

SIX SIGMA BLACK BELT BODY OF KNOWLEDGE

The University of Michigan recognizes that not all Black Belt programs are the same and training providers may emphasize or deemphasize certain topics based on their business needs. Still, we believe a Six Sigma Black Belt should be knowledgeable in at least the following areas and/or to an approved body of knowledge such as the [American Society of Quality](#) or [The Council for Six Sigma Certification](#) .

Note: Some topics are listed below as “advanced or optional”. We view these topics as recommended, but not required, body of knowledge areas.

Black Belt Body of Knowledge Topics

History, foundation, core principles, and financial drivers for Six Sigma
Integration of Lean and Six Sigma
Classic Forms of Waste
DMAIC Six Sigma versus Design for Six Sigma
Six Sigma Roles and Responsibilities
Project Identification and Selection
DMAIC Problem Solving Process and Project Management

DEFINE Phase: Identify Improvement Opportunities

Voice of the Customer (VOC) and Voice of the Business (VOB) Requirements Flow Down
Project Definition, Problem Statements, Scope Statements, and Project Charters
Process Maps/SIPOC/Swim Lane/Value Stream Mapping

MEASURE: Measure the Current State

Categorical versus Numerical Data
Descriptive Statistics
Yield, PPM Defective, Defects per Million Opportunity (DPMO), Rolled Yield
Process Time Decomposition (Process Time, Wait Time, Lead Time/Total Time in System)
Process Capability Indices and Analysis
Process Capability Analysis – Normal/Non-Normal Distributions
Basic Graphical Tools (Run Chart, Histogram, Box Plot, Scatter Plot, Interval Plot)
Overview of Basic Statistical Concepts – Sampling Methods, Estimation, Central Limit Theorem, Hypothesis Testing, Error, p-values, Statistical vs. Practical Significance
Assessing Process Stability – Variable Control Charts (X-Bar/Range, I/MR)
Assessing Process Stability – Attribute Charts (p-chart, u-chart)
Measurement Systems Analysis: Sources of Measurement Error (Accuracy, Repeatability, Reproducibility, Stability, Linearity)
Gage Accuracy Studies, Repeated Measurement Studies, and Gage R&R Studies
Attribute Agreement Analysis (Advanced)
Data Collection Plans

ANALYZE: Analyze Existing Process

Process Map (Flow Chart, SIPOC, Swim Lane, Value Stream Mapping)
Current State (“As-Is”) vs. Future State Maps
Structured Brainstorming, Cause and Effect Diagram, 5 Whys, and P-Diagram

Two Group Hypothesis Tests (F-tests, t-tests, 2 Proportion)
One-Factor ANOVA
Power and Sample Size Planning
Nonparametric Hypothesis Tests (e.g., Levene, Mann-Whitney, Kruskal-Wallis) (Advanced)
Simple Linear Regression/ Correlation/R-squared/Fitted Line Plot
Multiple Regression/Stepwise Regression/Best Subset/General Regression
General Linear Model (GLM) (Advanced)
Binary Logistic Regression (Advanced)
Principles of Design of Experiments (DOE)
DOE – 2k and 3k Factorial Experiments
DOE – Fractional Factorial Designs
DOE – 2k w/Center Points and Mixed Level Experiments (Advanced)
Multi-Vari Analysis (Multi-Vari Charts and Multiple Box Plots)
Categorical Data Analysis – Cross Tabulation and Chi-Square Tests for Independence
Categorical Measures of Associations (Advanced)
Reliability Analysis (Advanced)

IMPROVE Phase - Countermeasures and Short Term Verification

Error Proofing
Redesign Process Flow, Load Leveling
Standardized Work
Before versus After Improvements (Using above tools)
Pilot Studies

CONTROL – Develop Control Plans and Long Term Verification

Methods of Control/Control Plans
Quality at the Source/Source Inspection (Error Proofing)
Visual Controls and Daily Visual Management
Process Monitoring (including Leading vs. Lagging Indicators)
Failure Mode and Effects (FMEA) and Improving Methods of Control/Detection
Total Productive Maintenance (TPM) (Advanced-Optional)
Tolerance Analysis

Additional Lean-Six Sigma Topics (All Optional)

Conducting a Kaizen Event
System Productivity Analysis (Takt, Throughput, Nominal/Effective Time, Total Lead Time)
Capacity Planning/Analysis and Utilization (Nominal vs. Effective)
Load Leveling Analysis (Operator Bar Charts)
Standard Work Analysis (Time observation, capacity planning sheets, detail job instructions)
Implementing Pull Systems (Kanban, FIFO, CONWIP)
Flow Improvements (One-Piece Flow, Little's Law, Improving Facility Layout)