WHITE BELT

Quick Reference Guide

SIX SIGMA SOCIETY

sixsigmasociety.org

INTRODUCTION

OVERVIEW

Lean Six Sigma is a method for improving our business processes.
- Process – ongoing, repetitive activity (e.g. shipping orders)
- Project – temporary initiative (e.g. building a new website)

Primary Goals:
- #1 – Remove Waste (Lean)
- #2 – Reduce Variation (Six Sigma)

BASICS OF LEAN

Waste ("muda") – Anything that does NOT add value for the end customer.

7 Elements of Waste ("TIM WOOD"):
- Transportation – The unnecessary movement of materials in a process. (aka "Conveyance)
- Inventory – Raw materials that are not immediately used.
- Motion – The unnecessary movement of people in the process.
- Waiting – Waiting for the next step in the process. (Idle time.)
- Overproduction – Producing more finished goods than the customer demands.
- Overprocessing – Doing more work than the customer requires.
- Defects – Correcting defects in our products. (aka "Correction")

History of Lean:
- Henry Ford – In 1913, he introduced the assembly line. It increased production and lowered unit costs.
- Toyota – In the 1950s, they began a system to eliminate waste, which included "just in time".
- Worldwide – In the 1980s-1990s, lean moved beyond Asia and was implemented across the world.

BASICS OF SIX SIGMA

Key Terms:
- Sigma (σ) – Standard Deviation – How close our data is to the mean (average).
- Sigma Level – The # of σ's that fit between the mean and the closest customer limit.
- Six Sigma – Having 6 σ's between the mean and the closest customer specification limit.
  * Represents fewer than 3.4 defects per million opportunities (DPMO) (i.e. 99.9997% defect free).

History of Six Sigma:
- Walter Shewhart – At Bell Labs in the 1920s, he began using statistical process control (SPC).
- Bob Galvin – In the 1980s, while at Motorola, he led the creation of Six Sigma.
- Jack Welch – In the mid 1990s, at General Electric, he led one of the largest implementations.
- Worldwide – From the late 1990s until the present, it spans industries worldwide.

Six Sigma Measurements:
- Process Lead Time – The time it takes the process to complete after an order is received.
- Process Cycle Efficiency (PCE) – Value-added time / lead time.
- Cost of Poor Quality (COPQ) – The financial impact of our defects.
- Defects per Unit (DPU) – # of defects / # of units.
- Defects per Opportunity (DPO) – # of defects / (# of units * # of opportunities).
- Defects per Million Opportunities (DPMO) – DPO * 1,000,000.
- Rolled Throughput Yield (RTY) – The probability that a process will produce a defect-free unit.

Cost of Poor Quality (COPQ):
- Prevention – before production – e.g. contract reviews, education/training, field tests…
- Appraisal – during production – e.g. product inspections, process control measurements…
- Internal Failure – after production but before shipment – e.g. rework, repairs…
- External Failure – after production and after shipment – e.g. recalls, warranty claims, penalties…

"Iceberg Model" for COPQ:
- Visible Costs (Hard Costs) – easier to quantify – e.g. recalls, rework…
- Hidden Costs (Soft Costs) – more difficult to quantify – e.g. loss of future sales, damage to brand…

PROJECT IMPROVEMENT METHODOLOGY

A methodology for improving processes.

The "DMAIC" Lifecycle Phases:
- DEFINE the goals of the improvement. (e.g. Scope a new project, get approval…)
- MEASURE the current process ("as is"). (e.g. Map the process, measure the process…)
- ANALYZE the process for areas of improvement. (e.g. Perform regression, use hypothesis testing…)
- IMPROVE the process ("to be"). (e.g. Conduct experiments, implement 5S…)
- CONTROL the new process. (e.g. Prepare a control plan, monitor the process...)

Problem-Solving Formula:
- y = f (x)
- x = process inputs (aka "independent variables")
- y = process output (aka "dependent variable")
- on-time shipment = f (inventory levels, carrier availability, weather, traffic…)

Roles & Responsibilities:
- Executive Sponsor – Decides to invest in Lean Six Sigma. Sets goals for the organization.
- Process Owner – Responsible for the process being improved. Consults teams during the project.
- White Belt – Understands foundational terms.
- Yellow Belt – Has a basic understanding. Supports small projects. Often focuses on their own work.
- Green Belt – Has an intermediate understanding. Leads small projects in their functional area.
- Black Belt – Has a deep understanding. Leads large, cross-functional projects.
- Master Black Belt – Has expertise in all areas of Lean Six Sigma. Provides advice and training.

