LEANOhio

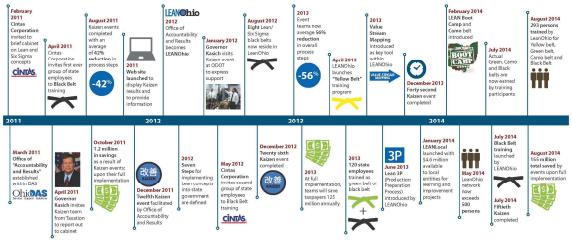
Transforming the Public Sector

Green Belt

Six Sigma Body Of Knowledge

SIMPLER. FASTER. BETTER. LESS COSTLY.

LEANOhio Timeline



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Making state government in Ohio simpler, faster, better, and less costly.

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Six Sigma

Lean Six Sigma Methodologies

Lean Process Efficiency & Speed	• Used for improving process efficiency & reducing cycle time.
Kaizen Events Quick Process Improvements	• Used for getting quick process improvement, 5 days, good for recurring issues.
DMAIC Variation & Defect Reduction	• Used for improving quality, reducing variation, and eliminating defects.
Lean Routine Sub-processes	• Used on smaller sub-processes - routine processes.
3P Production Preparation Process	• Used for developing new products or processes; or to radically change in process.
Value Stream Mapping	• Used in strategic planning to map the entire value stream all product families.

Six Sigma Overview

Six Sigma is a set of tools and strategies for process improvement that seeks to improve the quality of process outputs by:

- identifying and removing the causes of defects (errors)
- and **minimizing variation** in processes

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Six Sigma Definition

Six Sigma is the Best of the Best

- Six Sigma: by controlling and reducing variation – leads to reduction in errors and a dramatic impact to organization
- Six Sigma is an initiative that includes emphasize on the:
  - Culture of the organization
  - Improvement tools
  - Support system for the tools

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Three Levels of Six Sigma

- Metric: Six Sigma Levels
- Methodology: DMAIC
- Management system

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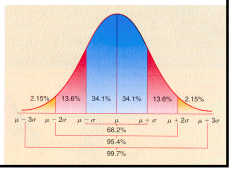
Six Sigma as a Metric

- As a scale of quality Six Sigma equates to 3.4 defects per one million opportunities
- A Six Sigma process is one in which 99.99966% of the products manufactured are statistically expected to be free of defects



Six Sigma Levels

Sigma Level	DPMO	% Defective	% Yield
1	691,462	69%	31%
2	308,538	31%	69%
3	**66,807**	**6.7%**	**93.3%**
4	**6,210**	**0.62%**	**99.38%**
5	233	0.023%	99.977%
6	3.4	0.00034%	99.99966%

Today's organizations fall here

DPMO = Defects per million opportunities

What does it mean to have defects?

Sigma 5 is really a good process, it is 99.97% effective, however…

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Two bad landings at most airports every day

99% Good

One bad landing at most airports every 5 years

99.99966% Six Sigma

15 minutes of unsafe drinking water every day

99% Good

1 minute of unsafe drinking water every 7 months

99.99966% Six Sigma

200,000 wrong prescriptions given to patients each year

99% Good

68 wrong prescriptions given to patients each year

99.99966% Six Sigma

Six Sigma as a Methodology

- Improvement methodology focused on:
  - customer requirements
  - data analysis to minimize variation
  - continuous improvement focused on core processes
  - DMAIC model

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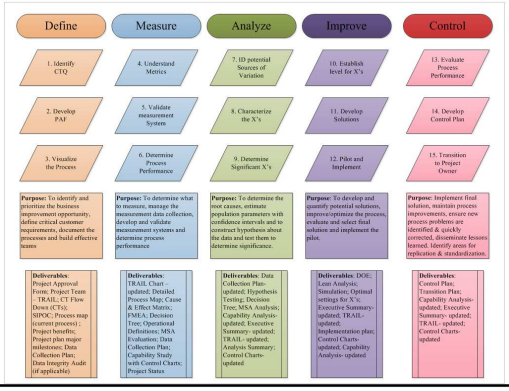
DMAIC



Six Sigma Mantras

- Zero Mantra: Bring Home the Bacon
- First Mantra: Y is a Function of X

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The Six Sigma Approach

The Framework for Six Sigma

$$Y = f(X_1, X_2, X_3 \ldots)$$

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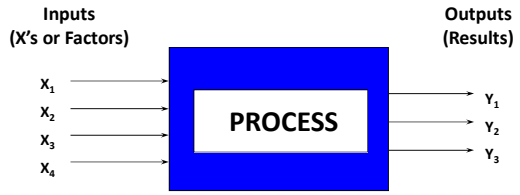
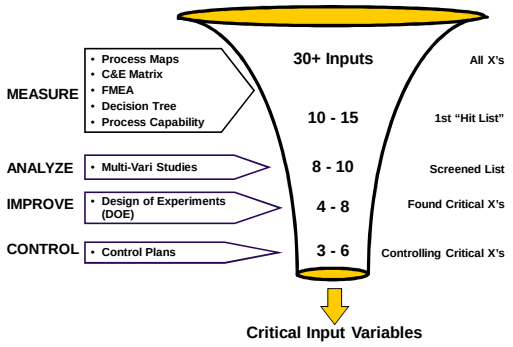
The Six Sigma Approach



