Billion-Dollar Benefits

Six sigma vs. traditional quality systems

BY DOUG CATER

I would be remiss if I didn't provide readers with an overview of the Six Sigma process. Since it was developed by Mikel Harry, while at Motorola, this statistical approach to understanding and improving process capability, and hence product quality, has been touted as the most revolutionary approach to productivity and profitability improvement ever.

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The impact Six Sigma has had on the bottom line of believers is no less than phenomenal. While Jack Welch referred to it as a "Quality Program", by the end of 2000 GE was estimated to have received over $6 billion in gross benefit and Allied Signal has had savings in the neighborhood of $2 billion since 1994. What other quality system or flavour of-the-day program has delivered results anywhere close to that? What has your ISO 9000 or QS 9000 program done for your costs in the last five years?

Six Sigma is a structured program of continuous improvement, focused on customer satisfaction. It has been defined as both a quality system and a business strategy. GE and Motorola, among others, have used Six Sigma to dramatically improve business performance. In contrast, many organizations use traditional quality systems such as ISO 9000 to satisfy contractual obligations, focusing on product quality and detection of defects. Six Sigma, on the other hand, focuses on defect prevention through process improvement, process design and process redesign.

The statistical term "sigma" is a measure of process variability. It describes the distribution of values about the average of a process. A process with Six Sigma capability would produce about 3.4 defects per million opportunities (DPMO), or 99.99966% good parts. Typical organizations produce goods with processes that have capability in the 3 to 4 sigma range — producing between 6,000 to 66,000 defects per million opportunities — driving the need for costly programs designed to inspect and test out the defective products. The higher the sigma level the greater the yield from the process and the lower the cost to produce.

If the probability of producing a defect is low enough, we do not need to incur costs to inspect product quality. Fewer inspectors, less inspection equipment, defect free products, lower cost — all leading to happier customers and more profitable business.

Implementing Six Sigma

Six Sigma implementation is typically team and project based, with a structured process in place for selecting appropriate improvement opportunities. The selection process is designed to ensure management support for the team, measurable benefit to the customer, and significant return on investment. Typical projects relate to quality, cost, throughput rates, or cycle time. A steering committee will normally review the project selection and ensure all necessary support is available, including funds, access to specialists, time for team members to work on projects, etc.

An organization's efforts are typically focused on product characteristics or features that are critical to the customer – Critical to Quality (CTQs). Black Belts Projects are typically managed by a Black Belt – an individual who has been trained in basic statistical methods, and who serves as a change agent for the organization. Their role is to drive process improvement through a structured process (defined below) involving the use of statistical tools and techniques. A successful Black Belt must be a Change Agent, which requires more than just a set of statistical tools. The appropriate mindset is something that is very difficult to teach and some people never really get it. Old habits die hard, and individuals have to overcome a number of organizational forces, as well as their own past behaviour, in many cases.

The job of a Change Agent/Black Belt can be a thankless, difficult task in some organizations. In order to achieve the results that make Six Sigma a success, the rate of change is usually very fast, putting the organization and its people under significant stress. This requires a person who can operate outside their "comfort zone" and who can successfully drive others outside of theirs.

The Six Sigma Process — DMAIC

1) Define – Define the customer's requirements. Involve the customer in establishing those "critical to quality" characteristics that will have a dramatic impact on their satisfaction and your profitability. Establish and define the team's charter, their specific, measurable goals and objectives. Identify the Team Leader, typically a trained Black Belt. Ensure the team has a sponsor. Map the process that is to be improved.

2) Measure – Identify and develop a process for measuring those CTQs identified by your customer. Since we can't measure everything, pick the three to five key inputs or outputs that define the characteristic and one measure of process performance (cost, cycle time, throughput, etc.) Data collection should involve understanding what conditions led to the current state and how the problem or opportunity impacts the customer. Those conditions could relate to material, machinery, methods or manpower.

The objective is to determine the inherent capability of the process considering the variability from all sources over the long term. This provides the benchmark for both the process, and the features of the product that are important to the customer.

3) Analyze – Where process capability is below +/- 6 sigma, the process is further analyzed and observed to determine what key factors or variables have the greatest influence on the CTQ and hence provide the greatest opportunity for improvement. This is where the statistical tools such as cause and effect diagrams, histograms, Pareto analysis, average and range charts, scatter diagrams, etc., are used. Process maps may be further developed to capture individual tasks, which are then analyzed to determine the value they add. Through analysis of facts and data using statistical methods, we identify those levers that will provide maximum benefit to the customer when improved.

The team's objective in the analysis phase is to establish and confirm the root cause of the problem or variability described in the "Define" phase of the project.

4) Improve – Based on the analysis, changes are made to the process and the results verified through the metrics. Typically, this is much more than "tweaking" the process. Brainstorming by the team, including customers and suppliers, often leads to the identification of significant changes to the process that are required to reach the Six Sigma level. Tools such as affinity diagrams are used to sift and sort through the solutions that are generated in the brainstorming process. The scope of the planned changes typically demands a project plan to document the key activities and tasks necessary to implement the changes.

Target dates, responsibilities and costs are tracked and monitored using structured tools such as Gantt Charts, Pert Charts, etc.

5) Control – Once the process improvements have been implemented, controls are put in place to ensure the gains are not lost. Statistical tools such as Pareto analysis, average and range charts; and non-statistical tools such as process sheets, flowcharts, checklists and work instructions, are used to control the new process. These not only control the process, they also provide the feedback loop necessary to ensure continuous improvement over the long term.

The Next Steps

There are already many books written on Six Sigma, and there will be many more as the success stories pile up. Find time to read them. Train your people and involve them in the improvement process. Benchmark other companies and find out what they are doing. Find a change agent who can drag you out of your comfort zone. You can't afford not to participate in this improvement initiative.

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