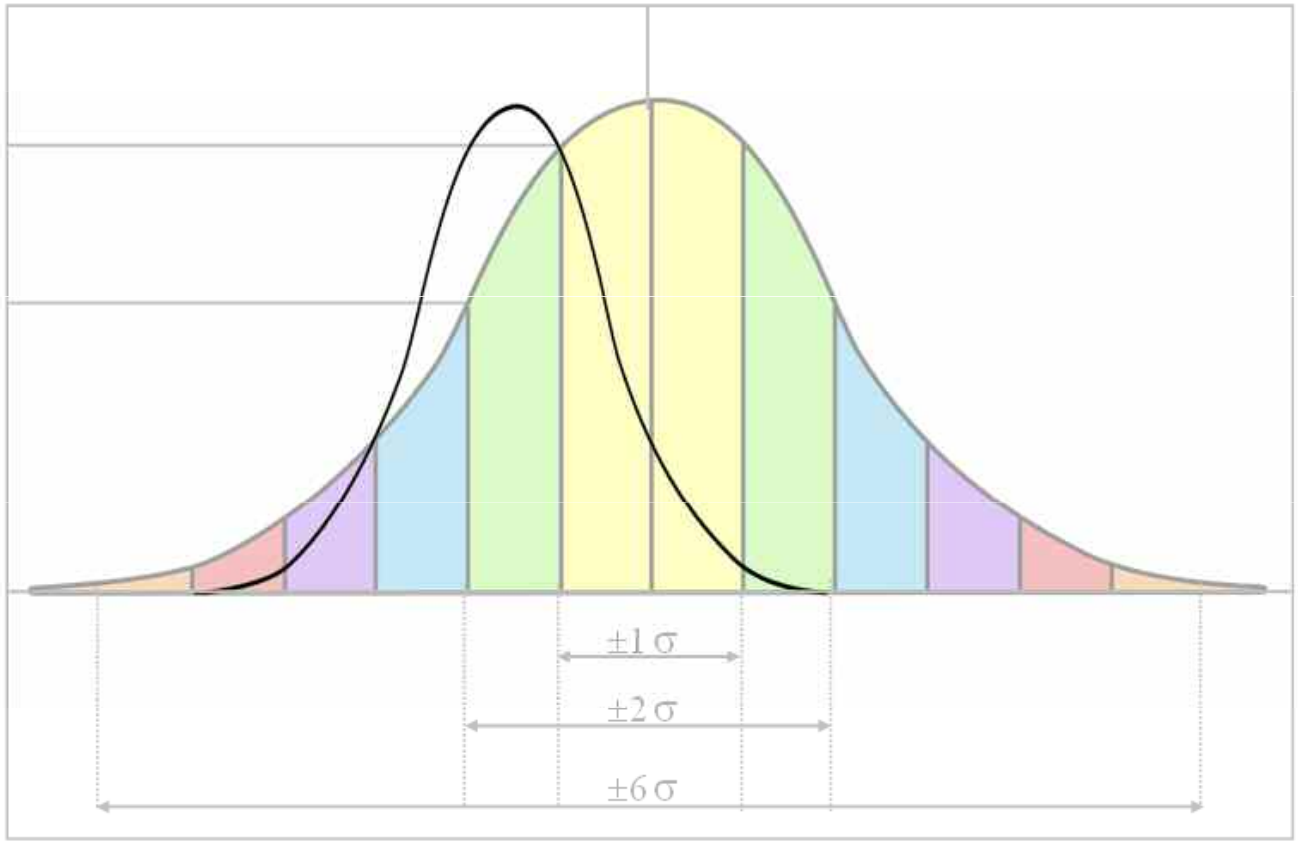
Comparing Six Sigma to six sigma
(with and without "sigma shift")

	Includes sigma shift		*Excludes* sigma shift	
***Sigma**	**DPMO**	**% Yield**	**DPMO**	**% Yield**
1	690,000	31	31,730	68.27
2	308,300	69.2	4,550	95.45
3	67,000	93.32	270	99.73
4	6,220	99.379	.63	99.9937
5	233	99.977	.0570	99.999943
6	3.4	99.9997	.0002	99.9999998

The difference between 3.4 DPMO and 2 DPBO is a factor of about 17,000; translated this means 17000 times more defects.
(compare 2 to 34000 (or 3.4 * 10000))



Visual Impact of Sigma Shift
(as proposed by Motorola)



BTW – Donald J. Wheeler discounts the arbitrary nature of sigma shift as "*goofy*"; its applicability as "*doubtful*."