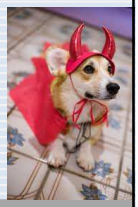
Find and control the critical X's to control the Y's

The Funneling Effect



Six Sigma Mantras

- Zero Mantra: Bring Home the Bacon
- First Mantra: Y is a Function of X
- Second Mantra: Variation is Evil



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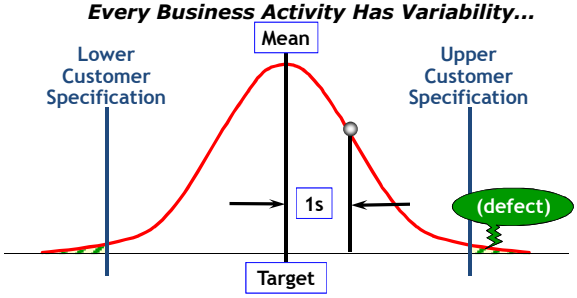
Six Sigma as a Concept

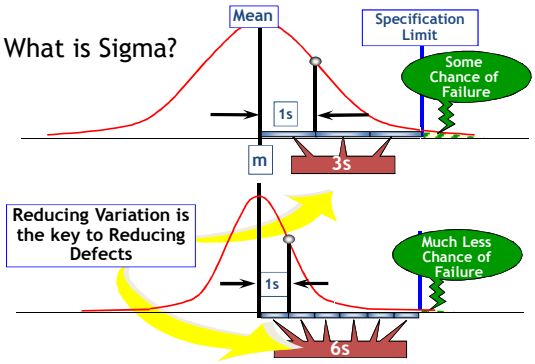
Every Business Activity Has Variability…



Reducing variability is the essence of Six Sigma

Six Sigma as a Concept

What is Sigma?



Six Sigma Mantras

- Zero Mantra: Bring Home the Bacon
- First Mantra: Y is a Function of X
- Second Mantra: Variation is Evil
- Third Mantra: Shift Happens!

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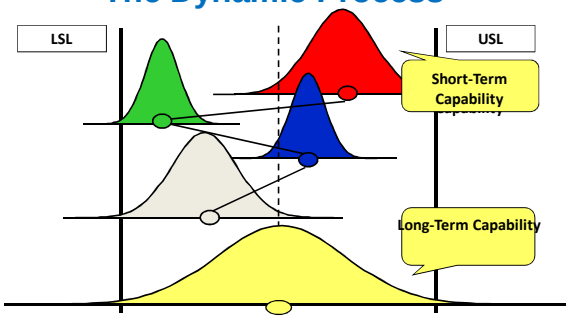
The Dynamic Process



Week One Review

- Project Charter
- Operational Definitions
- SIPOC
- Process Mapping
- Baseline Data

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Other Six Sigma Methodologies

Theory of Constraints

- Theory of Constraints pays attention to the "weakest link" of the system
- A constraint is anything that limits an organization from moving toward its goal

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Steps of Theory of Constraints

- Identify the system constraint and determine whether it is a physical constraint or a policy-related issue
- Decide how to fix the constraint without committing to potentially expensive changes or upgrades
- Focus on the constraint in order to operate at maximum effectiveness, and then evaluate the results to see if the constraint is still holding back the system
- Elevate the constraint by taking whatever action is needed to eliminate it
- Go back to beginning, but beware of inertia

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Quality Function Deployment (QFD)

- **Quality function deployment (QFD)** is a "method to transform user demands into design quality
- QFD was originally developed in Japan in 1966 by combining work in quality assurance and quality control
- QFD is designed to help planners focus on characteristics of a new or existing product or service from the viewpoints of market segments, company, or technology-development needs
- QFD helps transform VOC into engineering characteristics

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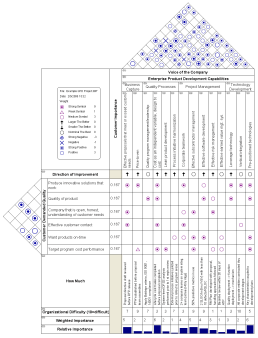
Quality Function Deployment (QFD)

- QFD provides structure to the development cycle and compares this structure to the framework of a house



Statistical Process Control (SPC)

- Statistical process control (SPC) is a philosophy focusing on optimizing continuous improvement by using statistical tools for analyzing data, making inferences about process behavior, and then making decisions
- SPC leaves the variations from common causes to chance, and instead focuses on identifying and eliminating special causes
- SPC relies on evidence rather than intuition

Statistical Process Control (SPC)

SPC Tools: Basic Quality Tools:
- Flow charts
- Run charts
- Pareto charts and analysis
- Fishbone diagrams
- Histograms
- Scatter diagrams

These tools will be covered this week!

SPC Methods
- Control charts
- Process-capability analysis

Advanced Statistical Analysis Methods
- Regression
- Hypothesis testing
- Design of experiments
- Analysis of variance

Questions?

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