

Six Sigma for World Class Performance

- An introduction to the most powerful breakthrough management tool ever devised

Expert knowledge means success

Contents

1. Introduction
1. Origins of Six Sigma
1. Statistical Reference
2. Benefits
2. Key Concepts
2. How Does it Work?
3. Comparisons with Other Initiatives
3. The Breakthrough Strategy
4. Training
4. Six Sigma Champion
4. Tools and Terms
5. Recommended Reading
6. Six Sigma Articles and Web Resources
6. Further Information



Note: This publication has not been updated since it was last published. Some of the hyperlinks may have changed and may need updating. In addition, some of the information in this publication may be out of date.

Introduction

Six Sigma is a highly disciplined process that helps an organisation to focus on developing and delivering near-perfect products and services. Why "Sigma"? The word is a statistical term that measures how far a given process deviates from perfection. Thus, Six Sigma is a management philosophy focused on eliminating mistakes, waste and rework - the central notion behind it is that if you can measure how many "defects" you have in a process, you can systematically work out how to eliminate them and get as close to "zero defects" as possible. Zero defects means quality and perfection. It cuts costs, enhances customer satisfaction and contributes more than anything else to business success.

There are three key elements of quality: customer, process and employee. If an organisation wants to be and remain a world-class quality company, it needs to focus on these three essential elements. Customers value consistent, predictable business processes that deliver world-class levels of quality. This is what Six Sigma strives to produce.

Origins of Six Sigma

The world's most successful business, the US company GE, has applied the principles of Six Sigma for years. Its former chief executive Jack Welch regarded it as the most important initiative that GE ever took.

In the mid-1980s, the Chairman of Motorola calculated his company's quality level as 4 Sigma. He set a new target; to achieve the standard of 6 Sigma. Over several years quality levels improved to 5.5 Sigma, saving Motorola a reported US\$2.2 billion dollars. Other US manufacturing companies began to adopt Six Sigma but it was not until General Electric in the mid-1990s that it truly began to take shape as a management system. Since then, Six Sigma has spread to European manufacturing companies.

6 Sigma at GE

"6 Sigma - The Breakthrough Strategy, is the most important initiative GE has ever taken...it is part of the genetic code of our future leadership."
Jack Welch, former CEO, GE

Statistical Reference

Sigma - taken from the Greek alphabet - is a statistical reference for measuring variation in data:

- The Six Sigma methodology is said to have originated at Motorola in the 1980s as a means for comparing variation in any process related to customer satisfaction.
- A sigma level of six means defects occur within a process only 3.4 times in one million chances.
- The level is determined by using process yield, or Defects per Million Opportunities (DPMO). If you know your process yield, it's easy to identify your sigma level right now by checking where you are on the sample sigma conversion table below.

Most businesses operate at a three- to four-sigma level, where the cost of defects is roughly 20% to 30% of income. By approaching Six Sigma (3.4 per 1million opportunities) the cost of quality drops to less than 1% of sales. Although zero defects is the goal, as a measure Six Sigma will drive a business toward achieving higher levels of customer satisfaction and reducing operational costs.

Six Sigma is a robust continuous improvement strategy and process that includes cultural methodologies such as Total Quality Management (TQM), process control strategies such as Statistical Process Control (SPC) and other important statistical tools. It uses a structured systems approach to problem solving and strongly links initial improvement goal targets to bottom-line results.

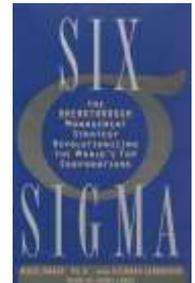
Sigma	DPMO	Yield
6	3.4	99.99966%
5.5	32.0	99.9968%
5	233	99.977%
4.5	1,350	98.87%
4	6,210	99.38%
3.5	22,750	97.7%
3	66,807	93.3%
2.5	158,655	84.1345%
2	308,538	69.146%
1.5	500,000	50%
1	691,462	30.9%
0.5	841,345	15.9%
0	933,193	6.7%

DPMO = defects per million opportunities

What is Six Sigma?

