Six Sigma: The Power of Culture

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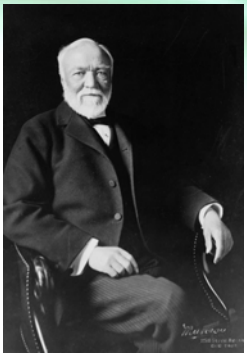
Introduction



"Quality is the most important factor in business."

Andrew Carnegie

Introduction

"Nine-tenths of the uncertainties of pig-iron making were dispelled under the burning sun of his chemical knowledge (Dr. Fricke's) ... What fools we had been! But then there was this consolation: we were not as great a fool as our competitors, who said they could not afford to hire a chemist.... We had almost the entire monopoly of scientific management."

One of the *critical lessons* you learn from Carnegie was his personal *engagement* in the *quality and manufacturing process* and his *personal selection of managers* who *would transform his goals into action* through *continuous improvement and innovation*.

Introduction

Six Sigma was the first improvement initiative that tied a level of investment to a clear profit return, the language a CEO can understand.

Anyone who has worked within a Six Sigma-driven organization knows Six Sigma isn't just an "improvement methodology." It is:

- ✓ A system of management to achieve lasting business leadership and top performance applied to benefit the business and its customers, associates, and shareholders.
- ✓ A measure to define the capability of any process.
- ✓ A goal for improvement that reaches near-perfection.

Introduction

The sigma level numbers often associated with Six Sigma represents the capability of a core business process, as measured in defects per million opportunities:

Sigma Level	Defects per Million Opportunities	Yield
6	3.4	99.9997%
5	233	99.977%
4	6,210	99.379%
3	66,807	93.32%
2	308,537	69.2%
1	690,000	31%

Introduction

The system needed to achieve Six Sigma creates a culture characterized by:

Customer centricity: The knowledge of what the customer values most is the start of value stream analysis.

Financial results: No project or effort is undertaken unless there is evidence indicating how much shareholder value will be created. The goal is for each black belt to deliver an average of $500,000 of improved operating profit per year.

Management engagement: The CEO, executives, and managers are engaged in Six Sigma. They have designated responsibilities for overseeing and guiding Six Sigma projects to make sure those projects stay focused on organizational priorities.

Resource commitment: A significant number, typically 1% to 3% of the organization's staff, is devoted to Six Sigma efforts full-time and other employees are expected to participate regularly on projects.

Execution infrastructure: The hierarchy of specific roles (such as black belts and master black belts) provides ways to integrate Six Sigma projects into the "real work" of the organization and sustain the rate of improvement.

Critical Success Factors for Six Sigma

Customer Centricity

The Six Sigma culture is customer-centric; its goal is to delight customers. The quality of a product or service is measured from the customer's perspective, by its contribution to their success. This customer focus comes through the Six Sigma drivers:

- ✓ Voice of the Customer: What the customers say they want.
- ✓ Requirements: Voice of the Customer input that is translated into specific, measurable elements.
- ✓ Critical to Quality (CTQ): Requirements that are most important to customers.
- ✓ Defect: Failing to deliver to a customer's CTQ.
- ✓ Design for Six Sigma: Designing products and processes based on customer requirements.

Critical Success Factors for Six Sigma

Financial Results

Six Sigma speaks the language of the CEO. That's why Six Sigma is quite explicit about financial benefits expected from each and every effort. Black belts and champions are expected to contribute between $250,000 and $1,000,000 of incremental operating profit each year (and/or capital reduction times the cost of capital).

These expectations tie Six Sigma to the financial goals of the company as no other improvement process has before it. There are some up-front costs: a lot of time and money is invested in the training and startup phase. But a well-designed Lean Six Sigma process more than pays its costs during the first year of implementation.

Critical Success Factors for Six Sigma

Management Engagement

Endorsement is inadequate

Executives must be an integral part of Six Sigma deployment

Critical Success Factors for Six Sigma

Resource Commitment

"How am I going to get my designs out if I give up my best engineers and program managers?"

The simple answer is that you need to make sure the projects selected are of highest priority to the organization and its customers. Then it's not a question of giving up anything, but rather devoting current resources to the highest priorities based on their potential to contribute to shareholder value. Those projects always get a lot more effort than is currently the case, whereas lower-value projects may be delayed. Ultimately, the champion will present the opportunities to his Profit and Loss (P&L) manager for approval.

