Basics of Six Sigma

Using examples of successful implementation of the Six Sigma Breakthrough Strategy at such companies as General Electric, AlliedSignal and Polaroid, Mikel Harry, Ph.D., and Richard Schroeder (both of the Six Sigma Academy, Inc.) lay out in detail the theory and practice of achieving the astounding level of quality (3.4 defects per million opportunities) at the heart of this approach.

The Six Sigma Breakthrough Strategy is compelling and successful because it focuses on business processes and the components that comprise those processes. Among the lessons the authors impart in this summary are the following:

- What factors and business needs lead companies to implement Six Sigma.
- How to benchmark performance and use statistically constructed metrics to measure progress.
- How to breakdown a process into its elemental components, then find and correct the disconnects and variables that lead to errors, problems and dissatisfaction.
- How to structure your Six Sigma project teams, from the top down, and motivate them to succeed in their project-related endeavours.
- How to implement the Breakthrough Strategy at the business, operations and process levels.

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The Six Sigma Breakthrough Strategy is one of the most compelling and successful management strategies of the last quarter century. The Six Sigma Breakthrough Strategy is compelling and successful because it focuses on business processes and the components that comprise those processes. This article delves into the basics of the Six Sigma from the professional angle.

- How to prepare your organisation for the challenges, changes and ultimate rewards of Six Sigma.

There are also confirmations of Six Sigma's worth by no less a pair of executive-level experts than GE's Jack Welch and AlliedSignal's Lawrence Bossidy. They, among others, both note that in spite of the tremendous effort required to achieve Six Sigma quality, the Breakthrough Strategy is well worth every drop of sweat, every moment of frustration, every minute of training it requires. The rewards of extreme quality can be yours, too.

Why Six Sigma?

What drives companies to implement Six Sigma?

Quality alone is not the most important motivating factor. Six Sigma is about improving profitability — each sigma shift provides a 10 per cent net income improvement (see" The Cost of Quality" table below), a 20 per cent margin improvement, and a 10 to 30 per cent capital reduction.

Why Else Do Companies Implement Six Sigma?

It Sets Different Standards: Past definitions of quality focused on conformance to standards as companies strived to create products and services that fell within certain specification limits.

It is Process-Oriented: Companies use thousands of processes (activities that take an input, add value to it, and produce an output) to create their products and services. Six Sigma creates specific improvement goals for every process within an organisation, allowing companies to understand and incorporate new technologies for improved process performance.

It Stands for Quality: For some companies, the cost to

deliver a quality product can account for as much as 40 per cent of the sales price. No wonder former Motorola CEO Bob Galvin was once quoted as saying that leaders must take quality to a personal level in order to create lasting improvements.

The Cost of Quality		
Sigma Level	**Defects Per Million Opportunities**	**Cost of Quality**
2	308, 537 (Non Competitive Companies	Not applicable
3	66,807	25 - 40% of sales
4	6,210 (Industry average)	15-25% of sales
5	233	5-15% of sales
6	3.4 (Word Class)	< 1 of sales
Each Sigma Shift provides a 10 per cent net income improvement		

The Cost of Quality

Each sigma shift provides a 10 per cent net income improvement.

- It is a business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimise waste and resources while increasing customer satisfaction.
- It guides companies into making fewer mistakes in everything they do, from filling out purchase orders to manufacturing airplane engines, eliminating lapses in quality at the earliest possible occurrence.
- It doesn't merely detect and correct errors; it provides specific methods to recreate processes so that errors never arise in the first place.

The Players in Six Sigma

Before we examine the Six Sigma Breakthrough Strategy in detail, let us first review the different players in our company who will be involved in the process.

Champions: These key leaders fall under two categories: Deployment Champions (who function in executive capacities, with the added responsibility of nurturing Six Sigma) and Project Champions (who function at the business unit level and nurture Six Sigma at the project level). These individuals organise and lead the initialisation, deployment and implementation of Six Sigma— choosing the specific projects and implementing the required strategies and tactics.

Master Black Belts: These individuals are selected by Champions to act as in-house experts for disseminating the Breakthrough Strategy knowledge throughout the organisation. They devote 100 per cent of their time to Six Sigma— training and coaching Black Belts and Green Belts and communicating overall progress and status of projects within their areas or businesses.