Visual Impact of Sigma Shift
(to the right)

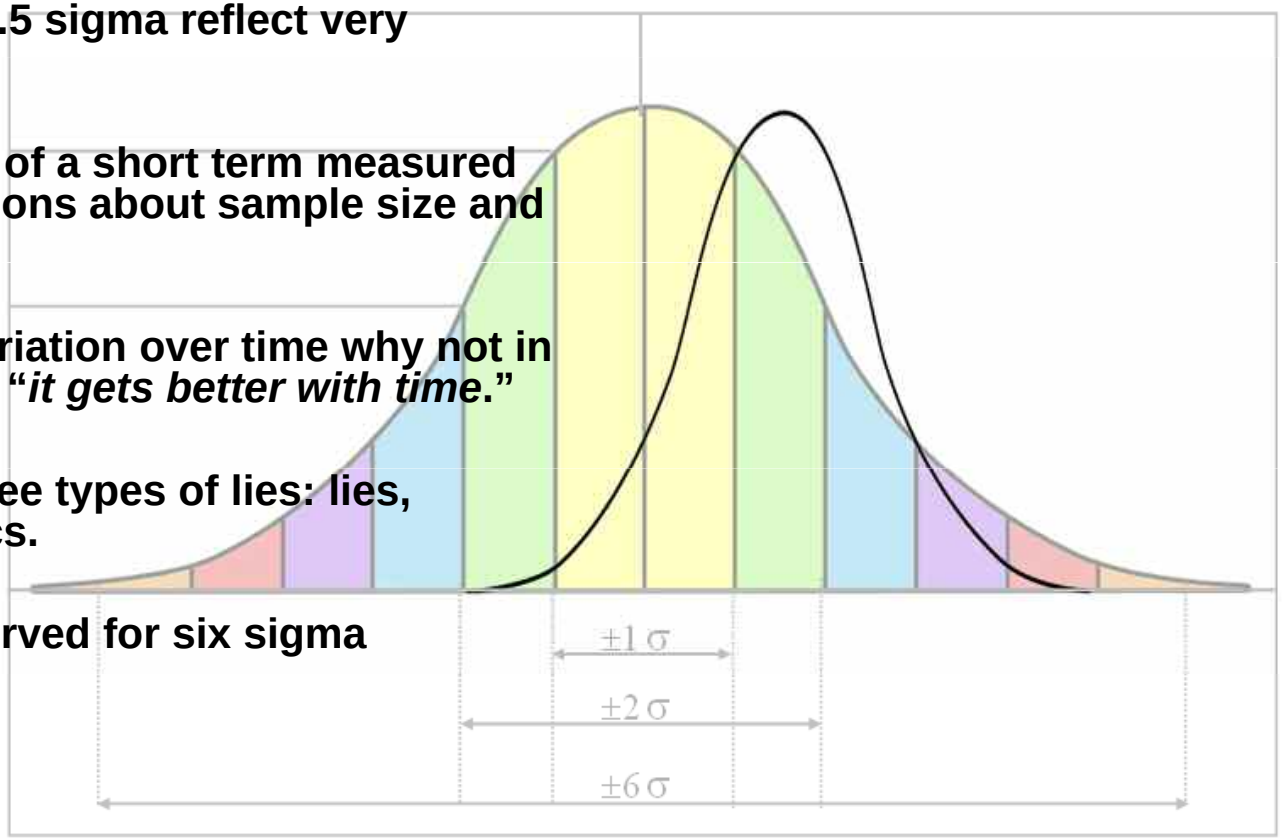
6 sigma, 4.5 sigma, and 7.5 sigma reflect very different results.

