

A Comparative Literature Study on the Importance of Focusing of SIX SIGMA with the SERVICE QUALITY for the SERVICE SECTORS

(A Comparison between the Indian and the Foreign Industrial Scenarios)

R.Surya Kiran

Assistant Professor ,Dept. of Industrial Engineering,GIT,GITAM University ,Visakhapatnam-45
 E-mail: surya_raja@gitam.edu

Vikas Kumar Singh

Assistant Engineer (Production Dept.),CRM Department Bhushan Steel Limited, Orissa

Abstract

Customer service is becoming more an “Industry Buzz Word ” because many large companies who treat their customers poorly are starting to loose the customers right and left. Aided by innovative and pervasive communication Technologies ,even the old Manufacturing Facilities have largely tuned into Service factories(Chase & Garvin,1989). A good practice is to close the information gaps as the modern day customers understand what is right and what isn't. Basically Six Sigma has evolved out as the finest element of all the Service quality initiatives. Six Sigma has become a tool for the achievement ,Sustenance and for the optimization of the Business strategies by closely understanding the customer needs ,disciplined use of the facts ,disciplined use of the Data and also the disciplined use of the Statistical Analysis with the diligent approach for managing the achievements ,Business Sustenance and for the optimization of the Business Strategies. Six sigma believes that there is an output when there is a process, there is a performance variation when there is a process and there is a six sigma opportunity when there is a variation.Six sigma is a world class philosophy which is a statistical measure for determining the Process Capability .Statistically Six Sigma is 3.4 DPMO/EPMO/PPMO (Defects per million opportunities/Errors per million opportunities/Problems per million opportunities).

Keywords: Sustenance ,Eligible Users ,Drop-Outs , Acceptance of the Service ,COSMOS,EUREKA.

Introduction

Table-1 99% quality is not enough...

1	30,000 letters lost by the Royal mail every day.	6	5000 unnecessary operations every year in England
2	5000 cheques processed to wrong accounts everyday by the clearing banks.	7	02 short/long landings everyday at the major airports
3	07 hours per menth without any electricity .	8	Unsafe drinking water 15 minutes per day.
4	02 lakhs drug prescriptions each year.	9	03warranty claims per car.
5	No electricity for almost 07 hours each month.		

Table-2 99.996% quality means ...

1	Unsafe drinking water 01 minute per day.
2	01 short/long landings every 05 years at the major airports.
3	68 incorrect drug prescriptions each year.
4	01 hour without the electricity every 34 years .

Table-3 Yield and the DPMO for 02-06 sigma...

1	02 sigma yields 69.2% with 308537 DPMO. (31 % Defective)
2	03 sigma yields 93.3% with 308537 DPMO. (6.7 % Defective)
3	04 sigma yields 99.4% with 66807 DPMO. (0.62% Defective)
4	05 sigma yields 99.97% with 233 DPMO. (0.023% defective)
5	06 sigma yields 99.996% with 3.4 DPMO

Table-4 Steps to calculate the Six Sigma Quality Level ...

1	Determine the number of the Defect Opprotunities per Unit? (O)
2	Determine the number of the Units processed? (N)
3	Determine the Total number of the Defects made? (D)
4	Calculate the Defects per opprotunities? [DPO= D/(N*O)]
5	Calculate the yield ? [Y=(1-DPO)*100]
6	Look up for the Sigma Quality Level in the sigma table ? (Process Sigma)

An example for Calculating the Sigma Level of the Process for the following billing process for a MART...

Given Data : O=6,,N=100,00,000, D=1,07,000

Now, DPO= 0.0017833,Y=99.82 ,Process Sigma = 4.4 – 4.5 (Calculated from the Table)

[1]Defination of Six Sigma ...

Banuelas & Anthony(2002)- A philosophy that employees a well structured continuous improvement methodology to reduce process variability and drive out the waste within the business processes using the statistical tools and techniques.

Bendell (2006)- A strategic companywide approach focusing on variation reduction ,projects have the potential of simultaneously reducing the cost and increasing the customer satisfaction.

Chakraborty & Tan (2007)- A quality improvement program with a goal of reducing the number of the defects as low as 3.4 parts per million opprotunities.