DEFINE PHASE

VOICE OF THE CUSTOMER

- Voice of the Customer (VOC) – customer needs and requirements.
- Voice of the Business (VOB) – business and shareholder objectives (often financial).
- Voice of the Process (VOP) – process measurements (e.g. variation, capability).
- Voice of the Employee (VOE) – employee needs and requirements (e.g. benefits, treatment).

Critical to Quality Characteristics (CTQs):
- We take the VOC and convert it to something measurable (CTQs).
- CTQs are measures that indicate whether or not we are meeting customer needs (VOC).
- CTQs can be related to performance, timeliness, reliability, durability, security, serviceability…
- Example: CTQs for a phone could be storage capacity in gigabytes and battery life in hours.

MEASURE PHASE

PROCESS MAPS:

Process Flow Diagrams:
- Shows the sequence of process steps.
- Swim lanes may be used to shown responsibility for each process step.

Process Flow Symbols:
- Rectangle – activity (e.g. shipping an order)
- Diamond – decision (e.g. determining whether an order passes inspection)
- Ellipse – start/end
- Arrow – directional flow
- Circle – connector (on-page)
- Pentagon – connector (off-page)
- Rectangle with Curved Bottom – a document
- Rectangle with Interior Vertical Lines – a predefined process

Value Stream Maps:
- A mapping of process steps along with process velocity and time.
- Non-value added activities are identified.

SIPOC Diagrams:
- Stands for **S**uppliers, **I**nputs, **P**rocess, **O**utputs, **C**ustomers.
- Provides an "end-to-end" view of the process.
- Shows suppliers that provide inputs and customers that receive outputs.

OTHER PROCESS DIAGRAMS

Cause & Effect Diagram – Visualizes causes of process problems. (aka Ishikawa, Fishbone)
X-Y Diagram – Used to prioritize X's (inputs). Shows their effect on Y's (outputs).
Pareto Analysis – Helps display and sort causes of process defects. Follows the "80/20" rule.

Failure Modes and Effects Analysis (FMEA):
- A tool that helps to predict failures and prevent their occurrence.
  * Severity – The financial impact of a failure.
  * Occurrence – The likelihood that a failure will occur.
  * Detection – The ability to detect a failure, if it does occur.
  * Risk Priority Number = Severity * Occurrence * Detection

ANALYZE PHASE

(No "Analyze Phase" topics on the White Belt exam.)

IMPROVE PHASE

LEAN IMPROVEMENTS

5S:
- A method for workplace organization.
  * *Sort – Seiri – Eliminate unnecessary items from the workplace.*
  * *Set in Order – Seiton – Ensure smooth workflow. Position process steps close to each other.*
  * *Shine – Seiso – Clean the workplace.*
  * *Standardize – Seiketsu – Align on best practices.*
  * *Sustain – Shitsuke – Review and improve the standards over time.*

Visual Workplace:
- Visual cues that help us understand the process and identify waste or other issues.
- Example: A gauge label with a red and green scale. When the dial is in the red, there is a problem.

Poka-Yoke:
- Features that prevent a defect ("mistake-proofing").
  1. *Contact Method* – Physical features detect contact (e.g. USB cable).
  2. *Fixed-Value Method* – Fixed # of actions must be performed (e.g. an online form).
  3. *Motion-Step Method* – Confirms the sequence of steps are correct (e.g. a pre-flight checklist).

Kanban:
- The best inventory control method for addressing waste.
  * *Pulling* (kanban) is when we produce "just in time," only when it's needed. (Wait for kanban signal.)
  * *Pushing* (NOT kanban) is when we produce lots of inventory in large batches, which results in waste.

Kaizen:
- A philosophy of continual process improvement.
- All process can and should become better.

CONTROL PHASE

(No "Control Phase" topics on the White Belt exam.)