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WHAT IS SIX SIGMA?

Six Sigma is a business strategy that employs well-structured continuous improvement methodology and statistical tools to reduce defects and process variability. It is a quality discipline that focuses on product and service excellence. Six Sigma has been employed in numerous companies to reduce operating cost, increase sales and revenue, increase reliability, incorporate innovation in products and services, increase productivity and profitability. The objective of a Six Sigma program is to reduce the variation in the process to the extent that the likelihood of producing a defect is virtually non-existent. This means improving quality, and meeting or exceeding customers' expectations.

The improved quality and reliability in products and services leads to higher perceived value and increased market share thereby, increasing revenues and profitability. The term *sigma* (denoted by the Greek letter, σ) is a metric based on the statistical measure called *standard deviation* and is a measure of variability in a process. A *metric* is simply a measurement of some quality characteristic (for example, percentage of defects). The term *Six Sigma* statistically equates to 3.4 defects per million opportunities. Thus, a Six Sigma process is capable of producing 3.4 defects per million opportunities (DPMO). In practice, this refers to the maximum acceptable range of noncompliance.

Six Sigma seeks to find and eliminate causes of defects and errors in manufacturing and service processes by focusing on outputs that are critical to customers and a clear financial return for the organization. Six Sigma can be viewed as:

- a customer focused approach to create near perfect processes, products, and services all aligned to delivering what the customer wants.
- a project based approach where majority of projects are selected for measurable bottom line or customer impact.
- a methodology that uses well defined set of statistical tools and process improvement techniques by well trained people in an organization.
- a business strategy that has evolved from a focus on process improvement using statistical tools to a comprehensive framework for managing a business.

BUSINESS SUCCESS OF SIX SIGMA

More and more companies are realizing that it is possible to achieve dramatic improvements in cost, quality, and time using Six Sigma. Several companies including Toyota, General Electric, and Motorola have accomplished impressive results with Six Sigma. The concept of Six Sigma originated in Motorola in the later part of the 1980s. Since then many companies – including banks and hospitals – have successfully implemented Six Sigma programs within their corporate structure. Among the companies who have reported significant success with Six Sigma are Texas Instruments, Honeywell, Boeing, IBM, Caterpillar, 3M, Xerox, Raytheon, Citibank, Home Depot, and the U. S. Air Force. The list goes on. Six Sigma has been successfully applied to many service industries including health care and financial services companies. The savings resulting from Six Sigma initiative range from \$150 million to \$800 million for some of the big companies.

SIX SIGMA COSTS AND SAVINGS

Lean and Six Sigma are business strategies with proven success records. The techniques have been used in numerous companies and are continued to be used in many others to significantly improve the quality of manufacturing and service, reduce costs, increase sales, revenue, and profitability. However, not all these are possible without investment in training and development, organizational infrastructure, and creating a culture evolution. Anyone implementing or planning to implement Six Sigma would like to know: How much financial commitment does it require and what financial benefits can one expect?

According to GE's 1996 annual report, "It has been estimated that less than Six Sigma quality, i.e., the three-to-four Sigma levels that are average for most U.S. companies, can cost a company as much as 10-15% of its revenues. For GE, that would mean \$8-12 billion." With GE's 2001 revenue of \$111.6 billion, this would mean \$11.2-16.7 billion of savings. This shows that the cost of poor quality is significant and therefore, many Six Sigma projects are directed towards reducing this cost.

SIX SIGMA: CURRENT TRENDS

The following are some impressive data reported:

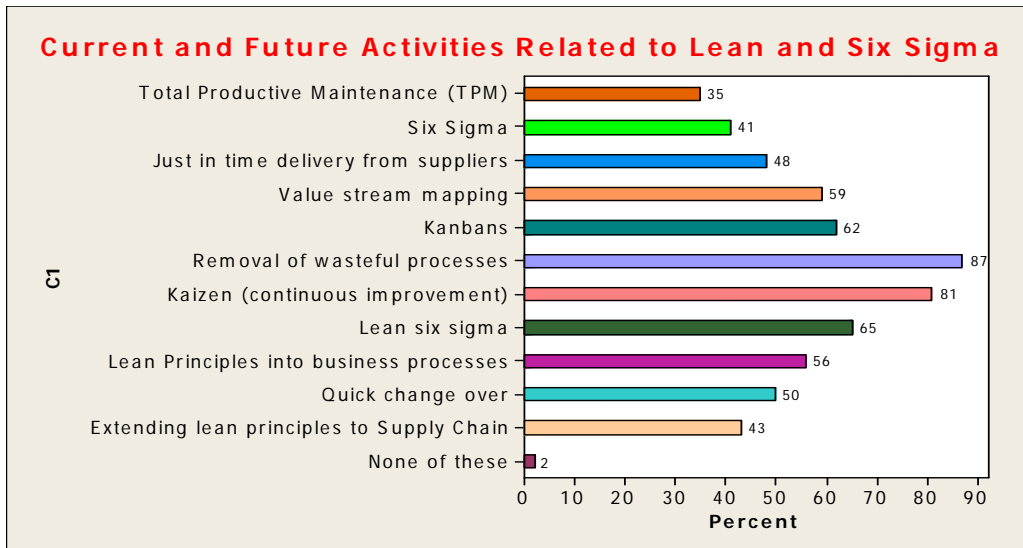
- Over the past 20 years, use of Six Sigma, the popular business improvement methodology, has saved Fortune 500 companies an estimated \$427 billion,

according to research published in the January/February 2007 issue of iSixSigma Magazine.

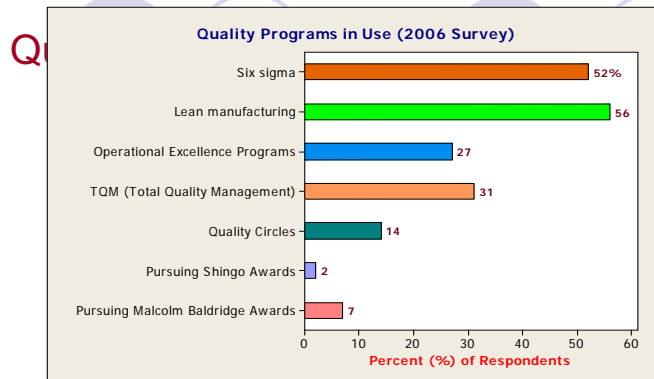
- Corporate-wide Six Sigma deployments save an average 2 percent of total revenue per year.
- Six Sigma adoption has increased phenomenally in recent years.
- Six Sigma started out slowly in the late 1980s but then took off in the mid-1990s once people started seeing successes at companies like GE and AlliedSignal.
- About 53 percent of Fortune 500 companies are currently using Six Sigma and that figure rises to 82 percent when you look at just the Fortune 100.
- The market for Six Sigma training and consulting is very much open where 47 percent of the Fortune 500 have not yet embraced the methodology.
- Six Sigma has a 20-year record of accomplishment of impressive results and is still expanding.(source: in iSixSigma LLC website)

COMPANIES USING SIX SIGMA AND RELATED TECHNOLOGIES

Source: US Manufacturing Report, 2006-07



QUALITY PROGRAMS IN USE (U.S. INDUSTRIES)

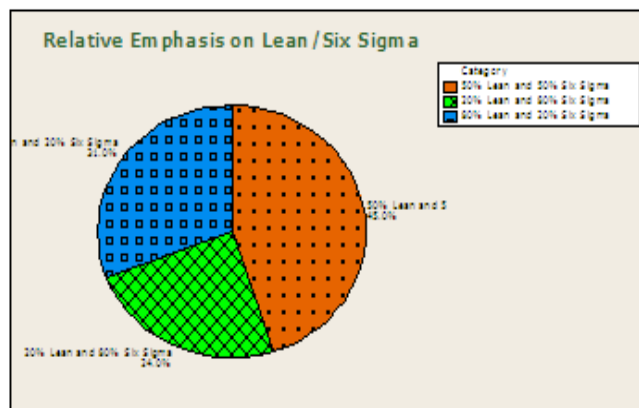


(Source: The Lean Sigma Benchmark Report, Aberdeen Group, September 2006)