Critical Success Factors for Six Sigma

Execution Infrastructure

Six Sigma possesses an infrastructure that effectively translates the CEO's agenda into a customer-centric set of projects chosen to maximize shareholder value and provides effective management and monitoring of results versus plan.

Starting at the top...

- ✓ The corporate champions are armed with the CEO and P&L manager 's agenda for financial performance and shareholder value increase.
- ✓ These strategic goals are translated to an operational agenda by the business unit champions (sometimes called "deployment champions") who report to the P&L managers. These unit champions are trained in the methods of identifying key value streams and prioritizing projects based on net present value (their potential contribution to shareholder value). The P&L manager has the ultimate authority for value stream identification and project selection, since his or her commitment to the process is essential for success.

Critical Success Factors for Six Sigma

Execution Infrastructure

- ✓ The customer critical-to-quality issues and the time traps within the key value stream are developed into projects and then prioritized. These projects (to execute cost reductions, quality improvements, etc.) are then executed by the black belts, who have been trained in the tools and team leadership skills of Lean Six Sigma.
- ✓ Project sponsors (who are or report to the P&L manager) own the process that is to be improved by a specific project. They have the specific authority to implement improvements and have ultimate long-term accountability for ensuring that the improvements and financial benefits stick.
- ✓ Implementation is accomplished by a mix of team members, including green belts (team members), black belts, and master black belts. Whereas the black belts and champions are assigned full time to improvement activities, the green belts who support black belt projects are generally part time and have received less training.

Critical Success Factors for Six Sigma

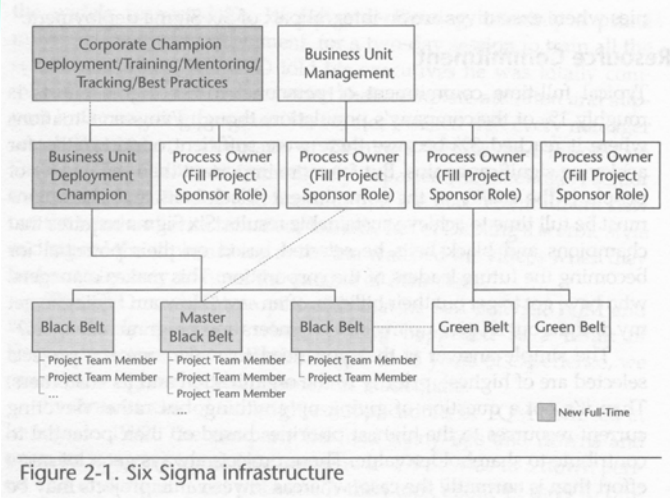


Figure 2-1. Six Sigma infrastructure

Critical Success Factors for Six Sigma

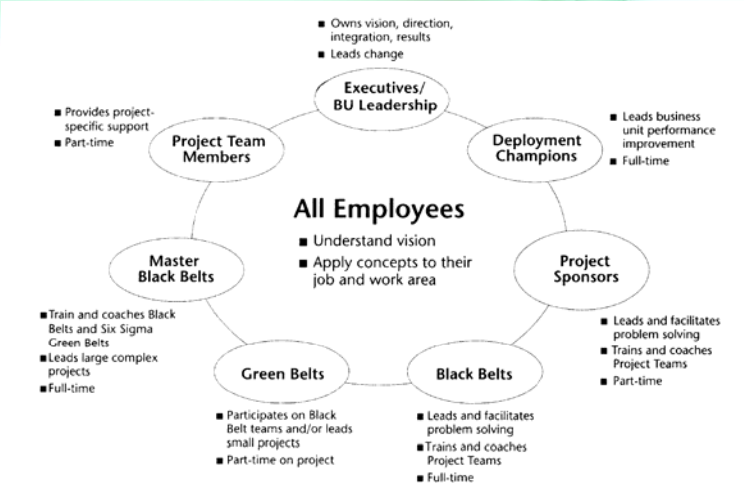


Figure 2-2. Performance improvement organization structure

Predicting Team Success, Preventing Team Failure

The success of Six Sigma is ultimately dependent on the ability of teams to execute projects effectively. It might be thought that the assembly of many brilliant individuals would be a satisfactory approach, but that perspective has been proven false time and time again. Even the Six Sigma culture can't over come poor team composition.

One area of common agreement is that it is possible to get much better results from a team if each member is playing his or her "preferred role," and if there is a balance of these essential roles on a team. Inexpensive software is available which facilitates relatively simple testing, which makes it possible to determine an individual's preferred role, both in his eyes and those of his peers.

