

**“SIX SIGMA AND THEIR APPLICATION IN COMPANIES”- A STUDY
OF DIFFERENT INDUSTRIES**

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ABSTRACT

Six Sigma's aim is to eliminate waste and inefficiency, thereby increasing customer satisfaction by delivering what the customer is expecting. Six Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services.

This paper aim is to study various companies in India and to see whether they are adopting this approach. This research paper will also try to find out whether the companies are having benefit/advantage of using this approach i.e. cost-benefit analysis.

SIX SIGMA- INTRODUCTION

As per Park (2002) Six Sigma implies three things: statistical measurement, management strategy and quality culture. It tells us how good products, services and processes really are, through statistical measuring of quality level. It is new management strategy under leadership of the top management to create quality innovation and total customer satisfaction. It is also a quality culture. It provides the way to do things right the first time and to work smarter by using data information.

While as per Magnusson, Kroslid and Bergman (2003) Six Sigma is a business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimize waste and resources while increasing customer satisfaction.

Six Sigma is a business improvement methodology that focuses an organization on:

- Understanding and managing customer requirements
- Aligning key business processes to achieve those requirements
- Utilizing rigorous data analysis to minimize variation in those processes
- Driving rapid and sustainable improvement to business processes.

SIGMA LEVEL

SIGMA LEVEL (PROCESS CAPABILITY)	DEFECTS PER MILLION OPPORTUNITIES
2	308537
3	66807
4	6210
5	233
6	3.4

Source: exploreHR.org

OBJECTIVES OF SIX SIGMA

- **Overall Business Improvement**

Six Sigma methodologies focus on business improvement. Beyond reducing the number of defects present in any given number of products, a business employing Six Sigma methods must seek improvement through any means available. That means identifying and remedying problems wherever they occur. Six Sigma calls anything that damages business functionality in a way that increases defects, raises costs, slows productivity or

reduces customer satisfaction a source of pain. The elimination or remediation of these sources of pain leads to overall business improvement.

- **Remedy Defects/Variability**

Any business seeking improved numbers must reduce the number of defective products or services it produces. Defective products can irrevocably harm customer satisfaction levels, as each customer ending up with a defective product becomes a potential lost customer--and because the displeased customer will tend to pass the word about this defective product along. Then you've got to fix the defects, which can increase research and production costs dramatically.

- **Reduce Costs**

Reduced costs equal increased profits. A company implementing Six Sigma principles has to look to reduce costs wherever it possibly can--without reducing quality. Cost reduction potential exists throughout a company. Acquire cheaper raw materials of equal or comparable value; reduce transportation costs via alternate shipping methods; streamline production and quality control processes with automation or improved equipment technology; cut personnel costs with outsourcing, downsizing or other methods; or reduce rent payments by moving production or sales facilities to different locations. Even the adoption of greener business practices can lead to reduced costs, as powered-down electronics, recycled paper and reduced wastage can have significant impact. No change is too small to consider.

- **Improve Cycle Time**

Any reduction in the amount of time it takes to produce a product or perform a service means money saved, both in maintenance costs and personnel wages. Additionally, customer satisfaction improves when both retailers and end users receive products sooner than expected. The company that can get a product to its customer faster may win her business, regardless of questions of quality or cost. There's a reason fast food was the definitive concept in food service during the 20th century.

- **Increase Customer Satisfaction**

The sources of pain that Six Sigma methodologies seek to remedy interrelate. Customer satisfaction depends upon successful resolution of all Six Sigma's other objectives. But customer satisfaction is an objective all its own. Every aspect of a business' self-representation, from marketing strategies to sales personnel performance, can have a positive or negative affect on customer satisfaction. Seek positive customer response to these self-representations, and customer satisfaction will improve.

SIX SIGMA PHASES

Phase-I Define

- Define customers and requirements
- Develop problem statement, goals and benefits
- Identify champion, process owner and team
- Define resources
- Evaluate key organizational support
- Develop high level process map

Phase-II Measure

- Define defect , opportunity.
- Detailed process map of appropriate areas
- Develop data collection plan
- Validate the measurement system
- Collect the data
- Determine the process capability and sigma baseline.

Phase-III Analyze

- Define problem objectives
- Identify value/non-value added process steps
- Identify source variation
- Determine root

Phase-IV Improve

- Perform design of experiments
- Develop potential solutions

- Define operating tolerances of potential systems
- Assess failure modes of potential solutions
- Validate potential improvement by pilot studies.
- Correct/re-evaluate potential solutions.

