

# Benefits, obstacles, and future of six sigma approach

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## Abstract

Understanding the key features, obstacles, and shortcomings of the six sigma method allows organizations to better support their strategic directions, and increasing needs for coaching, mentoring, and training. It also provides opportunities to better implement six sigma projects. This paper examines the evolution, benefits, and challenges of six sigma practices and identifies the key factors influencing successful six sigma project implementations. It integrates the lessons learned from successful six sigma projects and considers further improvements to the six sigma approach. Effective six sigma principles and practices will succeed by refining the organizational culture continuously. Cultural changes require time and commitment before they are strongly implanted into the organization.

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## 1. Introduction

The six sigma method is a project-driven management approach to improve the organization's products, services, and processes by continually reducing defects in the organization. It is a business strategy that focuses on improving customer requirements understanding, business systems, productivity, and financial performance. Dating back to the mid 1980s, applications of the six sigma methods allowed many organizations to sustain their competitive advantage by integrating their knowledge of the process with statistics, engineering, and project management (Anbari, 2002). Numerous books and articles provide the basic concepts and benefits of the six sigma method (Harry and Schroeder, 2000) (Hoerl, 1998, 2001). The challenges and realities in implementing the six sigma method successfully are immense. However, the benefits of applying the six sigma method to technology-driven, project-driven organizations are equally great.

The objective of this paper is to review and examine the evolution, benefits, and challenges of six sigma practices and identify the key factors influencing successful six sigma project implementation. The paper also integrates the lessons learned from successful six sigma projects and their potential applications in managing traditional projects, and considers further improvements to the methodologies used for managing six sigma projects. Wider applications of six sigma principles to the organization will succeed through senior management involvement, organizational commitment, cultural change, and effective project management.

## 2. Two perspectives of six sigma processes

### 2.1. Statistical viewpoint

Six sigma method has two major perspectives. The origin of six sigma comes from statistics and statisticians. Hahn et al. (1999), Hoerl and Snee (2002), and Montgomery (2001) discuss the six sigma method from a statistical, probabilistic, and quantitative point of view. From the statistical point of view, the term six sigma is defined as having less

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than 3.4 defects per million opportunities or a success rate of 99.9997% where sigma is a term used to represent the variation about the process average (Antony and Banuelas, 2002). If an organization is operating at three sigma level for quality control, this is interpreted as achieving a success rate of 93% or 66,800 defects per million opportunities. Therefore, the six sigma method is a very rigorous quality control concept where many organizations still performs at three sigma level (McClusky, 2000).

2.2. Business viewpoint

In the business world, six sigma is defined as a ‘business strategy used to improve business profitability, to improve the effectiveness and efficiency of all operations to meet or exceed customer’s needs and expectations (Antony and Banuelas, 2001). The six sigma approach was first applied in manufacturing operations and rapidly expanded to different functional areas such as marketing, engineering, purchasing, servicing, and administrative support, once organizations realized the benefits. Particularly, the widespread applications of six sigma were possible due to the fact that organizations were able to articulate the benefits of six sigma presented in financial returns by linking process improvement with cost savings.

3. Understanding six sigma

3.1. Six sigma strategies, tools, techniques, and principles

Six sigma is a systematic, data-driven approach using the define, measure, analysis, improve, and control (DMAIC) process and utilizing design for six sigma method (DFSS) (GE 2004). The fundamental principle of six sigma is to ‘take an organization to an improved level of sigma capability through the rigorous application of statistical

Table 1  
Six sigma strategies, principles tools, and techniques (adapted from Antony et al., 2003)

Six sigma business strategies and principles	Six sigma tools and techniques
Project management	Statistical process control
Data-based decision making	Process capability analysis
Knowledge discovery	Measurement system analysis
Process control planning	Design of experiments
Data collection tools and techniques	Robust design
Variability reduction	Quality function deployment
Belt system (Master, Black, Green, Yellow)	Failure mode and effects analysis
DMAIC process	Regression analysis
Change management tools	Analysis of means and variances
	Hypothesis testing
	Root cause analysis
	Process mapping

tools and techniques’ (Antony et al., 2003). It generally applies to problems common to production. Table 1 summarizes six sigma business strategies, tools, techniques, and principles.

3.2. Six sigma strategies, tools, techniques, and principles

Anbari (2002) pointed out that six sigma is more comprehensive than prior quality initiatives such as Total Quality Management (TQM) and Continuous Quality Improvement (CQI). The six sigma method includes measured and reported financial results, uses additional, more advanced data analysis tools, focuses on customer concerns, and uses project management tools and methodology. He summarized the six sigma management method as follows:

$$\begin{aligned} \text{Six Sigma} &= \text{TQM (or CQI)} + \text{Stronger Customer Focus} \\ &+ \text{Additional Data Analysis Tools} \\ &+ \text{Financial Results} + \text{Project Management} \end{aligned}$$

3.3. DMAIC process

DMAIC is a closed-loop process that eliminates unproductive steps, often focuses on new measurements, and applies technology for continuous improvement. Table 2 presents the key steps of six sigma using DMAIC process.

3.4. DFSS methodology

DFSS is a systematic methodology utilizing tools, training and measurements to enable the organization to design products and processes that meet customer expectations and can be produced at Six Sigma quality levels (Mader, 2002). The goal of DFSS is to achieve minimum defect rates, six sigma level, and maximize positive impact

Table 2  
Key steps of six sigma using DMAIC process (Adapted from McClusky, 2000)

Six sigma steps	Key processes
Define	Define the requirements and expectations of the customer Define the project boundaries Define the process by mapping the business flow
Measure	Measure the process to satisfy customer’s needs Develop a data collection plan Collect and compare data to determine issues and shortfalls
Analyze	Analyze the causes of defects and sources of variation Determine the variations in the process Prioritize opportunities for future improvement
Improve	Improve the process to eliminate variations Develop creative alternatives and implement enhanced plan
Control	Control process variations to meet customer requirements Develop a strategy to monitor and control the improved process Implement the improvements of systems and structures

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