The Six Sigma Implementation Process

By Forrest W. Breyfogle III and Becki Meadows

There is an increasing amount of pressure on organizations to meet stringent quality and delivery specifications at lower prices. Strategic process improvements are needed to increase profit margins while meeting the demands of customers. However, organizations often possess a firefighting mentality, becoming overwhelmed with day-to-day activities and lose sight of what needs to be done to make process focused improvements or systemic changes in order to thrive in the "long haul." Organizations often consistently incur significant costs of poor quality that are never documented and therefore never understood.

Six Sigma, if implemented successfully, is a strategic business improvement approach that seeks to increase both customer satisfaction and an organization's financial health through systemic process change. In this paper we will be describing a Smarter Six Sigma Solutions (S^4) business strategy that offers a roadmap for combining the wisdom of the organization and data such that information is created, which can lead to significant new opportunities and the reduction of fire fighting. This long-term, process focused strategy facilitates companies in identifying and understanding critical business processes such that they become more proactive, as well as productive.

Six Sigma can be a great success or an expensive failure, depending on how it is implemented. Successful implementation should be viewed as ongoing process of infusing the Six Sigma methodology into an organization's culture such that employees use Six Sigma techniques when they approach their every day work.

The implementation process, as illustrated in Figure 1, requires up front work to develop awareness and generate buy in before projects are started. This paper highlights key steps in the overall process.
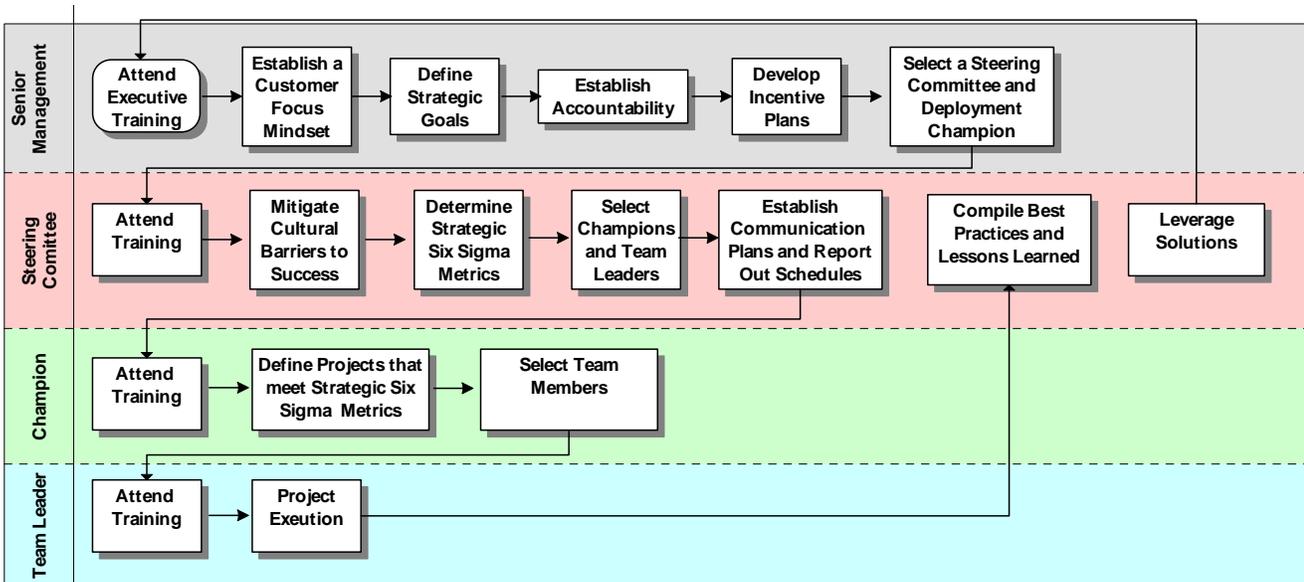

Figure 1: Implementing Six Sigma should be viewed as an ongoing, closed-loop process.

Step 1: Executive Level Training

A question we frequently hear from executives is " How does Six Sigma fit with other corporate initiatives?" We believe that Six Sigma should not be considered just another initiative but should integrate other programs. The "30,000 foot level" metrics of Six Sigma can be used to track progress in key areas of the business. In addition these metrics can give insight to what areas of the business should be given focus relative to project selection and what tool/strategy (e.g., lean manufacturing, Kaizen, Six Sigma Design of Experiments, or Six Sigma Gage R&R) is most appropriate for the given situation.