Phase-V control

- Define and validate monitoring and control systems
- Develop standards and procedures
- Implement statistical process control
- Determine process capability
- Develop transfer plan, handoff to process owner.
- Verify benefits, cost savings/Avoidance, profit growth
- Close project
- Communicate to business.

INDIAN COMPANIES AND SIX SIGMA RESULTS

S.No	Company Name	Annual Savings
1	General Electric	\$ 2.0 + Billion
2	JP Morgan Chase	\$ 1.5 + Billion
3	Johnson & Johnson	\$ 500 Million
4	Honey Well	\$ 600 Million

SIX SIGMA IMPLEMENTATION AND THEIR OUTCOMES

AUTOMOTIVE INDUSTRY

- Enhancing supplier quality
- Improving safety and reliability of finished goods
- Reducing manufacturing defects at each stage
- Using design FMEA to understand and prevent any design failures

- Reducing variation in all the critical parameters that impact the finished products.
- Improving the overall incoming material quality or parts quality
- Optimizing inventory levels for all major parts
- Reducing time to manufacture
- Reducing design defects
- Reducing supplier lead time i.e. the time taken by each supplier to deliver goods
- Improving first time yield and efficiency of each step in the Manufacturing assembly line.

Examples of Companies: Tata Motors, Ford, GM, Maruti

ENGINEERING PARTS MANUFACTURING INDUSTRY

- Reduce manufacturing cycle time
- Improve customer service performance scores
- Reduce or optimize inventory levels
- Reduce scrap or cost of poor quality
- Reduce warranty costs
- Reduce rejections due to design errors
- Improve parts design process to meet specifications 100% times
- Improve parts reliability by identifying & optimizing critical factors that ensure reliability

Examples of Companies: Gates India Ltd.

TEXTILES/ FASHION INDUSTRIES

- Eliminating manufacturing errors/defects
- Improving first sample approval percentages while working with buyers
- Improving buyers satisfaction levels
- Increasing repeat business
- Improving supplier evaluation process
- Reducing costs
- Reducing delays

Examples of Companies: Reliance industries, Raymond's, Grasim etc.

INFORMATION TECHNOLOGY SECTOR

- Reducing the overall software development time
- Reducing the number of errors found during product usage
- Improving the estimation process to reduce time and costs overruns
- Improving the requirements gathering process to reduce rework.
- Reducing complaints resolution time.
- Creating systems to detect defects early in the process(to reduce high costs associated with defects identified later)
- Reducing appraisal costs per defect by phase and appraisal type
- Reducing rework

Examples of Companies: TCS, Infosys, IBM, HP

TELECOM SECTOR

- Reducing bill errors
- Reducing timeline of billing
- Improving the call completion rate
- Reducing network congestion.
- Development of new features, processes for new services
- Improving accuracy, timeliness and completeness of new connections
- Reducing customer churn
- Reducing network congestion
- Improving call routine procedures
- Improving sales productivity

Examples of Companies: Bharti Airtel, France Telecom, Reliance Infocom,

INDIAN COMPANIES AND SIX SIGMA

Motorola

- The term “Six Sigma” was coined by Bill Smith, an engineer with Motorola.
- Late 1970s - Motorola started experimenting with problem solving through statistical analysis.

- 1987 - Motorola officially launched it's Six Sigma program Motorola saved \$17 Billion from 1986 to 2004, reflecting hundreds of individual successes in all Motorola business areas including:
 - a) Sales and Marketing
 - b) Product design
 - c) Manufacturing
 - d) Customer service
 - e) Transactional processes
 - f) Supply chain management

GE

- Jack Welch launched Six Sigma at GE in Jan,1996
- 1998/99 - Green Belt exam certification became the criteria for management promotions
- 2002/03 - Green Belt certification became the criteria for promotion to management roles
- Saved \$750 million by the end of 1998
- Cut invoice defects and disputes by 98 percent, speeding payment, and creating better productivity
- Streamlined contract review process, leading to faster completion of deals and annual savings of \$1 million

Honeywell

Six Sigma is one of the most potent strategies ever developed to accelerate improvements in processes, products, and services, and to radically reduce manufacturing and/or administrative costs and improve quality. It achieves this by relentlessly focusing on eliminating waste and reducing defects and variations.

- Initiated Six Sigma efforts in 1992 and saved more then \$600 million a year by 1999.

- Reduced time from design to certification of new projects like aircraft engines from 42 to 33 months.
- Increased market value by a compounded 27% per year through fiscal year 1998.

