

SIX SIGMA BASICS

By Frank Esposito, Ph.D., Master Black Belt

Six Sigma, the quality improvement methodology made famous by Motorola in the 1980s, has generated a multitude of articles and hundreds of books by many authors for good reason: *It has produced significant cost savings and reductions in waste for the organizations that have embraced it.* Although its roots are in manufacturing, and it continues strong within that industry, it has expanded into such non-manufacturing industries as financial services, healthcare and food processing. Even the public sector is embracing the methodology because of its proven track record in private industry. But what exactly is it?

Six Sigma is a revolutionary business process designed to significantly reduce organizational inefficiencies thereby increasing bottom-line profits. The concept is to eliminate defects that take time and effort to repair, not to mention make customers unhappy. It is a management philosophy that eliminates defects by emphasizing understanding, measuring and improving processes.

What's in a Name?

The statistical concept of the term *six sigma* means that processes are working nearly perfectly, delivering only 3.4 defects per million opportunities (DPMO). Sigma (the Greek letter σ) is a statistical term that measures standard deviation and represents a measure of variation, in other words, the distribution around the mean of any process or procedure. For management, this term is used to measure defects in the outputs of a process and show how far the process deviates from perfection.

Let's take an example of a process operating at a one Sigma level. This process will produce approximately 690,000 defects per million opportunities or an output of only 31%, which is a really poor process.

On the other hand, a process operating at a three Sigma level is producing approximately 66,800 defects per million opportunities, delivering an output of 93.3%. This is much better but is still wasting a lot of money and disappointing customers.

Most organizations in the United States are operating at 3 to 4 Sigma quality levels and could be losing up to 25% of their total revenue as the result of processes that deliver too many defects. The basic idea of Six Sigma management is that, if defects in a process can be measured, there are

systematic ways to eliminate them to approach a quality level of zero defects.

Although Six Sigma is the goal, it is less important than the objective of pursuing continuing process improvement. A Six Sigma quality level is an idea or mindset, but astute managers know the real focus is on identifying defects and eliminating their root causes.

Five Phases of Six Sigma Methodology

The Six Sigma methodology is universally recognized and defined as comprising the following five phases: Define, Measure, Analyze, Improve and Control (DMAIC). In some organizations only four phases are used: Measure, Analyze, Improve and Control (MAIC). In this case, the Define deliverables are considered pre-work for a project or are included within the Measure phase.

The DMAIC methodology breaks down as follows:

- Define:*** Define the project goals and customer (internal/external) deliverables.
- Measure:*** Measure the process to determine current performance. The problem must be quantified.
- Analyze:*** Analyze and determine the root causes of any defects.
- Improve:*** Improve the process by eliminating defect root causes.
- Control:*** Control future process performance.

Black Belts and Green Belts are the practitioners of the Six Sigma methodology. They are responsible for implementing process improvement projects within the business and are knowledgeable and skilled in the use of the Six Sigma methodology and tools.

Black Belts typically complete four weeks of DMAIC in-class training and demonstrate mastery of the subject matter over a period of 4 to 5 months through the completion of projects and an exam.

Green Belts' level of knowledge and the skills associated with Six Sigma is less than that of a Black Belt. Green Belts typically complete two weeks of DMAIC in-class training over a period of three months through completion of a project and an exam. Green Belts normally devote 25-50% of their time to Six Sigma projects; however, it is a full-time job for Black Belts.

Master Black Belts are Six Sigma Quality experts who are responsible for the strategic implementations within an organization. They have the highest level of technical and organizational proficiency. A Master Black Belt's main responsibilities include training and mentoring of Black Belts and/or Green Belts; helping to prioritize; selecting and chartering highly leveraged projects; developing, maintaining and revising Six Sigma training materials; and maintaining the integrity of the Six Sigma initiative. They also teach other Six Sigma facilitators the methodologies, tools, and applications in all functions and levels of the company and provide leadership in integrating Design for Six Sigma into the business strategy and operational plans.

Misconceptions Abound

There are many misconceptions about who can "do" Six Sigma. The common belief is that Six Sigma can only be implemented in large corporations with big structures that have deep pockets and a large resource pool. Not so!

Large companies normally train one percent of their workforce as Black Belts and follow by training 3 - 4% as Green Belts. While large companies may have the luxury to pull from a large workforce to train thousands of Black Belts and Green Belts, Corporate Champions, Directors and Small Business Unit Champions, different approaches can be used for small and medium-sized companies.