Black Belts: These individuals, working under the tutelage of a Master Black Belt, apply the tools and knowledge of Six Sigma to specific projects. Like Master Black Belts, Black Belts devote 100 percent of their time to Six Sigma projects. They undergo extensive training in statistics and problem-solving techniques, and should pass that knowledge on by training 100 Green Belts every year. Indeed, the bulk of executing the Breakthrough Strategy falls to Black Belts.

Green Belts: These employees execute Six Sigma as a part of their overall jobs. Although focused on the day-to-day projects that comprise their work, they are still given two primary tasks under the Breakthrough Strategy: deploying the success of Six Sigma techniques and leading small-scale improvement projects within their respective areas.

The Six Sigma Breakthrough Strategy

There are eight phases involved in applying the Breakthrough Strategy to achieve Six Sigma performance in a process, division or company: **Recognise Define, Measure, Analyse, Improve, Control, Standardise and Integrate.**

Each phase is designed to ensure the methodical and disciplined application of the Strategy, the correct definition and execution of Six Sigma projects, and the incorporation of results in day-to-day business endeavours. These eight components of the strategy fall into one of four categories:

Identification: The Recognise and Define phases fall under this category, in which companies begin to understand the fundamental concepts of Six

Sigma and recognise the Breakthrough Strategy as a problem-solving methodology with a unique set of tools. These phases allow companies to recognise how their processes affect profitability, and then define what the critical-to-business processes are. The key component for companies to address in these two phases is variation across processes — how much of an impact variation has on results in terms of cost, cycle time and defect rates.

To achieve Six Sigma, companies must determine how to focus and deploy the Breakthrough strategy so that key business priorities and strategy issues are sufficiently addressed. The approach that one company takes in this endeavour might differ from the approach another takes, but one component is constant: All implementation and deployment strategies must flow down from the executive leadership.

Characterisation: Measure and Analyse fall into this category, which considers where a process is at the time it is measured and points to the goals to which a company should aspire by establishing baselines and benchmarks— thus providing a starting point for measuring improvements. Leadership creates an action plan to close the gap between current and desired processes, in order to meet goals for a particular product or service. It entails breaking down every product into its key characteristics, creating a detailed description of every step in a process, and measuring short- and long-term process capabilities.

Optimisation: This category (comprising the Improve and Control phases) identifies the steps required to improve a process and reduce the major sources of variation. Key process variables are identified through statistically designed experiments, and the "vital few" that have greatest impact are isolated. The knowledge gained from these steps is then used to improve and control a process, ultimately improving profitability, customer satisfaction and shareholder value.

Institutionalisation: The Standardise and Integrate phases that comprise the Institutionalisation stage address the integration of Six Sigma into the way a business is managed on a day-to-day basis. More than just a focus of projects through to completion, this stage offers a way to step back and look at how collective results of smaller projects affect the large, high-level processes that run the day-to-day business.

The Three Levels of Breakthrough: Business, Operations and Process

Almost every organisation can be broken down into three basic levels. The highest level is the business level — the umbrella level that encompasses everything related to the company. The next level is the operations level, while the lowest level is the process level.

The success of Six Sigma is defined as the extent to which it transforms each level of an organisation to improve that organisation's overall quality and profitability. The fluidity of the methodology allows it to work up and down the different levels of the organisation. The Breakthrough Strategy is applied to each level of the organisation as follows:

Business Level: The business-level application of the Breakthrough Strategy focuses on making significant improvements to the informational and economic systems used to steer your business, such as customer feedback or supplier quality. It requires a three-to-five-year commitment from executive leadership to consistently do the following:

- *Recognise the true states of your business:* Do you really know the states (or conditions) of your business? You cannot improve what you do not measure; identifying the various states of your business help you properly focus on what must be improved.
- *Define what plans must be in place* to realise improvement of each state. Creatively consider how to achieve a higher level of performance and relate those things to customer satisfaction.
- *Measure the business systems that support the plans:* Know what you need to measure and how to properly measure it, and get executive commitment to pursue the correct measurements.
- *Analyse the gaps in system performance and benchmarks:* Diagnose capability measures and assess performance gaps, through analysing benchmarks and uncover-

ing the "secrets" of how businesses operate at higher sigma levels.

