

Six Sigma: For long-term profitability

A M Kannan*

Six Sigma is a financially driven and data-driven set of methodologies to improve quality and to meet the customer expectations. It has emerged as highly disciplined process that helps the companies to focus on developing and delivering near-perfect products and services. This article points out that Six Sigma needs to be extended beyond the boundaries of the organization including both upstream and downstream partners.

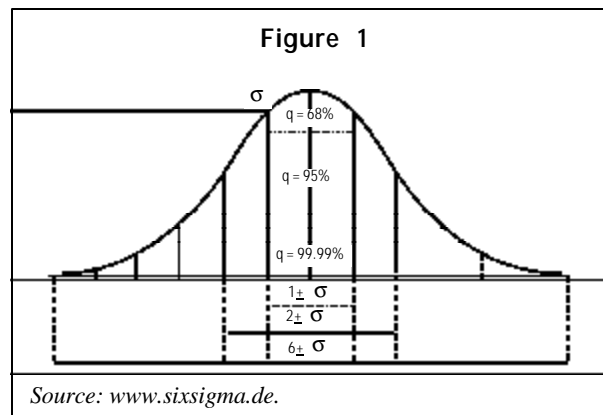
The concept of Six Sigma was first introduced in Motorola as a reaction to a steady decline in their market share. It was realized that due to the increasing complexity of their products conventional practices for quality control would be inadequate. It was also realized that the levels of product failures were much above the levels statistically predicted by finished products test results. It was also realized that in order to improve the quality and reliability of the finished products there would have to be a major shift in the quality paradigm. Will Smith a quality and reliability engineer at Motorola is credited with the early work on Six Sigma. He is credited with the view that one needs to talk in terms of defect rates of parts per million opportunities rather than the then prevalent practice of defects per thousand opportunities. The paradigm shift in the operations that can deliver such a high level of reliability is obvious.

Basic theory

The Greek alphabet sigma (σ) has been used as a measure of variation from a central mean of a physical quantity that varies randomly about the mean. Higher the sigma value higher the variation. Most production processes do exhibit a tendency to vary

about the mean value. A typical normal distribution curve as shown in figure 1 helps to understand the two key terms that have been used i.e., mean and variation.

With the above property, it is clear that if process has a variation such that the acceptable limits of the process fall outside the range of $6(\sigma)$ then the process will have a defect rate less than 2 parts per billion. In most industrial processes both the (σ) and the mean (m) tend to change with time. A Six Sigma process is one that can deliver a defect rate of less than 3.4 parts per million even when the mean itself shifts by up to $1.5(\sigma)$ in either positive or the negative direction.



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Box 1: Six Sigma at Wipro

Wipro employs Six Sigma to reach near Zero defects for a multinational chemical company.

The customer

Wipro's drive for quality leadership reached another milestone with the successful application of Six Sigma methodology to its software development process. Helping a large multinational chemical company raise their product quality levels to attain market leadership.

The challenge

The project involved development and delivery of web-based Interactive Technical Support Tools, called Wizards that would significantly reduce post-delivery defects of chemicals' products. The nature of project involved delivering wizards in stages; each stage having a very short project life cycle.

Benefits of Six Sigma

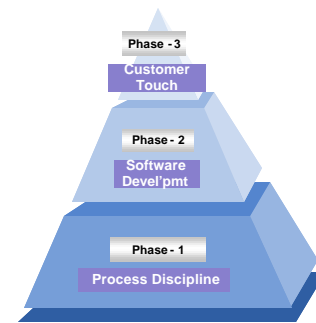
Six-Sigma is a process that helps the developer focus on developing and delivering near-perfect products and services. The central idea behind Six-Sigma is that if you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible.

Source: www.wipro.com.

Mission: Quality—a pervasive culture

- Quality is the #1 objective for all employees.
- Comprehensive quality system in place covering processes (ISO/SEI-CMM/Six Sigma), people (Six Sigma/SEI-PCMM) and technical skills (TL 9, 000).
- Over 6,500 employees trained in Six Sigma methodologies.
- 65+ certified Black Belts & 450+ live Six Sigma projects.

Phased expansion of our Six Sigma initiative



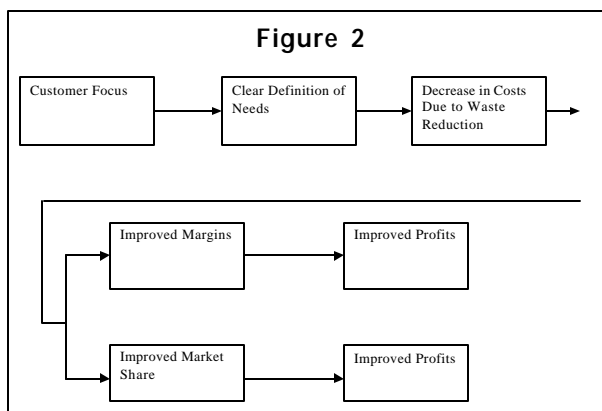
Savings from Six Sigma for the year ended March 2002—Rs. 920 mn (\$19 mn)

The Six Sigma philosophy

While Six Sigma may appear to be just another quality control tool that aims at delivering defect free products to an organization's customers, it goes much beyond being just a defect-eliminating tool. It is a process that aims at customer satisfaction by delivering his requirement. Six Sigma is therefore

customer centric and all improvement action begins with a clear definition of what the customer needs are.

