



## **Body of Knowledge for Six Sigma Green Belt**

### **What to Prepare For:**

The following is the Six Sigma Green Belt Certification Body of Knowledge that the exam will cover. We strongly encourage you to study and prepare for this exam.

### **Six Sigma Green Belt Certification**

#### **I. Importance of Six Sigma**

##### **a. Value of Six Sigma**

- i. **Six Sigma-basic premise**  
Describe how Six Sigma has fundamentally two focuses – variation reduction and waste reduction that ultimately lead to less defects and increased efficiency. Understand the concept of variation and how the six Ms have an influence on the process. Understand the difference between assignable-cause and common-cause variation along with how to deal with each type.
- ii. **History of organizational improvement/foundations of Six Sigma**  
Understand the origin of continuous improvement tools used in Six sigma (e.g. Deming, Juran, Shewhart, Ishikawa, Taguchi, etc.)
- iii. **Quality improvement concepts**  
Define and describe concepts such as prevention versus detection, quality characteristics (i.e. nominal-is-best, smaller-is-best or larger-is-best) and how they apply to target values.
- iv. **Value to the enterprise**  
Recognize why organizations use Six Sigma, how they apply its philosophy and goals. Describe how process inputs, outputs, and feedback impact the larger organization.
- v. **Drivers and metrics**  
Recognize key drivers for business [profit, market share, customer satisfaction, efficiency, product differentiation, defects per million opportunities (DPMO), etc.] and how key metrics are developed and impact the entire organization.
- vi. **Organizational Goals**  
Describe the project selection process including knowing when to use Six Sigma improvement methodologies (DMAIC) as opposed to other problem-solving tools, and confirm that the project supports and is linked to organizational goals.



- vii. **Business system and processes**  
Understand and distinguish interrelationships between business systems and processes.
- b. **Voice of the customer**
  - i. **Customer focus**  
Identify and classify internal and external customers as applicable to a particular project, and show how projects impact customers.
  - ii. **Collect customer data**  
Use various methods to collect customer feedback (e.g. Kano diagrams, observation, etc.) and identify key elements that make these tools effective.
  - iii. **Analyze customer data**  
Use graphical, statistical, and qualitative tools to analyze customer feedback.
  - iv. **Translate customer requirements**  
Assist in translating customer feedback into project goals and objectives, including critical to quality (CTQ) attributes and requirements statements. Use voice of customer analysis tools such as quality function deployment (QFD) and Kano diagrams to translate customer requirements into performance measures.
  - v. **Owners and stakeholders**  
Identify process owners, internal and external customers, and other stakeholders in a project.
- II. **Six Sigma and the organization**
  - a. **Six Sigma projects**
    - i. **Project charter and problem statement**  
Define and describe elements of a project charter and develop a problem statement, including baseline and improvement goals.
    - ii. **Charter negotiation**  
Create and negotiate the charter, including objectives, scope, boundaries, project transition, and project closure.
    - iii. **Problem statement**  
Develop problem statement, including baseline and improvement goals.
    - iv. **Metrics**  
Establish primary and consequential metrics (quality, cycle time, cost)
    - v. **Process elements**  
Define and describe process components and boundaries.  
Recognize how processes cross various functional areas and the challenges that result for process improvement efforts.