Long term effects (at 4.5) of a short term measured process (at 6) stirs questions about sample size and validity.

If sigma demonstrates variation over time why not in the other direction; as in, "*it gets better with time*."

Mark Twain described three types of lies: lies, damned lies, and statistics.

***Six Sigma* should be reserved for six sigma performance.**

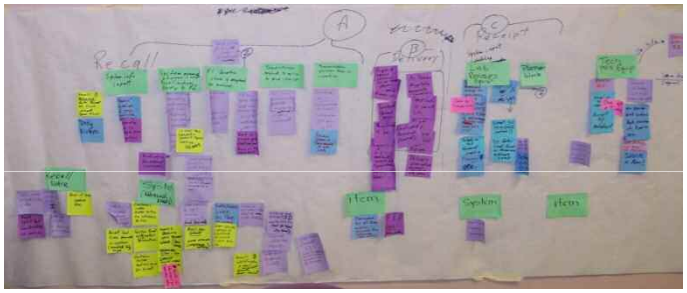


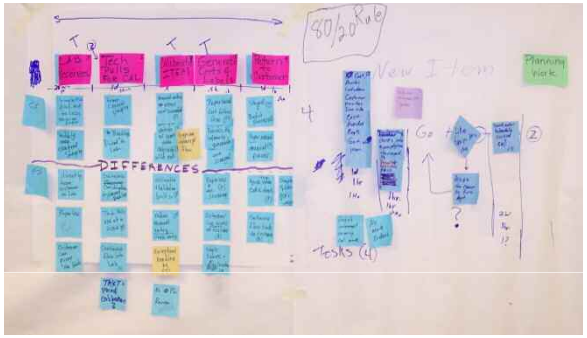
BTW – A 7.5 sigma process (shifted to the right) would have 3 defects per hundred trillion (3.1 DPhTO).

Brainstorming (BSing) woes

While these tendencies extend beyond LSS events,
events often draw heavily on BSing as a tool.

- Pre BSing – Be necessary and purposeful – don't ask what you should be telling; don't ask if you don't want to know
- Consider group size (breakout) exercises (size not > 4, diversity of viewpoints), pre-determined topical areas for BSing
- Be wary of facilitators that behave as if they are being paid by the number of flipcharts pages posted on the wall
- When Post-its® don't cut it





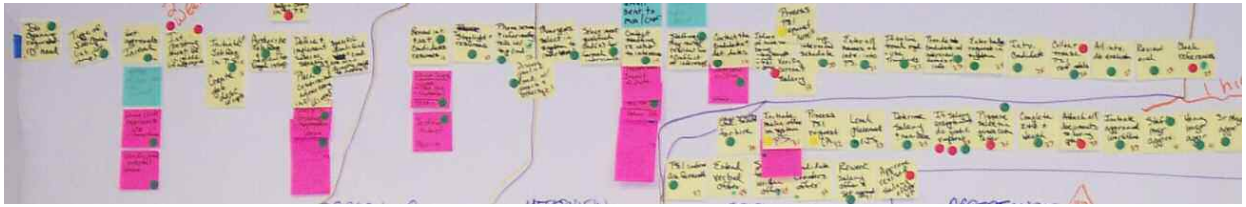
Brainstorming (BSing) woes (cont'd)

- Failure to manage the participation (inclusivity and exclusivity)
- Treating a brainstormed list as something useful
- Eventually a list – and that's the problem (2+ pages long of BSing)