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RELATIVE EMPHASIS ON LEAN/SIX SIGMA IN INDUSTRY

Relative Emphasis on Lean/Six Sigma



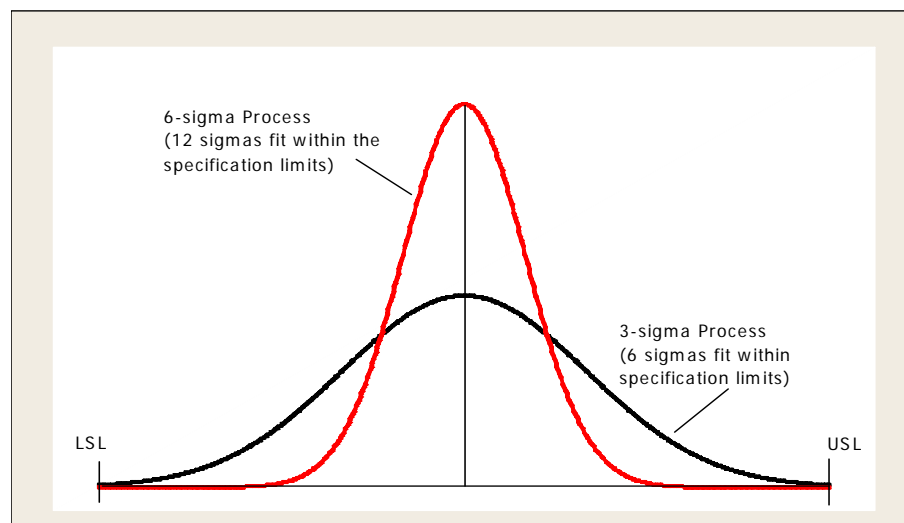
(Source: The Lean Sigma Benchmark Report, Aberdeen Group, September 2006)

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WHY SIX SIGMA? COMPARE A 3-SIGMA AND A 6-SIGMA PROCESS

- One of the major objectives of a Six Sigma program is to reduce variation in products and processes (variation reduction).
- The process variation is reduced to an extent that a spread of 12-sigmas (6-sigmas on either side of the mean) fits within the process specifications.

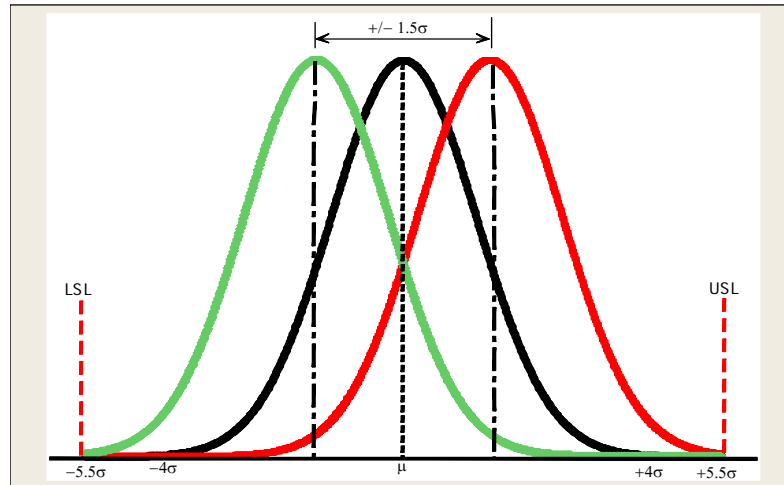
Comparing a 3-sigma Process to a 6-sigma Process



The largest allowable value that a quality characteristic can have is called its *upper specification limit* (USL); the lowest allowable value is called the *lower specification limit* (LS)

PROCESS SHIFT: IN EVERY PROCESS, THE MEAN SHIFTS OVER TIME

- No process can be controlled exactly at the target or the mean value. It is natural for a process to drift from its mean or target value in due course. This drift or shift can be as much as 1.5 standard deviations on either side of the target. If you have a 3-sigma process, a shift in this process will get out of control quickly and will start producing defective products in several order of magnitude. See the figure below.



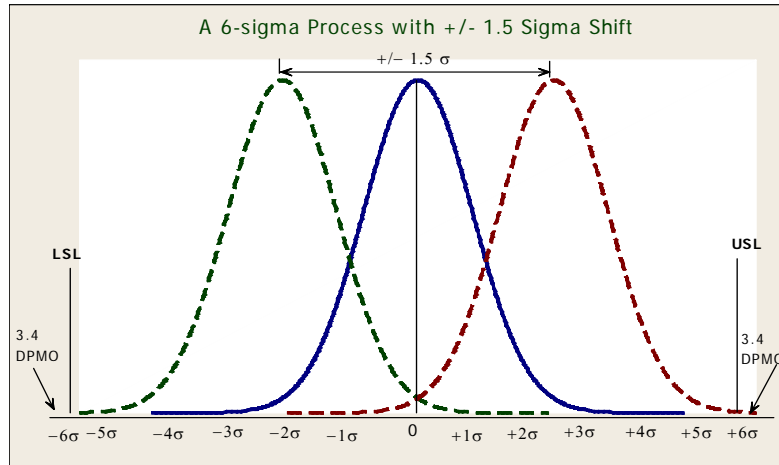
WHY SIX SIGMA? HOW DOES SIX SIGMA WORK?

