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Achieving Total Customer Satisfaction Through Six Sigma

Six Sigma is a concept for now and well into the next century: focusing on the customer, not the product

by Jane Erwin.

If practice makes perfect, then practicing the precepts of Six Sigma leads to virtual perfection.

Six Sigma is a concept for now and well into the next century: It focuses on the customer, not the product! And while philosophers debate and cynics doubt whether anything can be truly flawless, the Six Sigma program developed by Motorola Corp. is winning converts because it works. It brings about a cultural change in a company, a paradigm shift toward expecting the highest quality, which then drives a passion for continuous improvement by all players.

The Six Sigma concept matured during 1985 to 1986, growing out of various quality initiatives at Motorola. The company's Land Mobile Products Sector first established a single matrix for quality known as total defects per unit, which dramatically changed the way management measured and compared quality improvement rates for all divisions. Because all operations used the same measurement, the goal for defect reduction could be uniformly applied to all activities. For the first time, everyone spoke the same language.

"Sigma" is a statistical expression indicating how much variation there is in a product. A performance level of Six Sigma equates to 3.4 defects per 1 million opportunities--not perfect, but pretty close. A defect is defined as anything that causes customer dissatisfaction. A unit is any unit of work--an hour of labor or a circuit board, or even a keystroke.

Robert W. Galvin, chairman of the Motorola Management Board executive committee, has said that Six Sigma signifies near perfection. The company, whose education and training arm, Motorola University, teaches Six Sigma concepts and courses, has saved billions of dollars for its worldwide corporation by practicing what it preaches.

"It's irrelevant whether perfection is possible," comments Howie Berg, a senior MU consultant. "Companies have reduced defect rates by factors of 10 and 20 annually when unshackled by presuppositions that it's impossible. Improve, and improve aggressively, is the vision. That's doable."

MU Managing Consultant Bruce Hayes points to Six Sigma's ability to address the ultimate bottom line: survival. "If a company's managers were to have the attitude, 'Why bother,' I would ask them what they would do if they woke up tomorrow morning and their No. 1 competitor announced it had improved efficiency 10 times, improved quality 10 times and is committed to delivering a better product with better service in half the time--all at the same price," declares Hayes. "Sound familiar? It happened to Motorola, General Motors and others in the 1970s, courtesy of Japan."

Mission: quality

Wipro Corp. is one organization that decided to change its tolerance level. A diversified conglomerate headquartered in Bangalore, India, the company reports that using the Six Sigma methodology during the past 15 months eliminated unnecessary steps and decreased rework, leading to an eightfold gain over the investments made.

It wasn't a difficult decision for the organization, notes Subroto Bagchi, corporate vice president of mission quality. "Our international software services' customers depend on us for mission-critical applications, which we run on their behalf from halfway across the globe via satellite links," he says. "In the Indian market, we make soaps, computers, hydraulic cylinders and computerized tomography scanners. Which customer is willing to live with a defect? There's no question of delivering anything less than perfect."

Wipro executives had heard about Six Sigma via the company's partnerships with General Electric Co., so Bagchi attended a quality briefing at

Coming to Terms with Sigma

Six Sigma may sound arcane and mystical, but in reality it's a mathematical formula. "Sigma" is a statistical term indicating to what extent a process varies from perfection. The number of units processed is multiplied by the number of potential defects per unit; the answer is divided into the number of defects actually occurring and then is multiplied by 1 million. The result is the number of defects per million operations. A conversion table translates that number into sigma:

= 3.4 defects per million

= 230 defects per million

= 6,210 defects per million

= 66,800 defects per million

308,000 defects per million

= 690,000 defects per million

Six Sigma is achieved through a process, which is tracked using simple tools such as the Pareto chart. This bar chart is widely used as a data display tool in Six Sigma because it identifies which problems occur with the greatest frequency or incur the highest cost. Hence, it provides direct evidence about what should be corrected first. Italian economist Vilfredo Pareto, for whom the chart is named, theorized that 20 percent of possible causes are responsible for 80 percent of any problem.

Another way to test variance is by performing the Chi^2 test. With this analytical process, a table is used to test the relationship between two possible causes of variation to determine the relationship's statistical importance.

Design of experiments methodically

Motorola University in Chicago. Afterward, in November 1996, an MU team visited India to conduct a business systems analysis.