Table -5 (Rankwise) Key factors necessary for effective implementation of the Six Sigma(Pulakanam & Vogels,2010):

Rank	Key factors	Rank	Key factors
1	Senior Management Commitment	7	Understanding the six sigma methodology
2	Linking Six Sigma to the Business Strategy and the Customers	8	Training and the Education
3	Organisational Readiness and the project management skills	9	Project tracking and reviews
4	Management of the culture change	10	Incentive Programmes
5	Companywide commitment	11	Linking Six Sigma to the employees and the suppliers
6	Integration of the Six Sigma with the Financial Accountability.		

Table-6 Reasons for the lack of the interest in the implementation of the Six Sigma[2] :

Rank	Reasons	Rank	Reasons
1	Everything is to be thoroughly documented.	4	Lack of the knowledge of the meanings and the advantages obtained through the implementation.
2	Everything is to be statistically controlled.	5	High cost in the implementation.
3	Loss of the work time.		

Table-7 Reasons (Rankwise) behind the six sigma implementation as pointed out from the research paper on the foreign industries [2]:

Rank	Reasons	Rank	Reasons
1	Improving the product or the service quality .	8	Increasing our competitive advantage.
2	Improving the internal process and the procedures.	9	Use it as a promotional tool.
3	Improving the company image.	10	Maintain /improve market share.
4	Requisite to compete in the sector.	11	Direct entrance to the new markets.
5	Anticipating the market trend.	12	Corporate level decision.
6	Anticipating the Customer demands.	13	Demand/pressure from the customers.
7	Anticipating the competitors.	14	A basis for the business excellence.
15	Costs reduction.		

Table-8 Benefits (Rankwise) wise of the Six Sigma programme to the Indian Industries [8]:

Rank	Benefits	Rank	Benefits
1	Reduction of the scrap rate .	9	Increase of the profitability.
2	Reduction of the cycle time.	10	Improved sales .
3	Reduction of the Delivery time.	11	Improvement in the company image.
4	Reduction in the customer complaints.	12	Improvement in the employees morale.
5	Increase in the productivity.	13	Increase in the overseas sales.
6	Reduction in the variability of the process .	14	New product development.
7	Reduced need of the checking /Inspection.	15	Entry into the new markets.
8	Reduction of the costs .	16	Improved attitude of employees towards the quality and the problem solving.
17	Improved attitude of the top management towards the quality and the problem solving.		

From the literature point of view ,this paper discusses the importance of the six sigma with the service quality and takes the comparison as the Research Methodology between the Indian Industries and the Foreign Industries into consideration.

Literature Survey(for the comparison between the Indian Industrial Scenario & Foreign Scenario):

Six Sigma can be understood at three different levels (Antony & Fergusson, 2004) i.e.

1. As a Metric: 3.4 million defects per million opportunities allows the organizations to implement a measurement based strategy that focuses on process improvement and variation reduction.
2. As a Methodology: Its implementation usually follows a well defined problem solving roadmap and tools such as DMAIC.
3. As a Philosophy: It aims at reducing variation in business processes based on customer critical quality issues and data driven decisions.

Almost most of the firms are striving to produce high quality products and the services at the reduced cost and in the shortest time .Six sigma is the most widely recognized and continuous improvement strategy accessible by most of the organizations (Alsmadi & Khan,2010).

Motorola was the first company to launch Six Sigma in the 1980's with the following aims in mind:

Table-9 Aim's of the Motorola Company

1.	Aim of eliminating the defects.	3	To improve the cycle time.
2.	To reduce the costs.	4	To enhance the customer satisfaction.

Many companies claimed millions of Dollars savings as a result of the implementation of the Six Sigma (Miguel & Andrietta,2009).Current developments in globalization and international commerce have indicated an interest in the development of a global market that is open to fair competition based on the quality and the price (Alsaleh,2007).