Central to the theme of Six Sigma is the elimination of waste of all kind resulting in the optimal use of all resources in an organization. Optimal use of resources results in reduced costs and thus improved profitability, improved customer satisfaction also results in increase market share which in turn results in improved profitability. The outcome can be represented as shown in figure 2.



Implementation

Implementing Six Sigma involves a five step process also called DIMAC.

- **Define:** The goals of the existing system. Choose a process or product critical to business success. A clear customer focus is implicit in defining the goals of the system. It is only when the customer

Box 2: Six Sigma at GE: Achieving quality for the customer

Customers are the center of GE's universe

There are three key elements of quality: Customer, process and employee. Everything we do to remain a world-class quality company focuses on these three essential elements.

Delighting customers

Customers are the center of GE's universe: They define quality. They expect performance, reliability, competitive prices, on-time delivery, service, clear and correct transaction processing and more. In every attribute that influences customer perception, we know that just being good is not enough. Delighting our customers is a necessity. Because if we don't do it, someone else will!

Outside-in thinking

Quality requires us to look at our business from the customer's perspective, not ours. In other words, we must look at our processes from the outside-in. By understanding the transaction life cycle from the customer's needs and processes, we can discover what they are seeing and feeling. With this knowledge, we can identify areas where we can add significant value or improvement from their perspective.

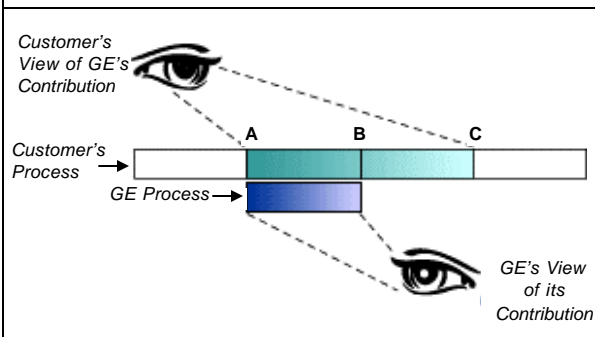
Leadership commitment

People create results. Involving all employees is essential to GE's quality approach. GE is committed to providing opportunities and incentives for employees to focus their talents and energies on satisfying customers.

All GE employees are trained in the strategy, statistical tools and techniques of Six Sigma quality. Training courses are offered at various levels:

- Quality Overview Seminars: Basic Six Sigma awareness
- Team Training: Basic tool introduction to equip employees to participate on Six Sigma teams.
- Master Black Belt, Black Belt and Green Belt Training: In-depth quality training that includes high-level statistical tools, basic quality control tools, Change Acceleration Process and Flow technology tools.
- Design for Six Sigma (DFSS) Training: Prepares teams for the use of statistical tools to design it right the first time.

Quality is the responsibility of every employee. Every employee must be involved, motivated and knowledgeable if we are to succeed.



Our customers feel the variance, not the mean

Often, our inside-out view of the business is based on average or mean-based measures of our recent past. Customers don't judge us on averages, they feel the variance in each transaction, each product we ship. Six Sigma focuses first on reducing process variation and then on improving the process capability.

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are offered at various levels: Customers value consistent, predictable business processes that deliver world-class levels of quality. This is what Six Sigma strives to produce.

GE's success with Six Sigma has exceeded our most optimistic predictions. Across the Company, GE associates embrace Six Sigma's customer-focused, data-driven philosophy and apply it to everything we do. We are building on these successes by sharing best practices across all of our businesses, putting the full power of GE behind our quest for better, faster customer solutions.

Source: www.ge.com.

Box 3: Six Sigma at Honeywell**Methodologies**

Honeywell has taken its continuous process improvement methods to a new level. As our overall strategy, Six Sigma *Plus* integrates all the improvement tools we've developed over the years. These include methodologies such as:

- Voice of the Customer
- Lean Enterprise
- Enterprise Resource Planning
- The Honeywell Quality Value assessment process
- New skills and techniques for Total Productive Maintenance
- Broader applications for Activity Based Management.

These Six Sigma *Plus* tools and methods improve our business processes to:

- Better understand customer expectations;
- Enhance the capability of our processes to meet and exceed those expectations;
- Enable the success of our e-business value creation strategy; and
- Forecast the impact of those improvements on our business.

But Six Sigma *Plus* is more than a collection of tools and methods. At today's Honeywell, it is a way of life.

