

The Six Sigma Standard

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Six Sigma

Six sigma is about results. It is a customer-centered, systematic, data-driven way of doing things better.

Six sigma puts tools and responsibility into the hands of people throughout the organization, and empowers them to make useful changes.

Six Sigma projects should naturally flow from the objectives of the organization. Approved projects should be those that provide the highest possible returns to the organization. As much as possible, they should also be free from pre-committed solutions, so that the tools and the data can drive the actual solution to the problem.

- “Customer-centered” means that six sigma projects begin with, and measure themselves by, customer satisfaction. Note that process customers are often internal to the organization.
 - Evidence of being customer centered:
 - Before a project is begun, steps are taken to investigate, understand, and prioritize customer wants and needs.
 - Process improvements from the project lead to measured improvements that better satisfy the customers of the process.
- “Systematic” means that it follows a roadmap that logically links tools in a way that makes them much more powerful than they are by themselves.
 - Evidence of being systematic:
 - Projects follow a pre-determined roadmap such that the outputs of tools used early in a project drive the application of tools used later in the project.
 - Tools are used in concert, to greater effect than if used separately.
- “Data-driven” means facts, data and analysis are used to make decisions and measure progress toward goals.
 - Evidence of being data driven:
 - The organization routinely gathers facts and data related to its operating environment, the needs and wants of its customers, and its effectiveness and efficiency at fulfilling those needs and wants.

- Facts and data are analyzed and organized in such a way as to make their information content easily visible.
- In a conflict between data and authority, data wins.
- “Doing things better” means in some measurable way improving the lot of customers, shareholders, or workers.
 - Evidence of success at doing things better:
 - The organization can demonstrate measured improvement in the magnitude and/or variation of revenue, cost, cycle time, inventory, product usefulness or durability, worker safety, or other relevant, measurable outputs.
 - The improvements are evaluated and shown to be real, rather than attributable to normal random variation.

Body of Knowledge

Six sigma may include any number of useful tools. No list can be exhaustive, but all practitioners should be competent in at least these core tools. Tools marked with * appear in practically all successful projects. A project should use only the tools that provide relevant insight.

Organizations may substitute alternate titles for these levels of competence. Each level includes the body of knowledge for the levels below it.

- Green Belt body of knowledge:
 - Principles of Six Sigma
 - A “roadmap” such as Define, Measure, Analyze, Improve, and Control (DMAIC), for applying tools in concert
 - Things happen because of a set of reasons (input variables). If we can discover and understand those reasons, we can control them to get the result (output variable) that we like. This is often expressed as $Y=f(x_1, x_2, \dots x_n)$.
 - Voice of the customer
 - Voice of the process
 - Principles of Lean/Toyota Production System
 - Constant improvement
 - Respect for people
 - Respect for natural resources
 - Customer centered
 - The ideal state
 - The Four Rules
 - Project Definition *
 - Project participants: team, leader, and management
 - Business case

- Objective
 - Key metric, and criteria for declaring success
 - Expected project results
 - Taguchi Loss Function
 - Individuals and Moving Range Charts *
 - Pareto Charts *
 - Muda
 - Process Map, showing the logical connection between process input and output variables *
 - Cause and Effect Matrix *
 - Failure Modes and Effects Analysis *
 - Poka Yoke
 - Process Capability
 - Control Plan*
- Green Belt project competencies:
 - Green Belts are competent to lead many types of projects that do not require the more advanced tools, but which benefit from the tools listed for the level.
 - Most business transaction projects
 - Some manufacturing projects
 - A few engineering or product/service design projects
- Advanced Green Belt body of knowledge
 - Data Types
 - Categorical/nominal
 - Ordinal
 - Interval
 - Ratio
 - Descriptive Statistics
 - Measures of central tendency
 - Measures of dispersion
 - The Normal Distribution
 - Confidence intervals
 - Measurement System Analysis
 - Interval or ratio data, precision/repeatability
 - Categorical/nominal data
 - Graphical methods, including at least
 - Box plots
 - Dot plots or histograms
 - Scatterplots.
 - Data Analysis (Regression, ANOVA, ANOM, or similar tools)
- Advanced Green Belt project competencies

- Advanced Green Belts are competent to lead many types of projects that do not require the Black Belt tools, but which benefit from the basic tools, plus Measurement System Analysis and multi-factor regression and ANOVA.
 - Practically all business transaction projects
 - Many manufacturing projects
 - Some engineering or product/service design projects
- Black Belt body of knowledge:
 - 2^K Experiments
 - Full Factorial
 - Fractional Factorial
 - Plackett-Burman
 - Evolutionary Operations
 - Central Composite Experiments
 - Xbar-R Charts
 - Capability Study based on rational subgrouping
 - Tests of Proportions
 - T Test
 - One-sample
 - Two-sample
 - Paired
 - Gage Repeatability and Reproducibility
 - Tests of Equal Variance
 - Chi Square Test
 - As needed, specialty Tools for Design for Six Sigma
 - Statistical Tolerancing
 - Pugh Concept Selection
 - Quality Function Deployment
 - Robust Product Design
 - Product FMEA
 - Reliability Prediction
 - Black Belts are competent to lead complex projects that require advanced tools for testing measurement systems, analyzing complex historical data, and planning and executing designed experiments.
 - All business transaction projects
 - All manufacturing projects
 - All the process improvement aspects of engineering and product/service design processes

Practitioner Certification

- Green Belt, Advanced Green Belt, and Black Belt candidates may certify by either of two paths.
 - They may certify by attaining a score of 75% or more correct on a proctored, comprehensive examination covering the body of knowledge for the level of certification sought.
 - They may certify by submitting a satisfactory report of a completed project to a Master Black Belt who was certified to this standard. The level awarded is determined by the tools that were appropriately and productively used in the project. Those who certify through this path are not required to take the examination, and are also awarded a Project Manager endorsement. To be successful, the completed project must present evidence that the project:
 - Directly relates to one or more of the organization's overarching goals.
 - Productively used the Six Sigma tools in concert, according to a roadmap such as Define, Measure, Analyze, Improve, and Control.
 - Demonstrates that the process is better than its predecessor, or, in the case of a new process/product, demonstrates that the process/product meets its design objectives.
 - Where feasible and productive, shows that the new process is:
 - Stable and predictable
 - Capable of meeting specifications
 - Controlled. "Controlled" means that the important process input variables have been identified and that an active plan is in place and working to keep those input variables in their desired state.
 - Satisfies the process owner.

Design for Six Sigma (DFSS) projects relate to the design of new processes or products. The criteria for certification are the same as for Green Belt, Advanced Green Belt or Black Belt. A DFSS project will often relate to just a portion of a product design.

- A candidate may be certified as a Six Sigma Champion on evidence that:
 - The candidate has led and managed a minimum of three Green Belt, Advanced Green Belt and/or Black Belt project leaders to successful project conclusion. One of these projects may be the candidate's own.
 - The candidate has contributed substantially to the management of a continuous process improvement program in their organization.

- A candidate who has been certified to this standard as both a Black Belt with Project Manager endorsement, and as a Champion, may be certified as a Master Black Belt.

Authorities

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