Building a Successful Lean Six Sigma Organization

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ASQ Board Chair

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Building a Successful Lean Six Sigma Organization

1. Quality and Continuous Improvement
2. What is Lean Six Sigma?
3. Lean Examples
4. Six Sigma Examples
What is Quality?

1. Efficiently providing products and services that meet or exceed customer expectations.
2. Adding value to the customer.
3. Continuously measuring the improvement of processes and services for customers.
4. Acting as promised and reporting failures.
5. Doing the right thing at the right time in the right way with the right people.
6. Ensuring customers come back and products do not.
7. Providing the best value to customers by improving everyday activities and processes.
8. Beyond delivering what the customer wants, anticipating what the customer will want when he/she knows the possibilities.
9. Delivering customer value across the company through best-in-class products, services, and support.
10. Meeting and exceeding the expectations of clients, employees, and relevant constituencies in the community.
The Permeation of Quality

- Many Quality tools and methods have their roots in manufacturing, especially the automotive industry.
- These tools and methods migrated from the shop floor to support areas like Purchasing, Human Resources, Logistics, the Laboratory, etc.
- They have taken root in Healthcare especially those tools geared toward efficiency improvements and reduction of errors.
- They are beginning to take hold in Education and in Service Industries.
- Some Quality tools are starting to be used in Government.
Continuous Improvement

- Tools and methods to improve a process.
- Anytime you’re doing something, that’s a process.
- Examples:
  - Lean
  - Six Sigma
  - Total Quality Management
  - Statistical Process Control
  - Kepner Tregoe
  - Shainin
Excellence
Patient Safety through Lean Six Sigma

1. Quality and Continuous Improvement
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What is Lean?

A practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and a target for elimination.

“Value” is defined as any action or process that a customer would be willing to pay for. Anything that adds form fit or function to a service or product.
History of Lean

Examples of efficiency improvements can be identified all through history.

Henry Ford introduced Just-in-time Manufacturing, Design for Manufacture and standardization and interchangeability of parts concepts.

Lean manufacturing is a process management philosophy associated with the Toyota Production System.

Today Lean concepts are used to improve processes in all types of organizations.
What is Six Sigma?

• A continuous improvement toolkit
• A problem solving methodology
• Seeks to improve quality
• Seeks to reduce variation
• Focus on statistical methods
Six Sigma methodology was formulated by Motorola in 1986. Motorola has reported over $17 billion in savings from Six Sigma.

Other early adopters of Six Sigma include General Electric and Honeywell (formerly Allied Signal). By the late 1990’s about two-thirds of the Fortune 500 organizations had begun Six Sigma initiatives.

In recent years, Six Sigma has been combined with Lean Manufacturing to yield a methodology named Lean Six Sigma.
Lean Six Sigma Belts

- Black Belt
- Green Belt
- Yellow Belt
- White Belt
- Master Black Belt
Patient Safety through Lean Six Sigma

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Lean Principles

1. Specify Value
2. Map the Value Stream
3. Establish Flow
4. Implement Pull
5. Work to Perfection
BMW’s Value Added Production System
7 Forms of Waste – TIM WOOD

**TRANSPORT**
Poor layout of facility – MRI on other side of campus from patient rooms

**INVENTORY**
Expired supplies and meds

**MOTION**
Lab processing involves backtracking and rework due to poor layout

**WAITING**
Waiting for OR; doctor to complete tasks prior to discharge; patient in doctor’s office

**OVER-PROCESSING**
Documentation required but never utilized; over-informing; unnecessary information provided

**OVER-PRODUCTION**
Unnecessary diagnostic procedures; lab draws

**DEFECTS**
Wrong medication given; item missing from surgery cart, wrong documentation on wrong patient.
Lean Tools

SIPOC
Lean Principals
Value Stream Map
Kaizen
5S
Waste Identification
Little's Law
Process Cycle Efficiency
Generic Pull Systems
Rapid Set-up

Low Cost Intelligent Automation
Replenishment Pull Systems
ABC Stratification
Batch Size Optimization
Process Balancing
Total Productive Maintenance
Visual Process Control
Standards
Mistake Proofing
5S

A method for creating and maintaining a high performance work space.