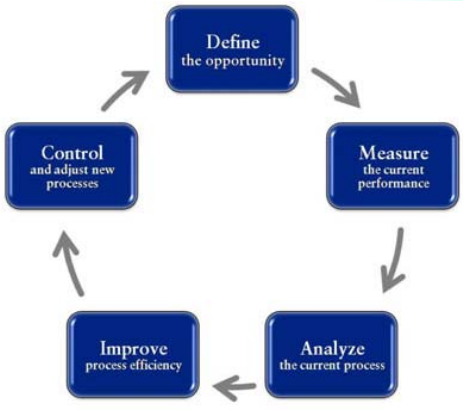
The Six Sigma Process and Improvement Tools

Some companies think Lean and Six Sigma is just a bag of tools and have attempted to implement Six Sigma by sending off people to black belt training and failing to make any of the substantive cultural changes described above. These programs end as just another "program of the month" failure. If you don't have the other elements discussed above—management engagement, a strong infrastructure, and so on—any effort put into improvement methods and tools will just be a waste of time.

So the key lesson is not to get lost in the statistical weeds or the improvement tools. Important as these are, the source of power is first and foremost in the culture.

The Six Sigma Process and Improvement Tools

Define-Measure-Analyze-Improve-Control (DMAIC)



The Six Sigma Process and Improvement Tools

Define-Measure-Analyze-Improve-Control (DMAIC)

The purpose of the **Define** phase is to clarify the goals and value of a project. Teams and champions use those tools necessary to assess the magnitude of the value opportunity in a given value stream, the resources required, and a design of the problem-solving process.

Assuming that the project is approved by the champion, the team proceeds to the **Measure** phase, in which the members gather data on the problem. Here, they primarily use data collection tools, process mapping, Pareto analysis, run charts, etc. (Teams working on non-manufacturing processes are often surprised at how much they gain by completing the Measure phase, because their processes have never been mapped or studied with data.)

The Six Sigma Process and Improvement Tools

Define-Measure-Analyze-Improve-Control (DMAIC)

In the **Analyze** phase, the team examines its data and process maps to characterize the nature and extent of the defect. The tools help them pinpoint the time traps and define the tools in priority order. This detailed knowledge about the problem lays the groundwork for finding improvements (in the next phase) that wifi address the underlying causes of the problem.

The **Improve** phase applies a powerful tool set to eliminate defects in both quality and process velocity (lead time and on-time delivery).

When the process has achieved the required quality level, the tools of the **Control** phase are employed to lock in the benefits. Some of these Control tools, such as mistake proofing (known as poka-yoke in Japanese), create a monitoring, gauging, and feedback system to instantly detect and correct trends—and to shut down the process if necessary. Mistake proofing makes it impossible for the process to create defects.

The Six Sigma Process and Improvement Tools

Process	Activity	Tools	
Define	1. Establish Team Charter 2. Identify Sponsor and Team Resources 3. Administer Pre-Work	Project ID Tools Project Definition Form NPV/IRR/DCF Analysis	PIP Management Process SSPI Toolkit
Measure	4. Confirm Team Goal 5. Define Current State 6. Collect and Display Data	SSPI Toolkit Process Mapping Value Analysis Brainstorming Voting Techniques Pareto Charts Affinity/ID	C&E/Fishbones FMEA Check Sheets Run Charts Control Charts Gage R&R
Analyze	7. Determine Process Capability and Speed 8. Determine Sources of Variation and Time Bottlenecks	C_p and C_{pk} Supply Chain Accelerator Time Trap Analysis Multi-Vari Box Plots Marginal Plots Interaction Plots	Regression ANOVA C&E Matrices FMEA Problem Definition Forms Opportunity Maps
Improve	9.Generate Ideas 10. Conduct Experiments 11. Create Straw Models 12. Conduct B's and C's 13. Develop Action Plans 14. Implement	Brainstorming Pull Systems Setup Reduction TPM Process Flow Benchmarking Affinity/ID DOE	Hypothesis Testing Process Mapping B's and C's/Force Field Tree Diagrams Pert/CPM PDPC/FMEA Gantt Charts
Control	15. Develop Control Plan 16. Monitor Performance 17. Mistake-Proof Process	Check Sheets Run Charts Histograms Scatter Diagrams	Control Charts Pareto Charts Interactive Reviews Poka-Yoke

Table 2-1. Lean Six Sigma tool set

The Six Sigma Process and Improvement Tools

Design of Experiments: Secret Weapon of the Rapidly Improving

One Six Sigma tool that demands special attention is Design of Experiments (DOE), an entire body of knowledge around how to manipulate process and product design factors to discover the combination that is most effective, efficient, and/or robust in actual operating conditions. There are many variations of DOE (the Classical, Taguchi, and Evolutionary Operations models, to name just a few), but all address the issue of yield improvement through reduction of variation.