First and foremost, it is a business process that enables companies to increase profits dramatically by streamlining operations, improving quality, and eliminating defects or mistakes in everything a company does. While traditional quality programs have focused on detecting and correcting defects, Six Sigma encompasses something broader: It provides specific methods to re-create the process itself so that defects are never produced in the first place.

SIX SIGMA is claimed to be the most powerful breakthrough management tool ever devised, promising increased market share, cost reductions and dramatic improvements in bottom-line profitability for companies of any size.



Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations, written by Mikel J. Harry & Richard Schroeder, published by Doubleday & Company, Inc, ISBN: 0385494378.

Benefits

Often, management take an insider view of the business based on average measures of recent interaction with customers. Customers don't judge a business on averages - they feel the variance in each transaction. Six Sigma focuses first on reducing process variation and then on improving the process capability. Its benefits are:

- Productivity increases
- Cycle time reduction
- Higher throughput
- Reduced defects
- High levels of outgoing quality
- Standardised improvement methodology across the organisation
- A set of techniques and tools to simplify improvement efforts
- Greater customer satisfaction
- Dramatic improvement in the "bottom-line".

Key Concepts

The goal of Six Sigma is "Bottom-line" financial improvement. At its core, it revolves around a few key concepts:

- **Critical to Quality:** Means the attributes most important to the customer.
- **Defect:** Means failing to deliver what the customer wants.
- **Process Capability:** Means what your process can deliver.
- **Variation:** Means what the customer sees and feels.
- **Stable Operations:** Means ensuring consistent, predictable processes to improve what the customer sees and feels.
- **Design for Six Sigma:** Means designing to meet customer needs and process capability.

"If I had to reduce my message to management to just a few words, I'd say that it all had to do with reducing variations"
W. Edwards Deming

How Does it Work?

Six Sigma is founded on a statistical approach, which assumes that a business is made up of a system of interconnected processes. It is systematic, scientific and fact based. As a closed-loop process, it eliminates unproductive steps, often focuses on new

measurements, and applies technology for improvement. Each one of these processes contains variations (defects) and all of these variations have a cause.

At the heart of Six Sigma is an improvement process methodology based on 5 successive steps (DMAIC):

Define

- Identify and classify processes according to their cumulative impact on the profitability of the project and the client's satisfaction.
- Define the process which is to be analysed.
- Collect and visualise the data in order to understand the client's exact needs and demands related to the concerned process:
- Voice of Customer (VOC) = > Critical To Quality (CTQ).

Measure

- Develop measurement systems based on the CTQs.
- Develop a data collection plan: Which data? Which collection method? With what frequency? Who is responsible?
- Represent the data graphically to show the current variability.
- Calculate the current performance of the process and the quality level. For example: time allowed to answer the calls = quality of service.

Analyse

- Understand the gap between the performance achieved and the objectives. Use multivariate analysis to identify the reasons for the variation and determine the opportunities for improvement.

Improve

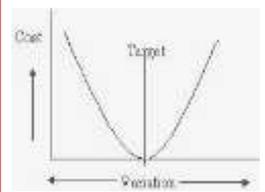
- Make an economic analysis of the situation and offer a solution.
- Pilot the suggested solution and evaluate the results.
- Develop a complete plan to permanently implement the change.

Check

- Develop a plan to master the new process.
- Document the new process, ie update the ISO documentation.
- Follow the improved process: re-calculate the performance of the process, i.e. the Six Sigma rating and the return on investments.

Six Sigma in Service Businesses

Quality in a service business means minimum process cycle times, high customer satisfaction ratings, timeliness and accuracy of reports and their delivery, problem free service delivery, reliable processes and order fulfillment, smooth back office systems etc. Any variation from the target value of service processes costs money. The Six Sigma methodology improves the process of service delivery so that it is focused on this target as close as possible to minimise cost.



