

Bottom-Line Success with Six Sigma

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Learning disabilities are tragic in children, but fatal in organizations. Because of this, few corporations live half as long as a person -- most die before they reach the age of forty [Senge]. "Learning organizations" defy these odds and overcome learning disabilities. The *wise* application of Six Sigma offers a strategy where corporations can evolve into learning organizations.

Wisely applied Six Sigma also offers a roadmap for changing data into knowledge in order to reduce the amount of daily firefighting and uncover opportunities to impact the customer and the bottom-line. However, some organizations have had mediocre results after implementing Six Sigma. Reasons for this vary but typically lie within their infrastructure, the roadmap used for executing projects, or how they handle metrics.

Companies with profitable Six Sigma strategies create an effective infrastructure for selecting, supporting, and executing projects. Creating a successful infrastructure needs to be thought of as an ongoing process to be continually improved, revisited as part of executive planning sessions. Figure 1 shows one version of this process. This article focuses upon the first process step under "project teams," as shown within this figure. Emphasis within this process step, "Defining the project KPOV's" (Key Process Output Variables), will be given to the counting of defects, metrics, and the Cost of Poor Quality (COPQ) [or the Cost of Doing Nothing (CODN)].

Counting of Defects

Organizations often waste a lot of time creating metrics that are not appropriate for particular situations. Executive leaders can get deceptive results if they force all projects to determine a "one size fits all" metric in order to compare the quality of products/services from various departments. From a management point of view, having one universal metric seems very beneficial. However, such a directive can lead to ineffective activities and often encourages "playing games with the numbers."

Metrics that expose the hidden factory (i.e., reworks within a process), such as "Defect Per Million Opportunities" (DPMO), can be a very beneficial to some projects; however, within other projects, the same metric can require a huge amount of questionable-valued effort. To illustrate how metrics can be deceptive, consider the following two scenarios:

- **Scenario 1: Measuring Defects in a Service Industry**

Within Six Sigma, a defect rate is one measure of the frequency that an event does not meet customer expectations. For example, in a manufacturing environment if a shaft is larger than a diameter tolerance specification limit, the shaft could be too large to rotate freely within a bushing that is part of a later assembly. In this process, manufacturing specification limits have physical meaning; however, in a service/transactional environment this is often not the case. The airline industry considers that when an airplane departs later than 15 minutes, the event is considered a defect. We would like for this type of defect metric to be an accurate representation of the desires of customers who are impacted by the process. If this were a good descriptive metric, passengers should be equally dissatisfied if the airplane is 16 minutes late, as if the airplane is 3 hours late. This is typically not the case since a plane departure of 16 minutes might not affect airplane transfers at a destination location or cause other inconveniences, while a 3-hour late departure would often cause much more passenger frustration and inconvenience.

- **Scenario 2: Measuring Defects in Manufacturing Process**

Another situation is the manufacturing of high precision sheet metal that is not to have any void or scratches on the surface. Since this manufacturing process does not consist of discrete parts, we would

in a one-size-fits-all metric culture be forced to define an area of the part as an opportunity. These boundaries are supposed to define customer needs but typically lead to inconsistencies and playing games with the numbers. For example, one group might select a square foot area as an opportunity, while another might select a square inch or a square millimeter. If the Sigma Quality Level or DPMO rate does not look good, a team might even feel the compulsion to improve the perception of product quality by changing the area considered. This can yield dramatically different results, which offer little insight into the process.

Choosing the Right Metrics

A Six Sigma business strategy should encourage creating the right metric(s) for each situation. We discourage using a Sigma Quality Level metric (e.g., 3.4 parts per million defect rate equals a Six Sigma Quality Level) since this metric can often lead to the wrong activity and fabrication of numbers (an extension of the pitfalls described in the above section). Within a Six Sigma business strategy we are trying to determine more than just a "snapshot" of the rates of occurrence for a process. We really would like to create a picture that describes the output of a process over time, along with other metrics to give us insight as to where to focus improvement efforts. Unfortunately organizations often encourage practitioners to compile data in a format that does not lead to useful information.

To avoid this common pitfall, we suggest infrequent sampling from a process and the creation of "30,000 Foot-level" metrics for a project, as illustrated in Figure 2. The frequency of sampling should be such that typical noise variability of the process has a chance to occur between each sampling point. For example, if raw material changes daily, we might select one datum point daily. It should be emphasized that the intent of a 30,000 foot-level control chart (and later process capability analysis) is not to understand what might be causing variability or unsatisfactory results. Our intent is to basically establish a process baseline and the COPQ /CODN from the vantage point of a final customer, which in Figure 2 is determined from the frequency of non-conformance before process change. When organizations use this approach to track key metrics, they will typically redirect resources from a "fire fighting" mode to "fire prevention" activities through Six Sigma projects. The reason for this is that many undesirable outcomes previously considered special cause would now be considered common cause, which can only be fixed through a systematic process improvement effort.

This approach gives focus to what is sometimes called long-term variability within Six Sigma. When the 30,000 foot-level metrics and COPQ/CODN indicate that change is needed (see Figure 2), teams then tap into organizational wisdom to determine where to focus improvement efforts or future passive analyses. Sometimes these techniques capture low hanging fruit improvement ideas that are obviously beneficial. In other cases, there will be a need to test out theories through passive analyses using statistical tools such as ANOVA, regression analysis, and variance components analyses.