Design of Experiments is one of the most powerful tools in the Six Sigma repertoire, but similar gains can be made with many of the simpler tools as well—especially iii organizations that have not yet applied Six Sigma methods to their processes. Tools such as flowcharts, run charts, and Pareto charts can help organizations pinpoint the true causes of a problem, which is the most important step on the road to finding effective solutions.

The Six Sigma Process and Improvement Tools

Design of Experiments Example

Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Braze Temp	+	–	+	–	+	–	+	–	+	–	+	–	+	–	+	–
Preheat	+	+	–	–	+	+	–	–	+	+	–	–	+	+	–	–
Braze Chemistry	H	H	H	H	L	L	L	L	H	H	H	H	L	L	L	L
Prep Meth	C	C	C	C	C	C	C	C	A	A	A	A	A	A	A	A

Table 2-2. Trial experiment for brazing

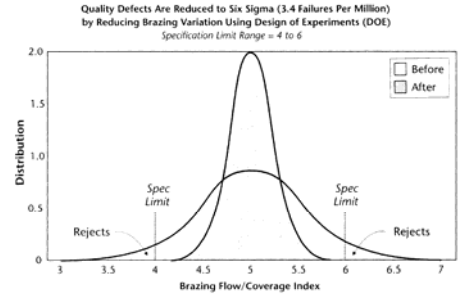


Figure 2-3. Reduced variation after DOE

The Six Sigma Process and Improvement Tools

The e-Infrastructure

E-tracking systems allow people throughout the infrastructure to monitor the effectiveness of black belt projects. All projects can be viewed on the web, and rolled up by the company champion for easy comparison to the CEO's plan for increased ROIC and revenue growth. Plan versus actual outputs of each business unit are available, and can be drilled down to the project level detail if so desired. Some are even using software to evaluate team strengths and weaknesses.

The Role of Six Sigma as a Metric

As a process metric, sigma level undoubtedly has value as an indicator of how often your organization's work fails to meet customer needs. Some advocates of Six Sigma have claimed that the concept also works at the corporate level. By some estimates, a manufacturer operating at 2 to 3 sigma guarantees that 15% of revenue is being wasted as cost of quality; by improving cost of quality to the 5 or 6 sigma level, that wasted 15% of revenue can be transformed into operating profit.

But other companies have been disappointed in trying to use the sigma level of the whole corporation as a valid metric. In service organizations, and even at the enterprise level of manufacturing firms, it's not always clear what should be counted as a "defect":

- ✓ From customers' perspective, long lead time and lead time variation are a defect that causes them to invest more capital in inventory (because they can't rely on getting the product when they need it from you, the supplier).
- ✓ Long lead time also causes excess internal costs, which is certainly a defect from the shareholders' perspective.

The Role of Six Sigma as a Metric

The best approach is to use the sigma level as a process metric. Measure initial sigma capabilities for specific core processes as a baseline, then recalculate them once you have improved those processes. Defects—be they due to process quality or process velocity or any other source—should be weighted not on their frequency, but on their importance to customers and their impact on shareholder value at the enterprise level. This has the further merit that it ties the improvement process into metrics that the operating managers are trying to improve.

The Key Is in the Culture

"culture eats strategy for breakfast"

Data indicates that most efforts succeed or fail based on execution; few fail for lack of a good strategy. Six Sigma provides the cultural framework to convert good strategy into good execution.

Key Messages of Six Sigma

- ✓ Everything starts with the customer.
- ✓ The infrastructure for cultural change is the most powerful contribution of Six Sigma.
- ✓ Decisions about which projects to pursue must be based at least in part on the potential impact on net present value.
- ✓ Sustained improvement is possible only with management engagement.
- ✓ CEO goals are translated to frontline projects and coordinated through an organization of people and technical resources.
- ✓ A standard problem-solving process and associated tool set provides the means for basing decisions on data.

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