Table-10 Highest popularity of the change programmes to the lowest popularity of the change programmes (as pointed out from the research paper on the foreign industries)[2]

Rank	Change Programme	Rank	Change Programme
1	Total Quality Management	5	Balanced Score-Card
2	Six Sigma	6	Agile Manufacturing
3	Lean	7	Theory of Constraints
4	Business Process Re-Engineering		

Table-11 (Rankwise) Criteria for the selection of the six sigma projects: (as pointed out from the research paper on the foreign industries)[2]:

Rank	Selection Criteria	Rank	Selection Criteria
1	Impact of the project on the bottom line	5	Alignment of the strategic business goals and the objectives
2	Impact of the project on the customer satisfaction	6	Risk involved in the project.
3	Cost involved in running the projects	7	Levels of the expertise required for the project
4	Cost of the poor quality (COPQ)		

Table-12 Priority(Rankwise) wise usefulness of the Tools/Techniques /Methods in Six Sigma[2] :

Rank	Usefulness	Rank	Usefulness
1	Brainstorming	12	Regression Analysis
2	Control Charts	13	Benchmarking
3	Root Cause Analysis	14	Normal Probability Plot
4	Cause & Effect Analysis	15	Process Mapping
5	Affinity Diagram	16	Analysis of the Variance
6	Run Charts	17	Cost of the poor quality (COPQ)
7	Pareto Analysis	18	Failure Mode & Effect Analysis (FMEA)
8	Scatter Plot	19	Matrix Analysis
9	Process Capability Analysis	20	Design of the Experiments (DoE)
10	Histogram	21	SIPOC Model
11	Quality Function Deployment (QFD)	22	Taguchi Method

Table-13 (Rankwise) Barriers ,Difficulties and Impediments to implementing the Six Sigma [2]:

Rank	Barriers ,Difficulties and Impediments	Rank	Barriers ,Difficulties and Impediments
1	Lack of the Knowledge about the Six Sigma	8	Internal Resistance
2	Lack of the Resources (People/Budget/Time)	9	Allowing the time for the Training
3	Lack of the value of the education of Six Sigma	10	Getting alignment within the organization
4	Poor Project Selection	11	Difficulty in identifying the process parameters .
5	Overcoming Business Cultural barriers	12	Difficulty in collecting the data .
6	Lack of the education and the Training	13	Too complex to use .
7	Insufficient Interdepartmental Communication	14	Committing black belts full time .

Table -14 (Rankwise) Critical Success Factors [2]:

Rank	Critical Success Factors	Rank	Critical Success Factors
1	Linking six sigma to the business strategy.	9	Understanding the six sigma methodology.
2	Linking six sigma to the customers .	10	Training and Education.
3	Project management skills .	11	Incentive Program.
4	Organisational Infrastructure /Readiness.	12	Project tracking and Reviews.
5	Executive Leadership/Senior Management.	13	Company wide Commitment.
6	Project selection / Prioritization.	14	Linking six sigma to the Suppliers.
7	Management of the cultural change.	15	Linking six sigma to the Employees .
8	Integration of the six sigma with the finance.		

Who should do and how should they do (Roles and Responsibilities of the Six Sigma Level Hierarchy)

Table -15 (Hierarchy wise) Designations [8]:

Lower level individuals will report to the higher level individuals with the problems and the higher level individuals are responsible for mentoring the lower level individuals .

Rank in the Hierarchy	Designation & Certifications	Roles	Responsibilities
1	Executive Leadership /CEO		
2	Six Sigma Champion	Ensure availability of the resources . Know the business at hand inside. Know the Six Sigma methodologies . Understand the intentions of the business . Synergistic relationship among the various belts .	Choose specific projects. Sponsor specific projects . Overall six sigma picture within an organization. Leverages improvement through out the business .
3	Six Sigma Master Black Belt	Deep expertise, knowledge Base . Offer mentoring /Coaching Situation handling ability Project Management to statistical analysis . Train & Certify others in t he six sigma methodology.	Identify the projects Manage several projects . Leadership skills .
4	Six Sigma Black Belt	Thorough knowledge about the six sigma philosophies & principles . Team Dynamics . Assigns the Team members with the roles & responsibilities. Basic knowledge of the lean enterprise concepts . Identify the non-value added activities .	Team Leadership. Change agents. Project Execution. Project Team Leader . Accountable for the Results
5	Six Sigma Green Belt	Gather the data and execute the experiments . Use DMAIC methodology. Posses the problem solving skills .	Lead small scale improvement projects . Successfully deploy the Six Sigma Techniques .
6	Six Sigma Yellow Belt	Act as the lowest officials . Integrate the Sigma methodologies with the production as well as the transactional systems to meet the customer expectations .	Act as the subject matter expert . Act in the core Team as a member . Run smaller process improvement projects .
7	Six Sigma White Belt	1. Act as a support staff . 2. Are introduced to the basic principles of the six sigma concepts.	No specific responsibilities .