The process of implementing Six Sigma begins with the training of executive leaders. It is not enough for executives to support Six Sigma; they must lead the strategy. Senior managers who write memos on the importance of quality but still drive through volume-based metrics, will not have success with projects to achieve bottom-line benefits and improve quality. A project to increase quality in this organization will not be accomplished if volume is the only measure and rewarded accordingly. Six Sigma must be viewed as a method to meet strategic goals; these goals need to be measurable and have the focus of executive management.

We believe that senior management leadership was often a typical missing element for success with past Total Quality Management (TQM) initiatives. Projects were not typically selected from a strategic, executive perspective. Effective usage of statistical tools often did not get recognized and the overall company culture was not impacted. For true success with Six Sigma, executive level leadership is needed that asks the right questions leading to the wise application of statistical tools and other Six Sigma methodologies across organizational boundaries.

Step 2: Establish a Customer Focus Mindset

Establishing a Customer Focus mindset within an organization goes hand in hand with Senior Management Leadership when creating a successful Six Sigma business strategy. The factors that are critical to your customers' success are necessary to a process improvement team's true success. Therefore, evaluating customers' perception of quality should be at the forefront of the implementation process.

Customers chose suppliers that have the highest cost to benefit ratio. Every complaint from a customer should be viewed as an opportunity for growth and increased market share; a spotlight on areas needing process improvement focus. The key to success in this initial step is to make it easy for your customers' comments to be heard. Accurately capturing the "voice of the customer" is a laborious process that is frequently skipped over.

The needs of customers are dynamic. Features that were once considered "delighters" become qualities that are now expected. Organizations believe they understand what is important to their customers and are sometime surprised when they actually spend the time to quantify their actual needs.

Depending on the size of an organization and its core values, the word customer can take on many different definitions. When collecting feedback, care should be taken to include a comprehensive view of customers.   By combining external feedback with such things as internal business strategies, employee needs and government regulations, an organization will obtain a balanced list of customer needs.

Learning through customer feedback of what works and what does not, will help to establish a mindset of continual process improvement within your organization. Jack Welch, CEO of GE and the most visible advocate of Six Sigma, himself has been quoted to say that a business strategy alone will not generate higher quality throughout an organization.

Step 3: Define Strategic Goals
Goals without a roadmap can be detrimental. Asking the right question means defining the strategic goals of your organization. It requires communicating to your employees what is strategic and why and following up those statements with executive focus and metrics.

It is the job of executives and the steering committee to integrate the voice of the customer into the strategic goals of the organization. Much work is done before projects are even started to transform comprehensive customer feedback and internal business goals into strategic Six Sigma goals. Six Sigma then becomes a roadmap to meet those goals.

Again, Six Sigma should not replace existing organizational initiatives, but instead create an infrastructure that offers a tactical approach to determine the best solution for a given process/situation. There has to be accountability. There must be enthusiasm. It is similar to a self-help program. What you put into it is what you will get out of it. If you pay it "lip service," you will get mediocre results. If it utilized as a business strategy, it becomes a focused approach to meeting the strategic goals defined by executive management, allowing the application of resources in critical areas to the bottom-line.

Step 8: Mitigate Cultural Barriers to Success
Every company that takes on Six Sigma, undergoes a unique journey of integrating the methodology into their current culture. Implementation plans vary significantly between organizations, depending upon their distinct culture and strategic business goals, however, there are essential elements needed for this process of creating a successful infrastructure.

Launching a Six Sigma business strategy is an excellent opportunity to assess current culture in an organization. Consider the following questions:

- How has your company historically dealt with change initiatives?
- Does your company make consistent changes that don't last?
- How effective are your project teams?
- Are you frequently focusing on the same problem?
- How do our employees attack problems and conduct their daily work?
- What is required within your company culture to make continual process improvement a lasting change?
- What will prevent your company from achieving success with Six Sigma?

A Force Field Diagram can be created to facilitate the understanding of how well Six Sigma integrates with the current culture in an organization. By evaluating the key cultural drivers and restraints to embracing Six Sigma, organizations can develop action plans that enhance the key drivers and mitigate the critical restraints. Organizations need to have a direction that ingrains a process-focused, proactive mindset into the way all your employees approach their every day work. When successful, Six Sigma becomes part of your culture.