PICK Chart Calculator

Issue	Hard to do - - > - - Easy				Weighted	Low Value > High Value				Weighted	Weighted Rank
	1	2	3	4		1	2	3	4		
1	15	3	1	0	1.26	0	0	0	19	4.00	**5.053**
2	5	8	5	0	2.00	3	2	7	6	2.89	**5.778**
3	8	7	6	4	2.00	0	0	1	18	3.95	**7.895**
4	3	5	9	0	2.35	3	3	8	3	2.65	**6.228**
5	2	6	5	5	2.72	3	4	5	6	2.78	**7.562**
6	6	9	2	1	1.89	0	0	1	17	3.94	**7.451**
7	1	3	8	6	3.06	1	3	9	5	3.00	**9.167**
8	3	5	5	5	2.67	6	5	5	2	2.17	**5.778**
9	0	0	0	18	4.00	4	2	5	7	2.83	**11.333**
10	0	2	5	12	3.53	1	1	5	11	3.44	**12.146**
11	2	3	8	3	2.75	0	1	7	9	3.47	**9.544**
12	1	1	8	8	3.28	3	4	8	3	2.61	**8.559**
13	0	0	3	15	3.83	4	2	6	6	2.78	**10.648**
14	0	0	2	16	3.89	2	5	6	5	2.78	**10.802**
15	0	0	5	13	3.72	3	1	10	4	2.83	**10.546**

- Dots disease



Instead: *create*, *clarify*, *consolidate* (merge), *chunk* (cluster), *choose* (prioritize), *conclude* (summarize as needed to lead into the next agenda item)

The "event" woes

Some six sigma events types include: kaikaku, kaizen, projects, value stream analysis, 6S, Design for Six Sigma (DFSS), vertical value streams

- the "magic" of having an event – has become the popular elixir of the day in some organizations; as in, *we can fix this in an "event"* or, *we need a kaizen*
- judging the value of an event by its duration – durations are seldom determined by the number of processes or participants, or belt efficiency (each which contribute to duration more than a predetermined timeframe)
- ignoring the "lean" in Lean Six Sigma – consider the various activities to complete an event; there are often some that are not required and whose outputs don't feed downstream in the process ("use" less, "transform" (outputs) more)
- setting aside the knowledge of the assembled participants to complete an event on a timely basis (following an agenda, but ignoring the process needs) – or sometimes seen as helping "belts in training" get certification
- what if purpose / expected outcome is out of alignment – as in, the purpose is to improve efficiency of the process, the expected outcome is a need for fewer staff
- believing that if the result / plan came from an event, it must be good
- not connecting expected outcomes to longer-term strategic goals

Instead: "it's about the outcome, not how long it takes"

6S events – quick history

Inspired by the "5S" popularized by Hiroyuki Hirano (1990).

1. *Seiri* - Separate needed and unneeded materials and to remove the latter.
2. *Seiton* - Neatly arrange and identify needed materials for ease of use.
3. *Seiso* - Conduct a cleanup campaign.
4. *Seiketsu* - Do seiri, seiton, and seiso at frequent intervals and to standardize your 5S procedures.
5. *Shitsuke* - Form the habit of always following the first four Ss.

Ford's CANDO program (Cleaning up, Arranging, Neatness, Discipline, Ongoing Improvement) is likely the origin for 5S.

A 6S (not to be confused with 6σ or success)

- ***S**ort* - Distinguish between what is needed and not needed and to remove the latter. For instance, Have all unnecessary items been removed?
- ***S**tabilize* - Enforce a place for everything and everything in its place.
- ***S**hine* - Clean up the workplace and look for ways to keep it clean.
- ***S**tandardize* - Maintain and monitor adherence to the first three Ss.
- ***S**ustain* - Follow the rules to keep the workplace 6S-right—"maintain the gain."
- ***S**afety* - Eliminate hazards--focus on Safety

Reference*: An Introduction to 6S; Don Roll*; http://www.vitalentusa.com/learn/6s_article.php

6S events may not lead to the results you desired

Before

After

The use of LSS may not lead to six sigma results

Good here, good there,
not quite so good though,
Everywhere (jrs)