Passive analyses can then lead to proactive testing in the "improvement phase of Six Sigma", using the power of Design of Experiments (DOE). Our Control phase would then be used to maintain identified Key Process Input levels such that project improvement benefits are sustained after the Six Sigma practitioner moves onto another project. This approach is a much more powerful strategy than using "short-term process entitlement" as a driving metric, as suggested by some Six Sigma providers.

Calculating the Cost of Poor Quality or the Cost of Doing Nothing

Organizations are inconsistent in how they count bottom-line Six Sigma project benefits. Some organizations only count "hard savings" and will not give focus to "soft savings" (e.g., improving efficiency where there is no immediate head-count reduction). If only hard savings are considered, there will be minimal effort to improving efficiency when there is no immediate head-count reduction or cost prevention activities, such as reducing development cycle times. However, both improved efficiency and cost prevention activities can be very beneficial to an organization and should be, in our opinion, addressed within a Six Sigma business strategy.

In addition to being a controversial metric, soft savings can be difficult to determine. For the same process, one person can calculate a soft savings amount that is considerably different from another person. Calculating COPQ/CODN is a sub-process of Figure 1, involving employees from multiple levels of the organization. The ideal process incorporates a rough estimate of COPQ/CODN when selecting strategic projects. The project team later refines this calculation with the help of a finance representative.

COPQ/CODN should be a common metric considered within all projects. This metric creates effective communication of project worth throughout all levels of the organization and ties quality to the bottom line. Even though a COPQ/CODN metric including soft savings is at times ambiguous, with some agreed-to guidelines, this metric can help lead organizations to the right activity. The wise implementation of the COPQ/CODN metric is a critical element necessary to any successful Six Sigma infrastructure.

Authors

Forrest W. Breyfogle III founded Smarter Solutions in 1992 after a 24-year career with IBM. Smarter Solutions, Inc. (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 and Managing Six Sigma*. Forrest is an ASQ fellow, certified Quality Engineer, and certified Reliability Engineer. Forrest can be reached at Smarter Solutions, Inc., 13776 U.S. Highway 183 N., Suite 122-110, Austin, TX 78750-1811, 512-996-8288, forrest@smartersolutions.com.

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Figure 1. Smarter Six Sigma Solutions (S⁴) Implementation Process
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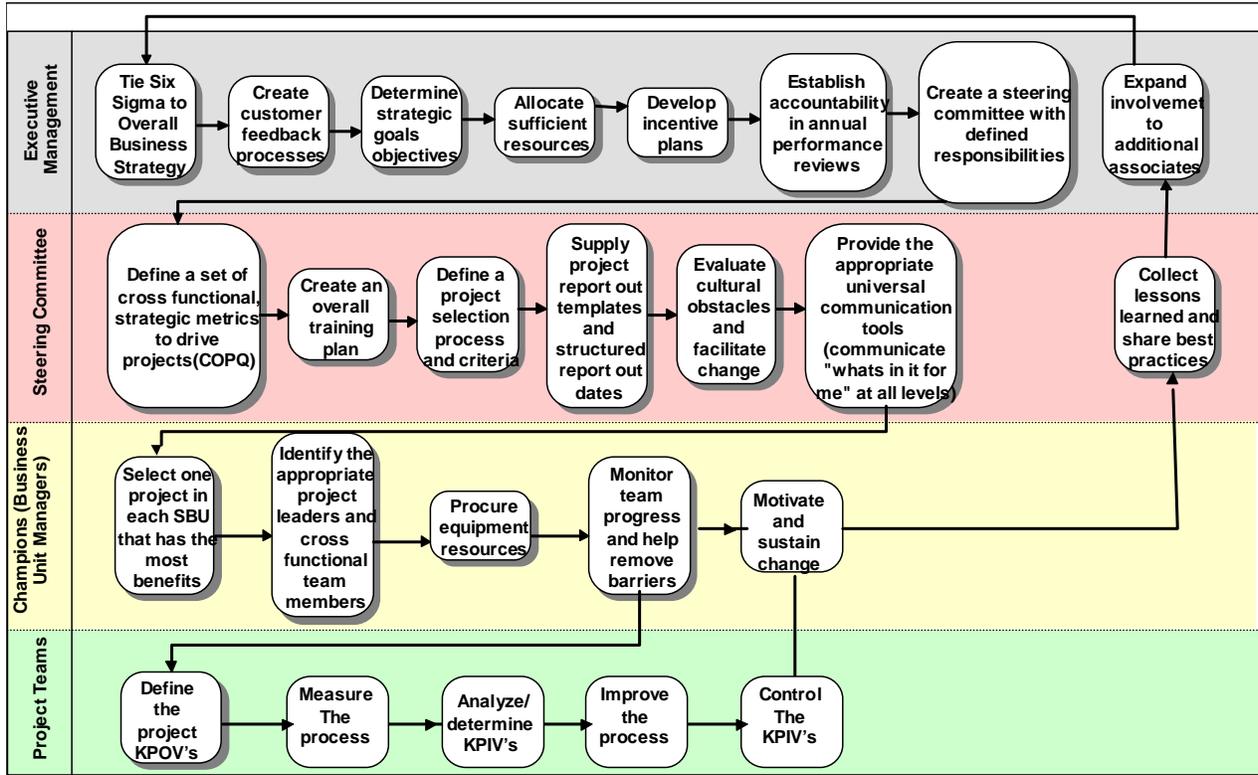


Figure 2. Smarter Six Sigma Solutions (S⁴) Measurement and Improvement Strategy with Example Tools
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