Step 9: Determining Strategic Six Sigma Metrics
The successful implementation of Six Sigma also highly correlates to the wise application of *Metrics*. Unfortunately, much confusion exists relative to the metrics of Six Sigma. There is no "one size fits all" metric applicable to every project. Effective metrics are cross-functional, providing a holistic view of the process and contributing insight to the project team. A lot of resource can be wasted if Six Sigma metrics are not applied *wisely* [2 and 5] and subsequently used to orchestrate improvement activities, "fire prevention" as opposed to "fire fighting".

Much confusion exists relative to the metrics of Six Sigma. The sigma level (i.e., sigma quality level) sometimes used as a measurement within a Six Sigma program includes a +/- 1.5σ value

to account for "typical" shifts and drifts of the mean, where σ is the standard deviation of the process. This sigma quality level relationship is not linear. In other words a percentage unit improvement in parts per million (PPM) defect rate (or defect per million opportunity [dpmo]) rate does not equate to the same percentage improvement in the sigma quality level.

To achieve this basic goal of a Six Sigma program might then be to produce at least 99.99966% "quality" at the "process step" and part level within an assembly (i.e., no more than 3.4 defects per million parts or process steps if the process mean were to shift by as much as 1.5σ). If, for example, there was on the average 1 defect for an assembly that contained 40 parts and 4 process steps, practitioners might consider that the assembly would be at a four sigma quality level, since the number of defects in parts per million is: $(^1/_{160})(1 \times 10^6) \approx 6210$.

Problems that can occur with using the sigma quality level metric include:

- The improvement from 4.1 to 4.2 sigma quality level is not the same as improvement from 5.1 to 5.2 sigma quality level.
- Determining the number of opportunities for any given process can be dramatically different between individuals.
- A sigma quality level metric can be deceiving. For example, one process might have a 50 percent defective unit rate and a sigma quality level much greater than six, while another process might have a .01 percent defective unit rate and have a sigma quality level much worse than six. To illustrate this first consider the counting of opportunities for failure within a computer chip as junctions and "components." The sigma quality level metric for this situation typically leads to a very large number of opportunities for failure for a given computer chip; hence, a very high sigma quality level is possible even when the defective rate per unit is high. Compare this situation to another situation where there were only a very few number of components or steps required for a process. The sigma quality level metric for this situation typically leads to a very low number of opportunities for failure; hence, a very low sigma quality level metric is possible even when the defective rate per unit is low.
- The sigma quality level metric can only be determined when there are specifications. Service/transactional applications do not typical have specifications like manufacturing does. When a sigma quality level is forced within a service/transactional situation this can lead to the fabrication of specifications and alterations of these "specifications" to make the "numbers look good."

Another Six Sigma metric that is used to describe how well a process meets requirements is process capability. A Six Sigma quality level process is said to translate to process capability index values for C_p and C_{pk} requirement of 2.0 and 1.5 respectively. Unfortunately there is much confusion with this metric, even though the following basic equations for these metrics are simple:

$$C_p = \frac{\text{USL - LSL}}{6\sigma} \qquad\qquad C_{pk} \;=\; \min\left[\frac{\text{USL} - \mu}{3\sigma}, \frac{\mu - \text{LSL}}{3\sigma}\right]$$

where USL is the upper specification limit, LSL is the lower specification limit, and σ is standard deviation. Computer programs often will not even give the same answer for a given set of data. Some programs consider the standard deviation to be short-term, while others consider standard deviation to be long-term. *Implement Six Sigma* [2] describes eight different approaches that could be used to determine standard deviation.

We believe that a *wise* approach to implementing Six Sigma is not to force a sigma quality metric within the various group and/or projects within an organization. It is most important to use the

right metric for any given situation [2, 5]. However, we must also note that we believe that it is essential that the sigma quality level metric be included, along with the other Six Sigma metrics, within all Six Sigma training. The positive, negative, and controversial aspects of each Six Sigma metric should be covered within the training so that organizations can more effectively communicate with their customers and suppliers.

Often customers and suppliers ask the "wrong question" relative to Six Sigma and other metrics. When an organization understand the plusses and minuses of each metric they can work with their customers and/or suppliers to direct their efforts toward the best metric for a given situation rather than reacting to issues that result from "mandated" metrics that makes no sense.

Care must be taken that the training an organization receives in Six Sigma metrics is not "sugar coated" and/or avoided. In addition to the wise selection of metrics, Six Sigma training should also address the wise use of statistical methodologies, providing insight to how one can best determine what is truly causing a problem.