Results were shared with top management from Wipro's five divisions, and they developed an 18-month plan. The chairman and senior management participated in a six-day training retreat. Then 12 facilitators, chosen from among successful line managers, were trained. Together with MU personnel, these facilitators trained nearly 800 people between May and November 1997. This year, about 1,000 more employees will be trained.

reduces process variation through a sequence of experiments rather than relying on a typical trial-by-error approach. Following each experiment, the combination of adjustments becomes an equation that can either be solved as a matrix or entered into a computer for a solution. DOE users can efficiently test a large number of variables without the expense of manufacturing the product totally.

"The entire scenario is like the fractal geometry exhibited in the petals of a flower," observes Bagchi. "Certified trainers train people who, in turn, train others, bringing a whole new change in the way we think and work."

Wipro's corporate goal is to reach Six Sigma in every process concerning customer satisfaction by the year 2002.

Lofty, but not impossible.

Six Sigma is a stretch goal intended to spur continuous improvement. Success doesn't come by radically restructuring a company or pumping new money into it; Six Sigma is attainable through time and strong dedication.

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New thought and manufacturing processes

Thinking outside the box also is important. "Before Six Sigma, we were interested in continuous improvement, but we tended to accept quality levels that merely mirrored our competitors'," notes Craig Erwin, quality engineering manager at Motorola Semiconductor Products Sector in Phoenix, Arizona. "We were somewhat internally focused and accepted the argument that things couldn't be made better."

"When we started, many people, including me, thought Six Sigma was unrealistic," he admits. "Once we understood that our management team was serious about it, we accepted the challenge."

It's part of the SPS culture now. All new employees receive Six Sigma training during their orientation. For those who went through training years ago, the company also offers them an opportunity to recharge their commitment through a combination of classes and a renewed emphasis by senior management. Various customer satisfaction activities reward ideas and implementation.

"One thing we looked at was changes in our thought and manufacturing proc-esses to eliminate rework," reveals Erwin. "In the short term, we saw some increased costs, but in the long run, we've improved our processes and applied more effective controls. We continue to see improvements in product reliability, manufacturing yields and internal quality metrics, despite increasing product complexity and higher customer expectations."

Product complexity continues to grow exponentially. Future products such as semiconductors and software undoubtedly will contain tens of millions, even billions, of elements. Creating more robust designs and reducing opportunities to introduce defects into the final product represents a one-time expense. If it's not done, however, repair, rework, excessive scrap costs and unhappy customers will continue through the product's life. Thus, it's imperative that companies reduce defect rates to a few parts per billion.

"Although Motorola has made huge reductions in defect rates, we still haven't achieved Six Sigma overall," reports Berg. "Motorola considers itself a 5.7 sigma company now. Six Sigma remains a very noble goal, but it's the rate of improvement that's important. Six Sigma has saved the company billions of dollars in terms of scrap and rework, enabling greater customer satisfaction--our ultimate goal."

Six Sigma successes

After examining how various financial companies pursue quality, Citibank, the international financial division of Citicorp, undertook the Six Sigma method in the spring of 1997. Its goal: to reduce defects within its various divisions by a factor of 10 during the first three years. The corporation already has seen reductions ranging from five to 10 times.

"Six Sigma appealed because it's pretty straightforward," comments James Bailey, Citicorp's executive vice president and corporate quality officer. "It also seemed like a program that would involve everyone."

Previously, various businesses and divisions within Citibank had tried different quality programs, but the company had never instituted a universal quality language or method.

"Continuous improvement is our goal," maintains Bailey. "We started training senior management in April 1997, and so far we've trained about 2,000 people around the world." Besides the defect reductions, the company has recorded a decreased response time for credit card applications and fewer errors in customer statements.

"We're on track," he declares. "We're more customer-focused. We know it's a long road, but we've made a reasonable start, and we're pleased."

GE, which launched a Six Sigma initiative in late 1995, says the $300 million invested in quality improvement in 1997 will deliver some $400 million to $500 million in savings. "Quality improvement, under the disciplined rubric of Six Sigma methodology, will define the way we work," the company announced in its 1996 annual report.

A three- to four-sigma level, average for most U.S. companies, can cost a company as much as 10 percent to 15 percent of its revenues. For GE, that would

mean $8 billion to $12 billion.

"The methodologies of Six Sigma we learned from other companies, but the cultural obsessiveness and all-encompassing passion for it is pure GE," states the report. "The intensity level involved in our decade-long struggle to achieve a boundary-less culture now seems 'laid-back' compared to the near monomania with which we are approaching Six Sigma quality."