• Sort
• Set in Order
• Shine
• Standardize
• Sustain

Also

• Safety
• Security
• Satisfaction
Value Stream Map

Motor Vehicle Accident w/Burns

Supplier:
911 Called/Notified of MVA Ambulance dispatched

Customer of Process:
Patient Arrives to ER

Survey the Scene
Includes safety of patients, staff and others. (Prevent other injuries)

Triage Patient(s)
Decide who to treat first.

Patient Care
Check: Airways/Breathing/Circulation/Disability and Neuro/Exposure (Anything immediate to life)

Packaging
Place patient on spine board.

Decide Transport and Load Patient
No transport necessary/Ambulance/Helicopter

TR= 15 mins
NVA= 15 mins

TR= 140 mins
NVA= 140 mins

15 mins
5 mins
10 mins
5 mins
5 mins
1 min
140 mins
Total Production Time=181 mins
Total VAT= 25 mins
Value Stream Map

Suppliers:
- Physicians
- Appointment Scheduling Software

Physician Office Patient Registration

C/T = Average CT in Minutes
VA = Average Valued Added Time in Minutes
NVA = Percent Non-Value Added Time

Customers:
- Patient

<table>
<thead>
<tr>
<th>Event</th>
<th>C/T Times (Minutes)</th>
<th>VA (Minutes)</th>
<th>NVA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Calls to schedule an appointment</td>
<td>240</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Patient arrives and checks in</td>
<td>3.5</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Patient is called to desk to complete patient registration</td>
<td>7.5</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Front desk reviews packet and verifies insurance</td>
<td>7.5</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Patient is called back to treatment room</td>
<td>10</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Nurse obtains and documents vitals</td>
<td>10</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Physician enters and examines patient</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physician orders strep test</td>
<td>3.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nurse swabs patient</td>
<td>3.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Strep test is analyzed and results reported</td>
<td>12.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physician reviews lab results</td>
<td>12.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Patient is diagnosed and treated</td>
<td>17.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physician writes prescription</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Physician transcribes documentation</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Front desk receives transcription for patient check-out</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Patient walks to check-out, pays co-pay and schedules future appointments</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

VA = 0
NVA = 100%
C/T = 3.5

VA = 0
NVA = 100%
C/T = 3

VA = 0
NVA = 100%
C/T = 3

VA = 0
NVA = 100%
C/T = 3
Kaizen Events

- Kaizen means “change for the better” or “small improvements”.
- Kaizen events are intensive workshops that last between 1 to 5 days.
- Low hanging fruit and other opportunities are identified during the workshop.
- Many of the improvements are implemented during the workshop.
- Typical kaizen events for transactional processes:
  - SIPOC
  - Current State Value Stream Map
  - Brainstorming
  - Future State Value Stream Map
  - Action Log
Patient Safety through Lean Six Sigma

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The DMAIC Process
## Six Sigma Tools

<table>
<thead>
<tr>
<th>Tools</th>
<th>Tools</th>
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<tbody>
<tr>
<td>Pareto Chart</td>
<td>One Sample t-Test</td>
</tr>
<tr>
<td>Rolled Throughput Yield</td>
<td>Two Sample t-Test</td>
</tr>
<tr>
<td>Control Charts</td>
<td>Paired t-Test</td>
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<tr>
<td>Capability</td>
<td>Correlation</td>
</tr>
<tr>
<td>Histogram</td>
<td>Simple Regression</td>
</tr>
<tr>
<td>Time Series Chart</td>
<td>Multiple Regression</td>
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<tr>
<td>Box Plot</td>
<td>One Way ANOVA</td>
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<tr>
<td>Dot Plot</td>
<td>Two Way ANOVA</td>
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<td>Normality Test</td>
<td>Equal Variances</td>
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<td>Scatter Plot</td>
<td>Main Effects Plot</td>
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<tr>
<td>Gage R&amp;R</td>
<td>Interval Plot</td>
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<td>Matrix Plot</td>
<td>Interactions Plot</td>
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<tr>
<td>Cause and Effect Diagram</td>
<td>Multi-Vari Charts</td>
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<td>Non-parametric analysis</td>
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<td>Failure Mode and Effects Analysis</td>
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<td>Cause and Effect Matrix</td>
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<td>Fault Tree</td>
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<td>Brainstorming</td>
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<td>Chi Square Analysis</td>
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<td>Logistic Regression</td>
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<td>Power and Sample Size</td>
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<td>Design of Experiments</td>
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<td>Control Plan</td>
</tr>
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<td>Statistical Process Control</td>
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7 Basic Quality Tools