- *Improve system elements to achieve performance goals:* Define your measuring system, collect the necessary data, analyse that data and prioritise your efforts for improvement.
- *Control system-level characteristics that are critical to value:* Monitor those efforts and their elements over a period of time, conducting regular "audits" of performance and controlling these critical-to-value characteristics.
- *Standardise the systems that prove to be best-in class:* Compare the optimal performance of your business systems with similar examples elsewhere. When appropriate, apply these findings to other business units, capitalising on the potential savings of your system level analysis and control.
- *Integrate best-in-class systems into the strategic planning framework:* Roll the improvements out to all pertinent business units, folding these improvements into critical business strategies and tying the initiative to compensation as an incentive for full cooperation.

Operations Level: The Breakthrough Strategy helps expose "operational issues" for what they are: a collection of higher-level problems that become confounded. The Strategy helps break apart the "issue" into its components, allowing you to define problems, formulate plans and take positive actions.

The Project Champion's role in this effort is as follows:

- *Recognise operational issues that link to key business systems:* Often, the tactical solution to an operational issue is masked by the underlying support system. For example, imagine a company's quality information system (QIS) that provides statistical data on product defects. The problem is that the defects are not identified until after the fact. Thus, while specific problems can be fixed, defects continue to appear sporadically over time. The company will not be able to improve its quality until it has identified the systemic problem: a QIS that delivers a posteriori data. Once it recognises that the issue is system- dependent, it can find a solution (for example, an in process quality measurement system).
- *Define Six Sigma projects to resolve operational issues:* Choose projects carefully. Six Sigma projects are usually identified and selected based on whether the project will save costs, is connected to operational issues with larger critical-to-quality (CTQ) issues, is connected to the operation of a business support system, and can proceed in a time-efficient manner.
- *Measure performance of Six Sigma projects:* Quantitatively gauge how well projects progress, in both an absolute and a relative sense, collecting and analysing data at the appropriate business levels.
- *Analyse project performance in relation to operational goals:* Compare the performance of a number of Black Belt projects with the operational goals of your business, and investigate the relationship between cycle time and quality.
- *Improve the Six Sigma project management systems:* Say, for example, that a business is tracking the savings generated by a project. At this point, it might start comparing projected and actual project costs. Or it might want to track other variables, such as net savings or project completion time.
- *Control inputs to project management system:* Institute regular audits of the project management system, ensuring standards are established and consistently met.
- *Standardise best-in-class management system practices:* Once you have uncovered a best-in-class management practice, make it a standard and transfer that standard to all relevant sectors in the business.
- *Integrate standardised Six Sigma practices into policies and procedures:* Institutionalise your Six Sigma practice into the fabric of day-to-day operations, interweaving the practice into operating policies and procedures and reinforcing them through rewards and recognition.

Process Level: Black Belts focus on processes, working to recognise poor processes that result in problems, additional costs and eroded quality. Their role in applying the Breakthrough Strategy is as follows:

- *Recognise functional problems that link to operational issues:* Break down errors in an effort to recognise the interrelated problems that cause them. Note the hierarchical nature of these process problems— in other words, how process problems connect to operational issues, which are, in turn, tied to support systems that link to business issues such as cus-

tomer satisfaction and profitability.

- *Define processes that contribute to the functional problems:* Determine whether the functional problems you have are related to products, services or transactions. Create process maps, breaking down necessary processes into individual steps, events or activities, to effectively search for solutions to problems.
- *Measure the capability of each process that offers operational leverage:* Express how well each process is performing, in the form of a measurement, noting the CTQ characteristics of each element, and its impact on the business.
- *Analyse data to assess prevalent patterns and trends:* Determine the relationships between the variable factors in the process and determine the direction of improvements.
- *Improve the key product/service characteristics created by key processes:* The Black Belt must focus on CTQ characteristics inherent in a product or service and then find ways to improve the capability of those characteristics. This is done by screening for variables that have the greatest process impact and establishing operating specifications for each.
- *Control the process variables that exert undue influence:* Process improvement is sustained by implementing measures that control the key variables. Note the difference between controlling the variables and merely monitoring them— you must address these variables before they contribute to problems, not after the fact.
- *Standardise the methods and processes that produce best-in-class performance:* Promote and standardise the Six Sigma methods that produced optimum results, as well as the optimised processes that result in exceptional performance.
- *Integrate standard methods and processes into the design cycle:* Don't create new processes for every new design or evolution in an existing design; make changes to the design itself to maximise efficiency.