Just as it takes a good recipe to create a perfect dish, it takes a good design to make a high-quality circuit board. By sharing Six Sigma *Plus* methodology with customers, Electronic Materials' Design Improvement Program (DIP) team has cooked up better designs, and, as a result, better products and delighted customers.

Electronic Materials' Advanced Circuits business manufactures circuit boards for use in servers, handheld radios, pagers, cell phones and other telecommunications products. The boards are built according to designs provided by the customer. Design problems can cause delays and costly redesigns.

The cross-functional DIP team assembled employees from Advanced Circuits' engineering and sales groups along with engineers from major customers Ericsson and Motorola. More than 350 engineers from customer organizations participated in learning classes in Design for Manufacturing (DFM) concepts.

Armed with DFM and other Six Sigma *Plus* tools, customers now provide better designs—reducing the potential for error and eliminating the need for time-consuming and costly redesigns. As a result, customers are delighted and they're sending more business to Advanced Circuits. One customer reported that, each time a redesign is avoided, his organization saves approximately \$100,000. Last year, Honeywell's revenue increased by \$86 mn from customers trained in DFM concepts.

"I feel that the design improvement program information that Honeywell Advanced Circuits provides is very valuable," says customer Bill Roma of Sun Microsystems. "We use it as a way to improve our design process and tools on a long-term basis."

Source: www.honeywell.com.

Box 4: Aerospace Services Wins Business Innovation Award

Honeywell Aerospace Services has received the Maintenance Repair and Overhaul (MRO) Business Innovation Award, in the Supplier category, from Aviation Week & Space Technology magazine.

According to the magazine, the award is given to a leading MRO supplier to honor a business that is “responsible for finding new ways to improve operations and service, profits, products, efficiency and effectiveness—while sustaining or improving safety and technical proficiency.” Among the achievements cited by the publication:

- Aerospace Services facilities use Six Sigma^{Plus} techniques to ensure service that is increasingly fast, dependable and highly responsive to customers’ needs. We hold our quality standards, processes and performance to the industry’s toughest standards and each employee benefits from at least 40 hours per year of job-related training.
- Our dedication to continuous improvement has driven significant enhancements in customer responsiveness. Average system-wide turnaround times for engine and component repairs have declined more than 40% since 1995; engine times have dropped from 46 to 25 days, and component times have dropped from 19 to 11 days. Three sites—Greer, South Carolina; Anniston, Alabama; and Burbank, California—have won quality awards from their respective states.
- Customers have benefited from our network’s continuous improvement practices and have recognized several of our sites for outstanding performance. For example, Tulsa, Oklahoma, has earned American Airlines’ SE2000 Platinum Award three years in a row. Anniston earned Platinum Level Supplier recognition from FedEx in 1999. In 1998, Greer earned the Pro Patria award from the US Coast Guard.
- Our world-class safety record demonstrates concern for our employees’ well-being, and it rewards customers with the increased efficiency of our operations. Four sites—Phoenix Sky Harbor; Greer; Kingman, Arizona; and Allentown, Pennsylvania—have earned the Voluntary Protection Program (VPP) Safety Through Accountability Recognition (STAR) award for their safety records, and Singapore earned the Ministry of Labor’s 1999 Silver Safety Award.

Source: www.honeywell.com.

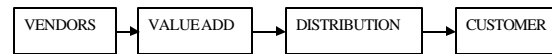
requirements are clearly understood that the critical processes can be identified and the process goals established.

- **Improve:** The system determines methods to change the process significantly and cut defect levels. This may involve redesigning both process and products so that they are in line with customer requirements. Advanced tools such as experimental design could also be used.
- **Measure:** The current system identifies the process parameter or product attribute that is critical to achieving the product/process goal. Establish to what extent the product /Process is achieving the goals.
- **Analyzes:** The system identifies potential areas for improvement, using simple quality tools like pareto analysis, cause and effect diagrams etc and basic statistics.
- **Control:** The new system monitors the new process to ensure the gains are realized and also sustained over a period of time. This will involve use of Statistical Process Control (SPC) techniques.

The impact

In striving to improve customer satisfaction, reduce wastage; improve margins and market share one has

to endeavor to improve the entire value chain. Working internally within the company can yield good results but for long-term results one will also have to work with operations external to the organization.



In a typical value chain represented above the only aspect of the chain strictly within the organizations control is the value adding process. However, to achieve the goal of delivering the customer requirement the organization will have to work closely with both the suppliers and the distributors of the product or service. This can lead to a cascading effect wherein all the elements in a supply chain can over a period of time achieve minimization of waste.

Conclusion

Six Sigma is a powerful tool to improve the long-term viability of an organization and can be an agent of both change and growth. This is amply proven by the experiences of a number of companies three of whom have been cited as examples. The Six Sigma approach is not restricted to an organization alone it does have a cascading effect and has the potential to be the change agent of the Indian economy as a whole, making Indian industry more competitive globally. ■

Reference # 15-02-11-03