Wipro also reports successes in its first year. "First of all, we now have a common language across our divisions," explains Bagchi. "People talk about the customer, defects, sigma level and a plan for continuous improvement."

"In India, many people have difficulty giving up the old and embracing the new, but the mind-set is changing. Six Sigma is making people look outward. We're shifting from an organizational focus to a customer focus."

Wipro's trained teams have launched close to 30 projects, including three major cross-functional undertakings. "Defects are steadily falling in cylinder manufacturing," discloses Bagchi. "In the fixed deposits area of our Financial Services division, we've established a process to eliminate nonvalue-added steps and mistake-proof the system. We're also projecting a 30-percent cycle-time reduction in our computer business. The estimated near-term gains will be six to eight times the total investments we've made in Six Sigma."

The first step

Other reengineering programs often advocate tearing down an organization and rebuilding from scratch. MU advises organizations to start where they are, build on current successes and modify current processes. They must rely on the interwoven concepts of defect reduction, which encourages employees to relate more to each other, and cycle-time reduction, which eliminates unnecessary, nonvalue-adding steps from processes.

Six Sigma requires more than a monetary investment, Erwin points out. "You must have a plan, necessary resources, the commitment of everyone and uncompromising matrixes," he says. "Then you set aggressive goals along the path and hold people accountable."

The MU Six Sigma program emphasizes the following key components:

- A goal of total customer satisfaction.

- A common language throughout the organization.

- Common, uniform quality measurement techniques for all business areas.

- Goals with identical improvement rates, based on uniform matrixes.

- Goal-directed incentives for both employees and management.

- Coordinated training in "why" and "how" to achieve the goal.

No one set procedure will work when following the Six Sigma method. Every

company is different and must account for its strengths and weaknesses, then leverage them accordingly.

"A clear, quantitative understanding of customer satisfaction typically is accomplished through surveys," notes Hayes. "Surveys should identify gaps between customer needs and a company's current performance level. Then, through benchmarking, a company's core processes are compared to another best-in-class performer. This is useful in determining the first layer of needed goals."

Motorola SPS statistician Skip Weed has been involved with Six Sigma since the program began. "The major impact, especially when it first started, was on our culture--the people and systems required to produce high-quality products and services," he recalls. "Previously, there was minimal effort in preventing defects rather than inspecting them out. The directive for the program came from our highly respected CEO, who was strongly behind it, and everyone then began to buy in."

Management by fact, not emotion

Ron Randall, quality improvement manager at Raytheon TI Systems, says his company is impressed with Six Sigma's quantitative methods. "We looked at our products and compared them to similar ones from Motorola," he explains. "We were less than four sigma, and Motorola was close to six. We couldn't believe someone was 2,000 times better than us. It really got our attention.

"Six Sigma really will work for anybody. It's management by fact, not emotion."

MU consultant Paul Zaura concurs. "In a math sense, Six Sigma is a known quantity," he asserts. "As improvements increase, expectations increase. Customer perceptions will change, and they will drive you to places you never new existed.

"You also must look at the cultural aspects and changing behaviors. Many corporate cultures are fear-based; mistakes aren't tolerated, and people learn to hide defects. Six Sigma flourishes in an open and safe environment."

Six Sigma champions say there are plenty of things to count, measure and benchmark regardless of the type of business, whether it's an attorney's office or a car rental company. And within a company, you can look at all kinds of divisions--personnel policies, warehousing, security, how to run the cafeteria.

"If you're not improving, you're going down," warns Zaura. "Six Sigma is a philosophy of continuous improvement and measurement to drive the direction of goals. Its concepts aren't earthshaking: Talk to customers and find out what the defects are. Work on big errors first. Try to decide how they happen and how to correct them permanently.

"Whether it's handling paperwork, an idea, a customer call or a hard product, there must be a process for it. That's probably one of the biggest concepts for people to grasp. Then you track your process using simple tools like Pareto charts, cause-and-effect diagrams and benchmarking. You compare what you have to a similar industry or process."

Perhaps Six Sigma's biggest mandate is *never rest*.

Companies that are content with their current quality levels simply don't understand quality's true challenge. They need to determine not only the defect

levels their customers experience but also internal defects that cause rework, additional inspections and higher product costs. Once a company has fully assessed itself, then improvement can really begin.

And no philosopher or cynic can quibble with improvement.

About the author

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