

Black Belt Lean Six Sigma Tables of Content

Introduction

- Introduction to Lean Six Sigma
- Historical development of Six Sigma
- Historical Development of Lean Management
- Lean Six Sigma integration
- Selecting Lean Six Sigma Projects
- The 15-Step Process
- Definition of DPU, DPMO, FTY, RTY Cycle Time
- Definition of CTQ, CTC, VOC, VOP
- Financial Evaluation & Cost of Quality
- The eight Types of Waste
- The 5S
- Value Stream Mapping

1) DEFINE Phase

- Introduction to Define
- Define Objectives
- Project Selection
- Define Tools

Step (1): Identify Project CTQS

- Focus on the Customer
- Voice of the Customer
- Product/Process Drill-Down Tree
- Identify Project CTQS

Step (2): Develop Team Charter

- Team Charter
- Business Case
- Problem & Goal Statements
- Project Scope
- Milestones
- Team Roles
- Project Exercise: Problem & Goal Statement
- Good Project vs. Bad Project
- Develop Team Charter

Step (3): Define Process Map

- Selecting the Right Projects
- High Level Process Map
- Project Approval Process
- Define Process Map
- CAP Tools
- Define Deliverables

2) MEASURE Phase

Introduction to Measure

- Measure Overview
- Measure Objectives
- Measure Tools

Step (4): Select CTQ Characteristics

- Identify the Measureable Customer CTQ
- Select CTQ Characteristic Objectives
- QFD Objectives
- QFD Opportunity
- QFD Definition, Flow down
- Building a House of Quality (QFD)
- QFD Pitfalls
- Understanding Processes Objectives
- Process Mapping
- Pareto Chart
- Failure Modes & Effects Analysis
- Data Types
- Continuum of Data Types
- Importance of Data Types
- Tool Summary
- Select CTQ Characteristics

Step (5): Define Performance Standards

- What is a Defect?
- Continuous and Discrete Data
- Establishing a Performance Standard
- Performance Standard

Step (6): Measurement Systems Analysis

- Sources of Variation
- Stability & Linearity
- Precision & Accuracy
- Gage Resolution
- MSA Checklist
- Test-Retest Study
- Gage Reproducibility & Repeatability Study
- Collecting the Data
- Equipment & Appraiser Variation in Gage R&R
- Analyzing the Gage R&R Results
- Analyzing Gage R&R Results Using Minitab
- Gage R&R: Important Questions to Ask
- Attribute R&R
- Destructive Gage R&R
- Measure Deliverables

3) ANALYZE Phase

- Introduction to Analyze
- Analyze Phase Objectives
- Analyze Tools

Step (7): Establish Process Capability

- Baseline Current Process
- Normality Test
- Baseline using Continuous Data
- Continuous Data Objectives
- Statistics & Some Distributions
- Probability
- Mean, Standard Deviation, & Equations
- Standard Deviation & Measures of Variation
- Normal Curve & Probability Areas
- Calculating Z & Probability of a Defect
- Catapult Exercise
- Basic Statistics Calculations (Histogram, Dot , Box Plot, Run Chart, Multivari Chart, Normality Test)
- Baseline using Discrete Data
- Discrete Data Objectives
- Unit, Opportunity, & Defect Definitions
- Linking DPO to Probability of Defect
- The Normal Curve & Capability
- Six Sigma Product Report
- Yield
- Inspection
- Quantification of Defects
- DPU Applications Rules
- Process Capability Goals & Objectives
- Z-short term
- Special Cause vs. Common Cause Variation
- Rational Subgrouping
- Shift & Drift
- Components of Variation
- Capability Calculations
- Short Term vs. Long Term Capability
- Sum of Squares & Standard Deviations
- Universal Equation for Z
- Z Bench
- Control vs. Technology

Step (8): Define Performance Objectives

- Defining the Performance Objective
- Process Capability
- Benchmarking

Step (9): Identify Variation Sources

- Cause and Effect
- Fishbone
- Pareto Chart
- Process Map Analysis
- Hypothesis Testing Overview
- Identify Variation Sources Objectives
- Tool Review
- Sample vs. Population
- A Statistical Hypothesis
- Hypothesis Testing Protocol
- Type I & Type II Error
- The p-value
- Types of Hypotheses
- Relationship Between A & B
- Data Analysis
- Factor vs. Response
- What will be covering in Analyze
- Hypothesis Testing: Continuous Y; Discrete X
- The Data Analysis Roadmap: Continuous Discrete X
- Study Stability
- Run Chart
- Study Shape
- Descriptive Statistics
- Non-Normal Data
- Mood's Median Test
- Data Transformation
- Single Sample Test for Mean (Confidence Intervals): Two Sided
- T Distribution
- Confidence Interval of Mean: 1 Sample t-Test
- Single Sample Test for Mean: Two Sided (p-value)
- Homogeneity of Variance Test
- Two Sample t-Test for Equal Means: Two Sided
- Two Sample t-Test for One Mean Greater than the Other: One Sided
- Paired Data
- Paired t-Test
- Homogeneity of Variance: Three or More Samples
- Test on Means (ANOVA): Three or More Samples
- Understanding Sample Size & Risk
- Power of a Test
- Sample Size for the One/ Two Sample t-Test
- Summary of Hypothesis Tests
- Hypothesis Testing: Discrete Y; Discrete X
- The Chi-Square Tests
- The Goodness of Fit Test