- Pareto Chart
- Cause and Effect (Fishbone Diagram)
- Histogram
- Check Sheet
- Control Chart
- Scatter Plot
- Segmentation
Graphical Summary

Anderson-Darling Normality Test

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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<tbody>
<tr>
<td>A-Squared</td>
<td>0.84</td>
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<tr>
<td>P-Value</td>
<td>0.029</td>
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<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Mean</td>
<td>599.55</td>
</tr>
<tr>
<td>StDev</td>
<td>0.62</td>
</tr>
<tr>
<td>Variance</td>
<td>0.38</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.082566</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.745102</td>
</tr>
<tr>
<td>N</td>
<td>100</td>
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<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
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<tr>
<td>Minimum</td>
<td>597.80</td>
</tr>
<tr>
<td>1st Quartile</td>
<td>599.20</td>
</tr>
<tr>
<td>Median</td>
<td>599.60</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>600.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>601.20</td>
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</table>

95% Confidence Interval for Mean

599.43 - 599.67

95% Confidence Interval for Median

599.40 - 599.60

95% Confidence Interval for StDev

0.54 - 0.72
Control Charts

Individuals Chart

- Observation Chart
- Individual Value
- X = 599.548
- UCL = 601.176
- LCL = 597.920

Graph showing individual observations with control limits UCL and LCL.
Capability Analysis

<table>
<thead>
<tr>
<th>Process Data</th>
<th>LSL</th>
<th>Target</th>
<th>USL</th>
<th>Sample Mean</th>
<th>Sample N</th>
<th>StDev(Overall)</th>
<th>StDev(Within)</th>
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</thead>
<tbody>
<tr>
<td>LSL</td>
<td>595</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target</td>
<td>*</td>
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<td></td>
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</tr>
<tr>
<td>USL</td>
<td>605</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sample Mean</td>
<td>600.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample N</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>StDev(Overall)</td>
<td>1.87388</td>
<td></td>
<td></td>
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<tr>
<td>StDev(Within)</td>
<td>1.70499</td>
<td></td>
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</table>

Overall Capability
- \( P_p \) = 0.89
- \( P_{PL} \) = 0.93
- \( P_{PU} \) = 0.85
- \( P_{pk} \) = 0.85
- \( C_{pm} \) = *

Potential (Within) Capability
- \( C_p \) = 0.98
- \( C_{PL} \) = 1.02
- \( C_{PU} \) = 0.93
- \( C_{pk} \) = 0.93

Performance

<table>
<thead>
<tr>
<th>PPM &lt; LSL</th>
<th>PPM &gt; USL</th>
<th>PPM Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed</td>
<td>Expected Overall</td>
<td>Expected Within</td>
</tr>
<tr>
<td>0.00</td>
<td>2627.23</td>
<td>1079.43</td>
</tr>
<tr>
<td>0.00</td>
<td>5455.68</td>
<td>2573.67</td>
</tr>
<tr>
<td>0.00</td>
<td>8082.91</td>
<td>3653.10</td>
</tr>
</tbody>
</table>
Cp and Cpk

\[ Cp = \frac{USL - LSL}{6\sigma} \]

\[ Cpk = \min(Cpu, Cpl) \]

\[ Cpu = \frac{USL - X}{3\sigma} \]

\[ Cpl = \frac{X - LSL}{3\sigma} \]
Summary - What you can do tomorrow

Lean – improve efficiency

– Look for opportunities for 5S to create a high performance work space.
– Identify and map core processes.
– Organize a kaizen workshop to pick the low hanging fruit.
– Learn to see the opportunity in every process.
Summary - What you can do tomorrow

Six Sigma – improve effectiveness

– Don’t over complicate! Use the basic problem solving tools.
– Use systematic problem solving (DMAIC for example).
– Don’t forget to find and address the root cause.
Thank you for your attention!