The Breakthrough Strategy is designed to ensure that companies apply its precepts in a disciplined, methodical way; doing so at all levels ensures "leveraged" success.

Implementation and Deployment of the Strategy

To achieve Six Sigma, companies must determine how to focus and deploy the Breakthrough strategy so that key business priorities and strategy issues are sufficiently addressed. The approach that one company takes in this endeavour might differ from the approach another takes, but one component is constant: All implementation and deployment strategies must flow down from the executive leadership. Six Sigma is not a "grassroots" initiative. Among the many factors you will need to address prior to implementation and deployment are dependencies, focus, structure and project selection.

Deployment Dependencies: Successful implementation of the Breakthrough Strategy depends on an interaction of several principles, among them:

- Active, visible, top-down leadership.
- Metrics that accurately track the progress of the initiative, weaving accountability throughout and providing a tangible picture of the company's efforts.
- Internal and external benchmarking that provides an honest assessment of the organisation's true market position (the recognition of which may be termed a "significant emotional event").

The Black Belt must focus on CTQ characteristics inherent in a product or service and then find ways to improve the capability of those characteristics.

- "Stretch" goals that focus on significantly changing, rather than "tweaking," existing processes. Sufficient and pertinent training at all levels of the organisation.
- Champions and Black Belts that promote and carry out the initiatives at all levels of the organisation.

Creating Focus: How a company decides to focus its Six Sigma projects directly influences the way Six Sigma is deployed. Companies can focus their efforts on any number of factors, including the following:

- Cost Savings: Using this factor, a company can determine the number of projects it needs to complete to save a specific dollar amount. There are limitations inherent to this approach; it is, for example, difficult to establish a new mindset about quality within the company when the dollar figure is the focus.

- Deliverables: Identify the product family or system that is both of utmost importance to your company, as well as being the greatest cause of poor customer satisfaction. The danger in this focus is that your defects become more important than the processes or systems that create the product.
- Processes: This is the best way to attack the root causes of defects and customer concerns. It requires strong cross-functional coordination— correcting a process in one division almost always has applications for other divisions within the company.

Structural Elements: How a company organises the personnel involved in Six Sigma projects depends on how it's focusing its deployment, as well as how Six Sigma is integrated into the organisation — whether resources are freed up to focus solely on Six Sigma concerns. There are a number of concerns that must be discussed and decided upon prior to launching Six Sigma projects:

Black Belt selection- Who chooses Black Belts and what criteria must be used? How many Black Belts does the endeavor require? How will Black Belts be recognised and rewarded for their efforts?

The key to good project selection is to identify and improve those performance metrics that will best boost your company's financial success and impact its customer base.

Project selection- What criteria must be met to engage or terminate a project? Who will sign off on projects, and what criteria will they use?

Metrics- Which metrics will be standard across the company? What improvement goals will the company set?

Coordination- How will Six Sigma be coordinated with other organisational endeavors?

Budget- How will the company handle budget issues, such as whether the salaries of Black Belts are categorised as direct or indirect costs?

Training- How will the company train its Master Black Belts to deliver Black Belt training? What guidelines will be used for Black Belts to select and/or mentor Green Belts?

Project Selection

The key to good project selection is to identify and improve those performance metrics that will best boost your company's financial success and impact its customer base. Projects can be measured through the following key metrics:

Defects per Million Opportunities, or the total number of defects per unit divided by the total number of opportunities for defects per unit, multiplied by 1,000,000.

Net Cost Savings, or the verifiable reductions in fixed or variable costs.

Cost of Poor Quality, or the cost (in scrap, rework, warranty claims or returned material) of failing to produce 100 percent quality the first time through.

Capacity, or the number of good units a process is able to produce in a given period of time.

Cycle time, or the length of time it takes to produce a product or service. ❐