- Chi-Square Distribution
- Test for Independence
- Minitab Chi-Square Test
- Sample Size for Discrete Data
- Hypothesis Testing: Continuous Y; Continuous X
- Scatter Plot
- Simple Linear Regression
- Regression Analysis Example
- Confidence & Prediction Bands
- Statistical Tolerance
- Multiple Regression
- Hypothesis Testing: Continuous Y; Continuous Xs and Discrete Xs
- General Linear Model

4) IMPROVE Phase

- Introduction to Improve
- Improve Phase Objectives
- Improve Tools

Step (10): Screen Potential Causes

- Determine the Vital Few X's that cause changes in your Y
- Discover Variable Relationships
- Determine the transfer function between Y and vital few Xs
- Determine optimal settings for the vital few x's
- Perform the Confirmation Runs
- Improvement by Design
- MSA for Xs
- Helicopter Experiment
- Stick-With-a-Winner Strategy
- One-Factor- At-a-Time Strategy
- Full Factorial Layout 3 Factors, 2 Levels
- Cube Layout
- The Factorial Pattern of Experimentation: 2k
- Replication vs. Repetition
- Randomization
- Lurking Variables
- Why Randomize?
- Generating Random Designs in Minitab
- Process of Experimentation
- Data Collection
- Analyzing & Plotting Raw Data
- Time Order Plots
- Outliers
- Time Order, Box Plots examples
- Variation Review
- The Pooled Standard Deviation

- Plot the Residuals

Step (11): Discover Variable Relationships

- Examine Factor Effects
- Main Effects Plots
- Factor Coefficients
- Factor Interactions
- Interaction Plots
- DOE with Prediction Model for Mean & Standard Deviation
- Analyzing Full Factorial Designs with Replicates
- Reducing the Size of Experiments
- Number of Runs Required
- Reducing the Size of a Factorial Experiment
- Choosing the Half Fraction
- Trade-offs Between Full & Half Fraction Designs
- Confounding Effects
- Screening Designs
- Plackett-Burman Designs
- Screening Design Selection
- Resolution
- Experimental Design Table
- Evaluating Multiple Responses
- Selecting an Experimental Design
- Detectable Effect Size
- How to Select an Experimental Design
- Experimenter's Checklist
- Identify Responses, Factors, & Factor Levels
- Selecting Response Variables
- Choosing Factors for the Experiment
- Center Points
- Making Decisions about Curvature
- DOE for Variances
- Collect & Analyze the Data
- Draw, Verify, & Report Conclusions

Step (12): Establish Operating Tolerance

- Specification limits
- Specify tolerances on the vital few Xs
- Tolerance
- Simulation

5) CONTROL Phase

- Introduction to Control
- Main Objectives
- Maintaining Control
- What is a Process Control System?
- Control Mechanisms
- Confirm the Solution
- Lean Control Tools (5S, Cellular Layout, Mistake Proofing, Quick Change Over, Standardize work)

Step (13) Define and Validate the Measurement System on Xs in actual application

- Measurement System is adequate to measure Xs

Step (14) Determine Process Capability

- Determine Post-Improvement Capability and Performance (Zst and Zlt)
- Compare process Capability Before and After
- Confirm improvement goal has been realized on the Y

Step (15) Implement Process Control

- Quality Planning
- The Quality Plan in the Project Lifecycle
- What is a Quality Plan?
- Process Controls
- Audit Requirement
- Types of Control Plans
- Control Methods
- Process Management Chart

Risk Management Process Introduction

- Objectives
- The Value of a Risk Management Process
- The Key Steps of a Risk Management Process
- Ways to Identify Risk
- Rating the Risk
- Prioritizing Risk
- Reducing Risk through Risk Abatement

Mistake Proofing

- Objectives
- Principles for Mistake Proofing
- Defects vs. Errors
- Why Do Errors Occur
- Inspection
- Elimination of Defects
- Mistake Proofing Techniques
- Prediction/Prevention & Detection Methods
- Mistake Proofing Steps

Variable Control Charts

- Statistical Process Control

- The Control Chart: In Control vs. Out of Control
- Some Variable Control Charts
- Five Main Uses of Control Charts
- Sampling & Collecting Data
- Control Limits
- Types of Control Charts
- X Bar & Range Chart
- Control Limits vs. Specification Limits
- Western Electric Rules for Out of Control Conditions
- Minitab Rules for Out of Control Conditions
- In Control vs. Out of Control
- Individuals & Moving Range Chart
- A Valid Control Chart

Attribute Control Charts

- Overview
- Defect & Defective Definitions
- Types of Attribute Control Charts (C-Chart, U-Chart, P-Chart, NP-Chart)
- Summary of Attribute Charts
- Implementing Attribute Charting (SPC)
- Five Main Uses of Control Charts

Process Focused Control Charts

- Objectives
- Why Use Process Focused Control Charts
- Process Focused Steps
- Control Chart Calculations
- 2-R Control Charts

Control Chart Summary

- Concepts
- Types of Control Charts
- Control Limits vs. Specification Limits
- Applying Control Processes to the Xs
- Process States
- Control Deliverables
- Six Sigma Control Plans
- Cost Benefit Analysis
- Elements of the Control Plan
- Elements of the Response Plan
- Project Benefits Calculation
- Project closer