The Real Power of Six Sigma

"The real power of Six Sigma is simple, because it combines people power with process power."

Source: Subir Chowdhury, *The Power of Six Sigma*

Comparisons with Other Initiatives

Six Sigma is complementary to other initiatives such as ISO 9000 registration, which is mainly procedural; Total Quality Management (TQM), which is mainly cultural and Statistical Process Control (SPC), which is primarily statistical process control monitoring. All of these initiatives attempt to improve quality levels but typically reach a plateau. The Six Sigma approach goes to the next level by recognising that improved quality is a means to an end – but not the end itself.

Lean manufacturing compared with Six Sigma

Both support the reduction of waste in businesses. Lean manufacturing focuses on ‘making value flow’, i.e. providing an easy to follow, uninterrupted product flow with minimal waste. Six Sigma focuses on variation related or lack of process knowledge related waste such as quality issues, tampering leading to amplified variation in the product delivery process etc. If applied in an integrated fashion the tools are complementary and should be used in a ‘hand and glove’ approach.

There are multiple implementation methods for Six Sigma. The appropriate method that drives the highest return on investment for an organisation depends largely on the business and the business environment that is being operated in. The following questions are often worth considering prior to deciding on the appropriate implementation model:

- What performance level is the organisation currently achieving?
- What is the goal for performance?
- What is the required time frame?
- Which level of the organisation is supporting the initiative?
- What kinds of results are targeted?
- What kind of talent is available in the organisation?
- How concentrated will the effort be?
- What are the key leverage points in the organisation?
- What are the key business metrics for the organisation?
- Which implementation method best supports breakthrough improvements for those metrics?
- What is the budget (monetary as well as resource related)?

The Breakthrough Strategy

In today's intensely competitive economy, only breakthrough strategies can yield the results that shareholders demand. The single most important determination of executive and organisational success lies in the ability to transform existing business strategies and lead an organisation that can create innovative new strategies effectively. There are eight fundamental stages in applying the Breakthrough Strategy to achieve Six Sigma performance:

1. Recognition
2. Definition
3. Measurement
4. Analysis
5. Improvement
6. Control
7. Standardisation
8. Integration.

Each stage is designed to ensure that:

- Companies apply the Breakthrough Strategy in a methodical and disciplined way.
- Six Sigma projects are correctly defined and executed.
- The results of these projects are incorporated into the day-to-day business.

The Breakthrough Strategy applies at each level achieving different yet complementary results. Success at each level is defined as to the extent of the improvement in the organisation's quality and profitability. The Breakthrough Strategy is a fluid methodology that works its way up and down the hierarchies of an organisation. This is one of the reasons that Six Sigma needs to be understood and integrated at every level of a company.

Six Sigma is focused on driving business results. In comparison to many other initiatives it is not a training program with the hope for increased productivity in the future, but rather it focuses on driving business results directly. Projects and candidates are specifically selected to accelerate business performance. Training is provided as a means to drive business results versus being a means of its own. Thus, Six Sigma is different to other initiatives:

- The initiative is business-focused not quality-focused.

The Six Sigma Academy

The Breakthrough Strategy® is the centrepiece offering of the Six Sigma Academy. They invented it and perfected it. Their services have evolved to reflect best practices from every client they have worked with. Their services are designed to help corporations smoothly and efficiently deploy the Breakthrough Strategy, in order to achieve breakthrough improvements in corporate performance.

Source:
www.6-sigma.com

- The leadership is Committed, Competent, and Involved.
- The methodology and tools are data driven and statistically validated.
- The best people in the organisation are 100% dedicated to defect reduction.
- The focus is on specific projects.
- Provision of a common language to global companies.