Structural Equation model was adopted to the valid 161 questionnaires collected from the managers of the Samsung Companies that adopt the six sigma . and the empirical results showed that six sigma contributes to the following: [9]

1. Process Management Refreshment.
2. Quality Improvement
3. Effects on the Culture, Operation system as well as the Profits .

Table-16 Factors and the results for measuring the Six Sigma Management [9] :

SI No.	Measuring Factors	Confirmatory Factors	SI No.	Measuring Factors	Confirmatory Factors
1	Information System	0.810	4	Policy /System	0.886
2	Communication	0.897	5	Process Innovation	0.895
3	Education /policy	0.840	6	Quality Improvement	0.877
			7	Corporate Competitiveness	0.881

Out of the above mentioned factors ,04 factors namely SI No. 01-04 were given more weightage.

Research Methodology: (Online survey @ <https://www.spidergap.com>)
Section breakdown: QUESTIONNAIRE

2.1 Do we have the right processes which produce the Customer Driven Product/ services ? Almost Always 5 Sometimes 4 Every ones in a while 3

2.2 Is the Right Customer served at the Right Time ? Almost Always 5 Sometimes 4 Rarely 2

2.3 Are the Right Products/Services satisfying the customer needs ? Almost Always 5 Sometimes 4 Every ones in a while 3

2.4 Do you think the workforce understands the customers need? Almost Always 5 Sometimes 4 Rarely 2

2.5 Is the workforce focused on meeting the customer the customer needs ? Almost Always 5 Sometimes 4 Every ones in a while 3 Never 1

2.6 Is the work force fully capable of meeting the needs of the customer? Almost Always 5 Sometimes 4 Every ones in a while 3

2.7 Are we able to decide who are the Customers with their exact needs ? Almost Always 5 Sometimes 4 Rarely 2

2.8 Are we able to measure the process performance? Almost Always 5 Sometimes 4 Every ones in a while 3 Rarely 2

2.9 Are the analysis of the causes of the defect are done exactly? Almost Always 5 Sometimes 4 Rarely 2

2.10 Is the removable of the causes of the defect perfect? Almost Always 5 Sometimes 4 Every ones in a while 3

2.11 Are there any sound business plans ? Almost Always 5 Sometimes 4 Every ones in a while 3

2.12 Are there clearly defined roles? Sometimes 4 Almost Always 5

2.13 Is there an efficient information system? Almost Always 5 Sometimes 4

Analysis :

Steps to evaluate the Evaluation Process[6] :

- I. Determine the purpose of the Evaluation .
- II. Develop the objectives of the Evaluation process .
- III. Convert the concepts into indicators into variables.
- IV. Develop the evaluation methodology.
- V. Collect the Data.
- VI. Analyze the Data.
- VII. Share the finding with the Share holders .
- VIII. Finalize the report.

An analysis of old service records may include the data for the percentage of the eligibility of the service , Perc drop outs and the Acceptance rate of the service.

1.Percentage of the Eligible Users =[(No.of the Eligible users) / (No. of the total users)] x 100

2.Drop out rate =[(No. of the Drop outs from the program/No. of the program Acceptors)] x 100

3.Acceptance of the Service= [(No. of the end-users of the service/No. of the eligible individual surveyed)] x 1

The observations from the above survey could be noted down as follows:

Almost Always 5	Sometimes 4	Every ones in a while 3	Rarely 2	Never 1
12	13	07	05	01
Highest Rating of 12 is for the-----Almost Always .				