Dabbawla

A dabbawala is a person in the Indian city of Mumbai whose job is to carry and deliver freshly made food from home in lunch boxes to office workers. Dabbawalas pick up 175,000 lunches from homes and deliver to their customer's everyday. Only one mistake is made in every 6 million deliveries. Accuracy rating is 99.999999.

Six Sigma: Advantages

- **Customer Satisfaction:**
With Six Sigma methodologies in use, a business will implement improved processes and better quality control, both of which should result in a better product. That, in turn, will lead to more satisfied customers.
- **Customer loyalty:**
Satisfied customers are customers who will stay loyal to a brand and return to make future purchases – as long as the product remains consistent in its quality.
- **Improve bottom line:**
Happy customers mean good word-of-mouth and also customers returning for more, all of which translates into a better revenue stream. If publicly held, this can also mean a rise in share prices.
- **Employee satisfaction:**
One of the side benefits of Six Sigma is how it can rally employees to a common cause. Unlike companies where management often flounders, Six Sigma offers leaders a chance to clarify and streamline the message. Also, improved results can create a sense of camaraderie that leads to even more good results going forward. Nothing succeeds like success.
- **Better partnerships:**

Whenever a company does well, other companies associated with it can see improvements, as well. This can lead to long-term partnerships as well as having other companies adopt similar Six Sigma strategies for their companies.

Facts & Figures: Six Sigma

- GE saved \$12 billion over five years and added \$1 to its earnings per share. Honeywell (AlliedSignal) recorded more than \$800 million in savings.”
- “Motorola reduced manufacturing costs by \$1.4 billion from 1987-1994.” “Six Sigma reportedly saved Motorola \$15 billion over the last 11 years.”

Companies and the year they implemented Six Sigma

S.No	Company Name	Implementation year
1	Motorola	1986
2	Allied Signal	1994
3	GE	1995
4	Honeywell	1998
5	Ford	2000

Source: <http://www.isixsigma.com/implementation/financial-analysis/six-sigma-costs-and-savings/>

SIX SIGMA COST AND SAVING BY COMPANIES

Year	Revenue (\$B)	Invested(\$B)	% revenue invested	savings(\$B)	% Revenue Savings
Motorola					
1986-2001	356.9(e)	ND	-	16 ¹	4.5
Allied Signal					
1998	15.1	ND	-	0.5 ²	3.3
General Electrics					
1996	79.2	0.2	0.3	0.2	0.2
1997	90.8	0.4	0.4	1	1.1
1998	100.5	0.5	0.4	1.3	1.2

1999	111.6	0.6	0.5	2	1.8
1996-1999	382.1	1.6	0.4	4.4³	1.2
Honeywell					
998	23.6	ND	-	0.5	2.2
1999	23.7	ND	-	0.6	2.5
2000	25.0	ND	-	0.7	2.6
1998-2000	72.3	ND	-	1.8 ⁴	2.4
Ford					
2000-2002	43.9	ND	-	1 ⁶	2.3

Key:

\$B = \$ Billions, United States

(-) = Estimated, Yearly Revenue 1986-1992 Could Not Be Found

ND = Not disclosed

Note: Numbers are rounded to the nearest tenth

- Motorola Six Sigma Services. Motorola University. 22 July 2002.
- AlliedSignal Inc. 1998 Annual Report. Honeywell Inc. 22 July 2002.
- GE Investor Relations Annual Reports. General Electric Company. 22 July 2002.
- Honeywell Annual Reports. Honeywell Inc. 22 July 2002.
- Better Understand Six Sigma Plus With Honeywell's Special PowerPoint Presentation. Honeywell Inc. 22 July 2002.
- *Quality Digest*, "Six Sigma at Ford Revisited," June 2003, p. 30.

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Pillars of Six Sigma frameworks

- Top Management Commitment and Leadership
- Project selection and execution methodology
- Training & Education
- Customer relationship management
- Effective communication system
- Quality improvement tools & techniques
- Supplier management
- Human relationship management
- standardization

CONCLUSION

Six Sigma has already emerged as one of the most effective business strategies in the large organizations, worldwide. After its conception at Motorola, many success stories were charted by a number of multinationals. Indian industries have already started recognizing the strengths of Six Sigma as a breakthrough improvements strategy, which can bring overall operational excellence for global competence. As a part of the drive to ascertain the status of Six Sigma among Indian industries as a whole, this study was taken up to highlight the benefits gain by Indian industries through Six Sigma.

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