Tools from the Juran Institute

The Juran Institute (www.juran.com) provides a wide range of training, consulting services and products developed to improve an organisation's business performance by focusing on improving and re-engineering the quality of goods, services, and processes. Some of the tools they provide are:

- The Six Sigma Basic Training Kit is a complete, six-step program for familiarising your organisation's improvement teams with Six Sigma.
- How To Design Six Sigma Quality Into Products And Services - a 125-page reference guide containing all the basics steps for anyone going through training in breakthrough design/planning.
- Six Sigma Improvement Breakthrough is a systematic methodology for creating sustained improvements to Six Sigma levels in important production and repetitive processes.

Training

There are several organisations throughout the UK that now provide specific and tailored training on the understanding of the Six Sigma process and the use of six sigma tools. The student will be trained in the methodology and tools use through real projects with bottom-line impact on the firm's profitability. A list of training organisations is provided below but you must check on their suitability for your own business

Training Organisations

- www.isixsigma.com/co/six_sigma
- www.sixsigma.co.uk/training.html
- www.minitab.com/Ltd/sigma_training.htm
- www.papilolimited.com
- www.smallpeice.co.uk
- www.6sigma-tm.com/SixSigma_main.htm
- www.adamssixsigma.com
- www.sixsigmasystems.com/six_sigma_training.htm
- www.sixsigmascotland.co.uk
- www.statsoft.co.uk/training.html
- www.qualityquest.com/consultancy/6sigma.htm
- www.xr-associates.co.uk/qspro_1.html
- www.powerdigm.co.uk

Six Sigma Champion

A Six Sigma Champion is usually a top executive or senior manager who "talks the talk" and "walks the walk" of Six Sigma.

He/she is the catalyst and driving force behind an organisation's Six Sigma implementation.

Six Sigma champions are used in many organisations to provide 'program management'. Champions support project and candidate selection and handle any administrative, reporting related activity. They act as an interface to operational leadership.

Tools and Terms

There are various tools and terms used in Six Sigma – they relate primarily to quality. Some of them are:

- Control Chart – Monitors variance in a process over time and alerts the business to unexpected variance which may cause defects.
- Defect Measurement – Accounting for the number or frequency of defects that cause lapses in product or service quality.
- Pareto Diagram – Focuses on efforts or the problems that have the greatest potential for improvement by showing relative frequency and/or size in a descending bar graph. Based on the proven Pareto principle: 20% of the sources cause 80% of any problems.
- Process Mapping – Illustrated description of how things get done, which enables participants to visualise an entire process and identify areas of strength and weaknesses. It helps reduce cycle time and defects while recognising the value of individual contributions.



Six Sigma Belts – an Explanation

Black Belt:
Someone trained in the Six Sigma methodology and experienced leading cross-functional process improvement action teams. Acts as a full-time team leader responsible for measuring, analysing, improving and controlling key processes that influence customer satisfaction and/or productivity growth.

Green Belt:
An individual trained in the Six Sigma methodology. A team member of six sigma process improvement action teams. Similar to Black Belt but not a full-time position.

Yellow Belts:
Employees who continue to work in their current assignment but receive training in Six Sigma methods to allow them to contribute more to their organisation's involvement in Six Sigma.

Master Black Belt:
Someone trained in the Six Sigma methodology who acts as the organisation-wide Six Sigma programme manager. Oversees Black Belts and process improvement projects and provides guidance to Black Belts as required. A Master Blackbelt teaches other Six Sigma students and helps them achieve Greenbelt and Blackbelt status. First and foremost teachers, they also review and mentor Black Belts. Selection criteria for Master Black Belts are quantitative skills and the ability to teach and mentor. Master Black Belts are full-time positions.