USC Consulting Group takes a different approach. We obtain a clear understanding of our clients' organizational structure, culture and goals, assess their opportunities and, then, tailor training to a handful of people to help drive improvement through Six Sigma as it applies to their businesses. We also train and utilize Lean tools in conjunction with Six Sigma tools in order to help accelerate improvement.

Remember, Six Sigma is not an absolute; it is a vision.

Lean & Six Sigma Synergy

Six Sigma has been extremely effective in reducing and/or eliminating defects, improving quality and reducing costs. It has not been as effective in reducing process lead times and variation in the amount of time it takes to complete a process. This is because most methods and tools associated with Six Sigma do not focus heavily on *time*. Any savings in time that result from Six Sigma projects are usually a byproduct of reducing defects and the method itself.

As discussed in the previous section, in order to accelerate improvement, organizations must use both Lean and Six Sigma methods and tools simultaneously. It is the synergy of Lean and Six Sigma that helps organizations produce remarkable results.

Six Sigma will bring processes under statistical control. Lean will improve process speed or reduce invested capital. When these methods are used together, they are extremely powerful in improving the quality and speed of all types of manufacturing and transactional processes. USC Consulting Group draws from Lean and Six Sigma to tailor a solution that's right for our clients.

Design for Six Sigma

Design for Six Sigma (DFSS) is used to design or redesign a product or service from the ground up. It is based on the idea that when Six Sigma quality is designed correctly into the product at the outset, life cycle costs are dramatically reduced and product reliability greatly enhanced. DFSS augments an organization's current product development process; it is not a replacement. When the essentials of Six Sigma have been mastered, organizations are certainly ready to carry that improvement into the development and design of new products.

Like its parent Six Sigma, DFSS uses a disciplined set of tools to bring high quality to product launches. It begins with an analysis of an entire product development system to find gaps in the processes that are negatively affecting new product performance. It also addresses customer requirements that drive new product development. After gap analysis is completed and customer requirements identified, DFSS kicks in with its own version of Six Sigma's DMAIC. One popular DFSS is called DMADV (Define, Measure, Analyze, Design and Verify).

The DMADV methodology breaks down this way:

- Define:*** Define the project goals and customer (internal/external) deliverables.
- Measure:*** Assess the customer need and specifications; benchmark competitors and industry.
- Analyze:*** Examine process options to meet customer requirements.
- Design:*** Develop the process to meet customer requirements.

Verify: Check the design to ensure that it's meeting customer requirements.

There are many other versions of DFSS, including:

DMADOV (Define, Measure, Analyze, Design, Optimize and Verify)
DMCDOV (Define, Measure, Characterize, Design, Optimize and Verify)
DCOV (Define, Characterize, Optimize and Verify)
DCCDI (Define, Customer, Concept, Design, and Implement)
DMEDI (Define, Measure, Explore, Develop, and Implement)
DMADIC (Define, Measure, Analyze, Design, Implement and Control)

Although these approaches to DFSS differ slightly from one another, they generally proceed through similar steps toward the same goal using common tools. The general procedure for all is as follows:

- Customer requirements are gathered.
- These requirements are analyzed and prioritized.
- A design is developed.
- The requirements flow down from the system level to subsystems, components and processes.
- The product or service capability, including process capability, is tracked step-by-step and gaps between capabilities and requirements are identified to generate action items.
- A control plan is established.

Six Sigma vs. Design for Six Sigma

There are many similarities between Six Sigma and DFSS. DFSS could be viewed as a logical extension of Six Sigma, but the initiatives are very different. The basic differences between Six Sigma DMAIC with all versions of DFSS are that:

- DMAIC is more about reacting, detecting and resolving problems. DFSS is more proactive, a way of preventing problems from occurring.
- DMAIC is for an organization's current products or services. DFSS is for the design of new products or

services and processes in marketing, R&D and design.

- Cost savings obtained from DMAIC are easily and quickly quantified, however, savings resulting from DFSS are more difficult to quantify and can easily take a year or more after the launch of a new product before there is proper accounting on the impact of a DFSS initiative.

The new product development process via DFSS will provide the roadmap to success. DFSS provides tools and teamwork to get things done efficiently and effectively. By rigorously applying the tools and methods of DFSS, a predictable product quality product is assured.



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