- vi. **Project planning tools**  
Use project tools such as critical path method (CPM), and program evaluation and review technique (PERT) charts, etc.
  - vii. **Project documentation**  
Create data-driven and fact-driven project documentation using spreadsheets, storyboards, phased reviews, management reviews, presentations to the executive team, etc.
  - viii. **DMAIC**  
Describe the phases of DMAIC model including tollgate reviews.
  - ix. **Project metrics**  
Assist with the development of primary and consequential metrics (e.g., quality time, cycle time and cost) and establish key project metrics that relate to the voice of the customer.
  - x. **Project risk analysis**  
Describe the purpose and benefit of project risk analysis, including resources, financials, impact on customers and other stakeholders, etc.
  - xi. **Project closure**  
Describe the objectives achieved and apply the lessons learned to identify additional opportunities.
- b. Teams**
- i. **Initiating teams**  
Know the elements of launching a team and why they are important: clear purpose, goals, commitment, ground rules, roles and responsibilities of team members, schedules, and support from management, and team empowerment.
  - ii. **Selecting team members**  
Select team members that have appropriate skills sets (e.g., self-facilitation, technical/subject matter expertise), and create teams with appropriate numbers of members and representation.
  - iii. **Team stages and dynamics**  
Define and describe the stages of team evolution, including forming storming, norming, performing. Identify and help resolve negative dynamics such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions and facts, groupthink, feuding, floundering, the rush to accomplishment, etc.
  - iv. **Roles and responsibilities**  
Describe and define the roles and responsibilities of participants on Six Sigma and other teams, including Black Belt, Master Black Belt, Green Belt, champion, coach, facilitator, team member, sponsor, process owner, etc.



- v. **Team tools**  
Define, select, and apply team tools such as nominal group technique, multivoting, etc.
  - vi. **Team facilitation techniques**  
Apply coaching, mentoring, and facilitation techniques to guide a team and overcome problems such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, tangents, etc.
  - vii. **Team-building techniques**  
Recognize and apply the basic steps in team building: goals, roles and responsibilities, introductions and both stated and hidden agendas.
  - viii. **Team performance evaluation**  
Measure team progress in relation to goals, objectives and metrics that support team success.
  - ix. **Motivation techniques**  
Define, select, and apply techniques that support and sustain team member participation and commitment.
  - x. **Communication**  
Use effective and appropriate communication techniques for different situations to overcome barriers to project success.
- c. **Senior management elements**
- i. **Organizational leadership**  
Understand leadership roles in the deployment of Six Sigma
  - ii. **Strategic planning**  
Describe the key elements of strategic business planning and describe why it is important at the project level and at the top level of an organization.
  - iii. **Supply chain management**  
Describe why development of suppliers is important to a Six Sigma initiative.
  - iv. **Barriers to implementation**  
Describe how to handle some of the common barriers to implementation.
- III. Six Sigma objectives**
- a. **Key process and product/service parameters identified**  
Identify key process input variables and process output variables (SIPOC), and document their relationships through relational matrices, etc. Develop and review process maps, flowcharts, failure modes and effects analysis (FMEA) etc.



- b. **Measurement systems that are discriminate, repeatable, and reproducible**  
Calculate, analyze, and interpret measurement system capability using control chart methods.
- c. **Processes in statistical control**  
Identify, select, construct, and apply the following types of control charts: X-bar and R, XmR, p, np, c, and u. Describe how turning attribute data into variable discrete data. Understand how to make 'active use' of attribute data.
- d. **Statistically capable processes**  
Identify, describe, and apply the elements of designing and conducting process capability studies, including identifying characteristics, identifying specifications, and verifying stability and normality. Define, select, and calculate Cp and Cpk, and assess process capability.
- e. **Long-term capability**  
Describe the assumptions and conventions that are appropriate when only short-term data are collected and when only attributes data are available. Describe the changes in relationships that occur when long-term data are used, and interpret the relationship between long- and short-term capability as it relates to a 1.5 sigma shift.
- f. **Design for Six Sigma (DFSS) in the organization**  
Understand why DFSS is important to Six Sigma implementation
- g. **Visual workplace/factory**  
Identify the key aspects of a visual workplace
- h. **Standard work**  
Identify the key aspects of a standard work.

#### IV. Six Sigma approach

- a. **Process analysis and documentation**
  - i. **Quality Function Deployment (QFD)**  
Describe how House of Quality fits into the overall DFSS process.
  - ii. **Process mapping**  
Develop and review process maps, written procedures, work instructions, flowcharts, etc.
  - iii. **Failure mode and effects analysis (FMEA)**  
Define and describe failure mode and effects analysis (FMEA). Describe the purpose and use of scale criteria and calculate the risk priority number (RPN).
  - iv. **Data collection methods**  
Identify and classify continuous (variables) and discrete (attributes) data.