- Root Cause Analysis – Study of original reason for non-conformance with a process. When the root cause is removed or corrected, the non-conformance will be eliminated.
- Statistical Process Control – The application of statistical methods to analyse data, study and monitor process capability and performance.
- Tree Diagram – Graphically shows any broad goal broken into different levels of detailed actions. It encourages team members to expand their thinking when creating solutions.
- Control – The state of stability, normal variation and predictability. The process of regulating and guiding operations and processes using quantitative data.
- CTQ: Critical to Quality (Critical "Y") – The element of a process or practice which has a direct impact on its perceived quality.
- Customer Needs, Expectations – Needs, as defined by customers, which meet their basic requirements and standards.
- Defects – Sources of customer irritation. Defects are costly to both customers and to manufacturers or service providers. Eliminating defects provides cost benefits.
- Variance – A change in a process or business practice that may alter its expected outcome.

Recommended Reading



- The Six Sigma Way: How GE, Motorola, and Other Top Companies are Honing Their Performance by Peter S. Pande et al, Robert P. Neuman, Roland R. Cavanagh, published 2000 by McGraw-Hill Professional Publishing; ISBN: 0071358064.
- Six Sigma Simplified by Lowell Jay Arthur, published 2000 by LifeStar; ISBN: 1884180132.
- The Six Sigma Handbook by Thomas Pyzdek, published 2000 by McGraw-Hill Professional Publishing; ISBN: 0071372334.
- The Six Sigma Way Team Fieldbook: An Implementation Guide for Project Improvement Teams by Peter S. Pande, Roland R. Cavanagh, Robert P. Neuman, Roland Cavanagh, published 2001 by McGraw-Hill Higher Education; ISBN: 0071373144.
- Rath & Strong's Six Sigma Pocket Guide by Rath & Strong, published 2000 by Rath & Strong, Inc; ISBN: 0970507909.
- General Electric's Six Sigma Revolution: How General Electric and Others Turned Process Into Profits by George Eckes, published 2000 by John Wiley & Sons; ISBN: 047138822X.
- The Power of Six Sigma: An Inspiring Tale of How Six Sigma Is Transforming the Way We Work by Subir Chowdhury, published 2001 by Dearborn Trade; ISBN: 0793144345. Also published by Pearson Education; ISBN 0 273 65621 X.
- Implementing Six Sigma: Smarter Solutions Using Statistical Methods by Forrest W., III Breyfogle, published 1999 by Wiley-Interscience; ISBN: 0471296597.
- Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success by Forrest W Breyfogle, James M Cupello, Becki Meadows, published 1999 by Wiley-Interscience; ISBN: 0471396737.
- Making Six Sigma Last: Managing the Balance Between Cultural and Technical Change by George Eckes, published 2001 by John Wiley & Sons; ISBN: 0471415480.
- Six Sigma, The Breakthrough Management Strategy Revolutionizing The World's Top Corporations by Mikel J. Harry, Richard Schroeder, published 1999 by Doubleday; ISBN: 0385494378.
- Six Sigma: SPC and TQM in Manufacturing and Services by Geoff Tennant, published 2001 by Gower Pub Co; ISBN: 0566083744.

Six Sigma Articles and Web Resources

General Electric, the giant US corporation which popularised Six Sigma as a result of its outstanding success under the leadership of its CEO Jack Welch, has published very useful information on the subject at www.ge.com/sixsigma

Other resources may be found at:

- **"When is Six Sigma not Six Sigma"**, Schneiderman, Arthur M., 1999 www.schneiderman.com/The_Art_of_PM/six_sigma_metric/six_sigma_metric.htm
- "Motorola's Six Sigma Program", by Thomas Pyzdek, Quality Digest www.qualitydigest.com/dec97/html/motsix.html
- Six Sigma Academy www.6-sigma.com/Bts1.htm
- iSixSigma LLC www.isixsigma.com
- Six Sigma Systems Inc www.sixsigmasystems.com/faq.htm

Further Information

This guide is for general interest - it is always essential to take advice on specific issues. We believe that the facts are correct as at the date of publication, but there may be certain errors and omissions for which we cannot be responsible.

If you would like to receive further information about this subject or other publications, please call us – see our contact details on the next page.

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