- A process must be designed in a way to allow for a shift. The shift in a process is inevitable. To allow for this shift, we need to move from a 3-sigma process to a 6-sigma process
- A Six Sigma quality level represents 3.4 defects per million opportunities. This means that if a process is operating at Six Sigma level, it will produce no more than 3.4 defects per million. *This is only possible when the variation in the process is reduced significantly.*
- To be exact, the variation must be reduced to half or 50% that of a three-sigma level quality. See the figure below. This is a Six Sigma process. In this process, even a shift in the process mean of 1.5-sigma on either side of the mean results into 3.4 nonconforming products per million.

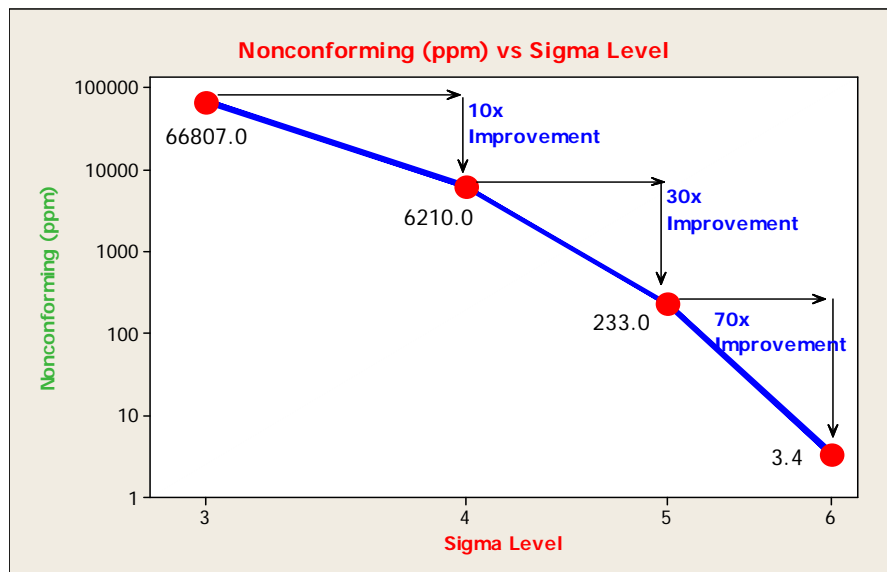
Six-Sigma Defined

In a Six Sigma process the process variation is equal to half of the design specification or tolerance so that a shift of as much as 1.5 standard deviations on either side of the target will keep the process well within the tolerance, and the likelihood of producing non-conforming products is virtually non-existent.

- With the variation reduced 50% of the 3-sigma level, even a drift in the process on either side of the mean or target value will not allow the process to go out of control.



IMPROVING YOUR PROCESS FROM 3-SIGMA TO 6-SIGMA WILL LEAD TO 70 TIMES IMPROVEMENT



WHAT MAY INITIATE A SIX-SIGMA PROJECT?

Six Sigma Project Selection: Problems and Opportunities for Six Sigma Projects

- High Cost of poor quality (COPQ)
- High costs (operation, material)

- Excessive defects
- Customer complaints
- Low customer satisfaction
- Declining revenue/profitability
- Declining market share
- Declining sales
- Low throughput yield...and more

Key Factors in Six Sigma Project Selection

- Impact on customers and organizational effectiveness
- Probability of success
- Impact on employees
- Link to the company strategy
- Competitive advantages and disadvantages
- Cost/revenue implications
- Financial return
- Impact on revenue and market share
- Cost of poor quality

In companies, the quality related costs or the cost of poor quality range from 20 to 40% of sales.

COMPETITIVE ADVANTAGES

Six Sigma :

- Is driven by customer wants and needs
- Makes significant contribution to business success
- Matches organization's unique resources with opportunities
- Is durable and lasting
- Provides basis for further improvement
- Provides direction and motivation

Six Sigma efforts are focused on building strong competitive advantage