- v. **Techniques for assuring data accuracy and integrity**  
Define and apply techniques such as random sampling, sample homogeneity, etc.
- b. **Probability and statistics**
  - i. **Basic probability**  
Understand the most basic fundamentals of probability (multiplication rule, etc.) measures of dispersion (range and standard deviation) and central tendency (mean, median, and mode), and construct and interpret frequency distributions.
  - ii. **Descriptive statistics**  
Define, compute, and interpret measures of dispersion (range and standard deviation) and central tendency (mean, median, and mode), and construct and interpret frequency distributions.
  - iii. **Graphical methods**  
Depict relationships by constructing, applying and interpreting diagrams and charts such as histograms [including cell interval calculations, stem-and-leaf plots, run charts, etc.] Depict distributions by constructing, applying and interpreting diagrams.
- c. **Collecting and summarizing data**
  - i. **Types of data**  
Identify, define, classify and compare continuous (variables) and discrete (attributes) data, and recognize opportunities to convert attributes data to variables measures.
  - ii. **Techniques for assuring data accuracy and integrity**  
Define and apply techniques for assuring data accuracy and integrity such as random sampling, sample homogeneity, etc.
  - iii. **Multi-vari studies**  
Create and interpret multi-vari studies to interpret the difference between within-piece, piece-to-piece, and time-to-time variation.
- d. **Lean enterprise**
  - i. **Value-added and non-value added activities**  
Identify waste in terms of excess inventory, space, test inspection, rework, transportation, storage, etc., and reduce cycle time to improvement throughput.
  - ii. **Characterize the classic wastes**  
Define and be able to differentiate the wastes (muda). (i.e. defects, overproduction, waiting, non-utilized talent, transportation, inventory, motion and extra processing).
  - iii. **Value stream mapping**  
Define and apply methods for construction including calculating take time, lead time, cycle time, etc.



iv. **Quick change-overs**

Describe the basic concepts regarding a quick change-over and why it is important to a lean enterprise.

V. **Quality improvement tools and techniques**

a. **Tools most commonly used in projects**

i. **Ishikawa tools**

Describe the objectives and benefits of cause-effect diagram, check sheet, Pareto chart, graphs, control charts, scatter diagram, and histogram.

ii. **New management tools**

Define, select and use 1) affinity diagrams, 2) interrelationship diagrams, 3) tree diagrams [including fault tree diagrams], 4) prioritization matrices, 5) matrix diagrams, 6) process decision program (PDPC) charts, and 7) activity network diagrams.

iii. **Control charts**

Describes the objectives and benefits of control charts, including controlling process performance, identifying special and common causes, etc.

1. **Rational subgrouping**

Define and describe how and why rational subgrouping is used.

2. **Populations versus samples**

Understand the distinction between a population parameter and a sample statistic.

3. **Random sample**

Understand the basic questions that should be asked about whether or not a sample is to be considered 'random'.

4. **Analysis of control charts**

Interpret control charts and distinguish between common and special causes using the rules for determining statistical control (i.e. seven points in a row for shifts and trends, points out of control and non-random patterns).

b. **Process capability and performance**

i. **Process performance vs. specification**

Distinguish between process limits and specification limits.

ii. **Calculate process potential**

Calculate process performance metrics (Cp and Cpk).

iii. **Design for Six Sigma (DFSS) in the organization**

Understand why DFSS is important to Six Sigma implementation.

c. **Maintaining a solution**



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- i. **Standard operating procedures**  
Define methods for standardizing procedures.
- ii. **Error proofing/Mistake proofing/poka yoke**  
Define and apply methods/examples for error proofing.
- iii. **Audits**  
Define and apply methods for application.
- iv. **Project tracking**  
Define and apply methods for application.