Step 16: Project Execution
Once strategic projects are selected, many practitioners (Black Belts) have found a "21-step integration of tools" roadmap helpful in developing a plan for specific projects [2 and 5]. Consider step 1 of this roadmap.

Conclusion
Many companies attempt to improve products with numerous small changes or "tweaks" to their current processes; however, changes are frequently not documented and the associated results not reported. Substantial results are rarely obtained with this halfhearted method of change. When employees in this type of corporate culture hear of a new initiative such as Six Sigma, they wonder what will be different.

As a program or initiative, Six Sigma risks becoming the "flavor of the month" and will not capture the buy in necessary to reap a large return on the investment in training. With this approach, employees may end up viewing Six Sigma as a program similar to Total Quality Management (TQM) and other quality "programs", which may have experienced limited success within their organization.

In today's constantly changing market place companies that are able to embrace change in a focused and proactive manner are leaders in their field. Companies who not only master the technical side of Six Sigma but also overcome the cultural challenges associated with change can realize significant bottom-line benefits.

Companies are embracing Six Sigma not only to reduce defects, but also as a catalyst to change the culture of their company, impacting how employees engage in their every day work. Utilizing a Six Sigma business strategy, organizations can understand threats and recognize new opportunities for growth, not only to survive but to actually thrive within competitive environments.

Six Sigma is a long-term commitment. Treating deployment as a process allows objective analysis of all aspects of the process, including project selection and scoping. Projects should be selected that meet the goals of an organization's business strategy. Six Sigma can then be utilized as a roadmap to effectively meet those goals.

Utilizing lessons learned and incorporating them into subsequent waves of an implementation plan creates a closed feedback loop and real opportunities for improvement. Deploying Six Sigma through projects can lead to dramatic bottom line benefits if the organization invests the

time and executive energy necessary to implement a process to create a successful Six Sigma infrastructure.

Finally, creating and implementing Six Sigma does not guarantee tangible benefits within an organization. However, when Six Sigma is implemented *wisely* as a business strategy accompanied with effective metrics, organizations can achieve significant bottom-line benefits. Through the *wise* implementation of Six Sigma, the success of individual projects can build upon each other gaining the sustained attention of executive management and resulting in a corporate culture change from a reactive or fire-fighting environment to a learning organization.

Authors

Forrest W. Breyfogle III founded Smarter Solutions Inc. in 1992 after a 24 year career with IBM. Smarter Solutions (www.smartersolutions.com) specializes in the training and coaching of *wisely* applied Six Sigma techniques. To expedite the understanding, application, and communication of Six Sigma techniques the training material of Smarter Solutions closely follows the chapters of our books, *Implementing Six Sigma* [2] *and Managing Six Sigma* [5]. Forrest is an ASQ fellow, certified Quality Engineer, and certified Reliability Engineer. Forrest can be reached at 13776 U.S. Highway 183 N., Suite 122-110, Austin, TX 78750-1811, 512-996-8288, forrest@smartersolutions.com.

Becki Meadows is a certified Six Sigma Black Belt from General Electric and a mechanical engineer with 8 years of work experience and over 4 years of experience as a black belt. As a Smarter Solutions Associate, Becki conducts Six Sigma training and consulting at various sites, helping organizations to implement Six Sigma effectively. She co-authored the book, *Managing Six Sigma* [5], with Forrest Breyfogle.

References

1. F. W. Breyfogle III, *Statistical Methods for Testing, Development, and Manufacturing*, Wiley, New York, NY, 1992.

2. F. W. Breyfogle III, *Implementing Six Sigma: Smarter Solutions using Statistical Methods*, Wiley, New York, NY, 1999.

3. F. W. Breyfogle III, "Implementing Six Sigma," ASQ *Quality Management Forum*, 25: 2, Milwaukee, WI, Summer 1999.

4. F. W. Breyfogle III, "Deploy Six Sigma Plan as a Four-Phase Project," *ASQ Quality Management Forum*, 25, 3, Milwaukee, WI, Fall 1999.

5. F. W. Breyfogle III, J. M. Cupello, B. Meadows, *Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy that Yields Bottom-line Success*, Wiley, New York, NY, 2000.

6. P. M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization*, Doubleday/Current, New York, 1990.

7. M. J. Harry, "The Nature of Six Sigma Quality," Technical Report, Government Electronics Group, Motorola, Inc., Scottsdale, AZ.