- “of 58 large companies that have announced Six Sigma programs, 91 percent have trailed the S&P 500 since.” Fortune Magazine; *New rule: Look out, not in. Old rule: Be lean and mean;* Betsy Morris, July 11, 2006
- "Invention is by its very nature a disorderly process . . . You can't put a Six Sigma process into that area and say, well, I'm getting behind on invention, so I'm going to schedule myself for three good ideas on Wednesday and two on Friday. That's not how creativity works.” 3M CEO, George Buckley
- "it's a basic version of quality improvement. There is nothing new there. It includes what we used to call facilitators. They've adopted more flamboyant terms, like belts with different colors.” Joseph Juran
- The departure of Robert Nardelli as Home Depot Inc.'s chief executive was largely seen as a result of his big pay package, terse management style and failure to lift the Atlanta home-improvement company's stock price at a time when the housing boom was at full bore. But it also is an example of "Six Sigma" -- a quality-boosting methodology made famous by Jack Welch, Mr. Nardelli's former boss at General Electric Co.—not panning out as promised” *The 'Six Sigma' Factor for Home Depot – Departure of CEO Nardelli Brings Into Focus A Management Technique He Championed*; Wall Street Journal; 1/4/2007

LSS and CMMI® Linkage

Process Areas:

- Measurement & Analysis
- Verification & Validation
- Requirements Management & Development
- Risk Management
- Project Planning
- Project Monitoring & Control
- Quantitative Project Management
- Technical Solution
- Organizational Process Definition (OSSP)
- Organizational Training
- Organizational Process Performance
- Integrated Process & Product Development

Generic Practices:

- Monitor & Control the Process
- Establish a Defined Process
- Collect Improvement Information
- Establish Quantitative Objective for the Process
- Stabilize Sub process Performance
- Ensure Continuous Process Improvement

Product Requirements Kaizen (PRK)™

- **DFSS / PDK overlook the need for requirements analysis**
- **Engineering in general, software engineering in particular, reminds us otherwise**
- **A Product Requirements Kaizen*TM* is intended to address this gap**
  - **Determine preliminary scope (boundary) of requirements – answers the question, how big is it?**
  - **Determine preliminary scope for the level of requirements – answers the question, how deep do we want to get in this event?**
  - **Determine preliminary constraints – thou shall not cross this line!**
  - **Identify needed resources: roles (sponsor, customers, people, time commitments, schedule, facility, equipment)**
  - **Schedule sponsor for kickoff**
  - **Establish training needs for the event**
  - **Establish expected outcomes – instantiate with thoughtful outcome statements – level of finality (soft or hard)**
  - **Establish the initial vision – level of finality (soft or hard)**
  - **Design the agenda and activities; determine needed inputs**

Lean aligns with Albrecht's original thinking around Function Points

- **Measure everything that goes to the customer**
- **Measure only that which goes to the customer**
- ~~**Measure must be independent of technology**~~

Reference

A New Way of Looking at Tools by Allan Albrecht; 1979

What's the point?

Primary points of this discussion included:

- Reported successes
- Which Lean Six Sigma?
- Lean Six Sigma does not result in six sigma results
- Comparing Six Sigma to six sigma
- Beware of the brain trust (storming) – demand results
- Trusting in "the event"
- Improvement – incremental or *disruptive* innovation
- Lean Six Sigma support of CMMI® (v1.2)
- Establishing Requirements for Six Sigma

In the final analysis:

Go Lean when:

- **A needed process is broken (you have proof!)**
- **A needed process is underperforming (you've measured it!)**
- **A needed process is prioritized and sequenced with other "needy processes"**
- **To optimize or improve an existing process that you can't afford to disable**
- **An event is tailored to your process and people needs**
- **The *right* participants have time to participate**
- **Facilitating belts are interested in your success and much as theirs (meeting corporate goals for events or savings)**

Limit Lean when:

- An existing process cannot be enhanced sufficiently to meet expectations
- Duration is established before requirements
- The agenda (event type) is established before requirements (needs should drive event type and duration)
- Belts outnumber participants
- The expectation is that the "event" is the cure
- The leading "belt" doesn't ask the question "What do you need when we walk out of this event?"