Productivity Methodologies, Tools, and Techniques

Part I: Understanding Six Sigma and DMAIC methodology

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Pioneered by Bill Smith in 1986 while employed by Motorola, Six Sigma was originally defined as a metric for measuring defects and enhancing quality. It was originally developed for production processes, but has subsequently been applied in banks, insurance companies, restaurants, hospitals, schools, and many other types of service organization around the world.

Six Sigma is far more than simply another novel concept and can be regarded as a major innovation in terms of the management of quality throughout an organization. As a comprehensive methodology for process improvement, Six Sigma provides organizations with a roadmap for longterm success through enhancement of the quality of services and customer satisfaction. The International Organization for Standardization defines Six Sigma as “a statistical business-improvement approach that seeks to find and eliminate defects and their causes from an organization’s processes, focusing on outputs of critical importance to customers.”

For a Six Sigma program to produce the expected results, organizational roles and responsibilities must be clearly defined and aligned. If training is limited and focused on only a few people in the organization, the probability of success decreases to virtually nil. It is also extremely important to have a buy-in from upper management and employees on all levels. If any of these levels is not enthusiastic about using the Six Sigma methodology, it can ultimately lead to failure. It is also important to keep in mind that the successful implementation of Six Sigma requires perseverance from the top. The statistical representation of Six Sigma describes quantitatively how a process is performing. To achieve Six Sigma quality, a process must not produce more than 3.4 defects per million opportunities. In Six Sigma, a defect is defined as anything that does not comply with customer specifications.

Sigma level	DPMO	Yield (%)
1σ	692,462	30.7538
2σ	308,538	69.1462
3σ	66,807	93.3193
4σ	6,210	99.3790
5σ	233	99.9767
6σ	3.4	99.9997

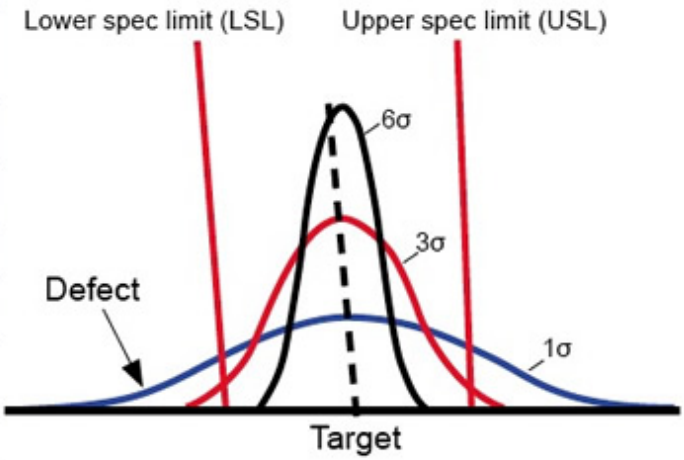

Figure 1. Six Sigma limits and defects per million opportunities (DPMO).

The tablular section is from Sheehy P., Navarro N., Silvers R., Keyes V., and Dixon D., The Black Belt Memory Jogger: A Pocket Guide for Six Sigma Success, *Salem, New Hampshire: Goal/QPC, 2002.*

An ESS can not only harness the collective wisdom of all employees, it can also help to develop two-way communication between management and employees to synchronize improvement activities within the organization (Figure 1). It provides opportunities for the leadership development of supervisors and a platform for workers to develop the kaizen mentality, creativity, and innovation. It is important for management to receive suggestions on solving problems positively. Negative attitudes often dampen employees' morale, causing them to refrain from making suggestions, without which there cannot be any creativity and innovation.

∞Define	Understand which process is to be improved and set a goal
∞Measure	Measure the current status
∞Analyze	Develop cause and effect theories of the cause(s) of the problem and scientifically search for the root
∞Improve	Develop and implement solutions
∞Control	Sustain the improvement

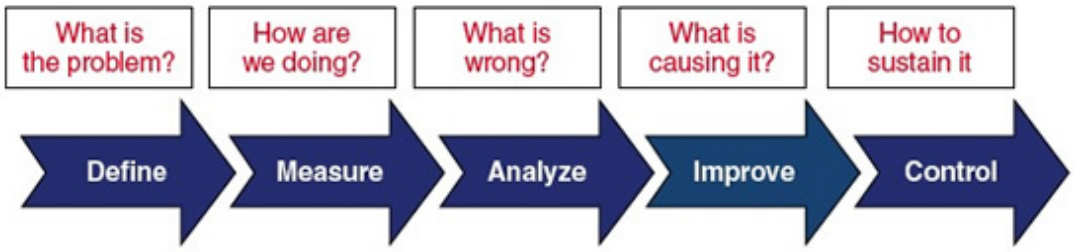

Figure 2. Steps in the Six Sigma DMAIC methodology.

Six Sigma and process variation

It is generally observed that customers judge a product or service based on the benefits they derive from using that particular product or service. Therefore it can be safely said that overall customer satisfaction rests heavily on the consistency of the product or service offered. To achieve this consistency, there must be a combination of improved process capability and reduced process variation. The

more variability in a process, the greater the probability that a defect will occur. A key element in achieving operational excellence is to identify sources of variation which affect a process, product, or service. Once identified, the key sources can then be earmarked for attention.

DMAIC methodology

The earmarking of key sources of variation is accomplished through the use of the Six Sigma define, measure, analyze, improve, and control (DMAIC) methodology. The Six Sigma DMAIC methodology differs from conventional problem solving in one significant way. There is a requirement for proof of a cause and effect relationship before any improvement action is taken. If the true cause(s) of a problem can discovered, then by controlling or removing the cause(s), the problem can be reduced or removed. Thus, discovering the root cause scientifically is at the core of the Six Sigma DMAIC methodology. In general, there are five steps in the methodology, as listed in Figure 2.

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