Conclusions :

1. It is to be noted that all the service firms normally exhibit similar scores to the manufacturing Firms .Despite the fact that Six Sigma originated in the Manufacturing area ,its principles and the practices can also be permeated to the service firms .
2. There is no difference in benefits achieved by the Six Sigma in the Large and the Medium Scale Industries (Indian Industrial Scenarios well as the Foreign Industrial Scenario) .
3. Evaluation Research could be taken up as the future work for the purpose of evaluating the literature gathered and compared above with the Academic Importance.
4. Process or monitoring evaluation with the Focus of Evaluation-Service Delivery ;Main issue for Evaluation- Efficiency on the service delivery and the following questions could be answered –
 - a) What are the problems with the way the service is being delivered ?
 - b) How can the service delivery be improved ?
 - c) How satisfied are the clients with the way the service is being delivered ?
 - d) Do staff need additional training ?
 - e) How satisfied are the service providers with the service delivery manner?
5. By comparisons , problems within the organization can be defined (may/may not be apparent) through much research and development.
6. Appropriate actions can be reduced to the number of the errors and reworks which were earlier known to be costing the time ,opportunities ,money and clients .
7. The knowledge and awareness could be translated into an open opportunity for the expansion of the business .
8. This could Improve the quality of the business output and provide millions of opportunities for the mistakes .
9. This paper was able to systematically discover where the defects might occur .
10. This paper devised plans to minimize the errors before they are made.
11. This has already been confirmed that the Standardisation of the measurement process can be achieved and six sigma also provides the Knowledge and the Technology needed for the change (Xagoraris,2003) .
12. Application of the Six Sigma in Services include Banking and Financial Services,Healthcare <Construction,Supply Chain Management ,Accounting,Customer relations ,Public Utilities ,material procurement , Education ,Library,Order Processing,Airline Industry ,Safety ,Govt. Org. & NGO's. [10]
Finally ,it can be concluded that six sigma is a systematic methodology of hard work that is fused with a disciplined ,factual ,Data based method using the statistical problem solving method . It is for a CHANGE MANAGEMENT .

Limitations of Research :

Although in this Literary Research Paper, all the data had been taken from the peer reviewed research papers and based upon the analysis done on the literature survey, the conclusions were submitted but no attempt had been taken to collect the additional information which is new to the already published literature .

Future work:

Evaluation Research is a process of reviewing an intervention or a program in order to make/informed decisions that is *Thorough, Reliable & Valid* and Systematic for *Efficiency,Effectiveness & Appropriate* about *Selecting between different interventions ,Incorporating Changes and fine tuning for greater effectiveness and efficiency & Terminating the program for the better use of the resources .*

Advantages of the Evaluation Research:

1. The Evaluation research could help in providing a good and quality of the service to the clients.
2. The clients could be given the evidence of the quality of the service.
3. Evidence –based –practice could be taken up.

Other advantage is that this could answer the following questions:

1. How do the consumers view the service?
2. What do the consumers of your service feel about?
3. What do they see as the positive aspects of your service?
4. What, in, their opinion, are the negative aspects?
5. How can your service be improved upon?
6. Is your service really helping those for whom it was designed ?
7. Is it achieving its objectives?
8. In what ways is it benefitting your clients ?
9. How expensive si your service?

10. What is the cost of providing the service to the client?
11. Is the cost justified?
12. Is the money being well spent?

Important Lessons Learnt:

1. Sigma is a letter in the greek alphabet and is used as a symbol by the statistician to measure variability in a process .
2. Six sigma standard is 3.4 problems per million opportunities.
3. Customer or the end user is responsible for defining the quality of a product or the service.
4. Six sigma implementation within an organization benefits the customer/upper management /Company employees .
5. Business employees are directly related to the quantity of a business product service .
6. The actual working definition of the term Six Sigma differs from company to company and also from country to country although the goal is always the same.
7. Six Sigma is a management system ,metric system and methodology .
8. DMAIC perfects the business processes already in place .
9. Employees job satisfaction is concerned with the quality produced by the company.
10. Six Sigma belts levels are organized into a Hierarchy and named according to the Martial Arts Conventions .
11. In the same regard , Federal Express had developed COSMOS-Customers operations and the Services Master Online to keep the promises for the prompt and the punctual delivery.
12. In this regard ,Eureka ,a communications system that allows their Customer Service Engineers ,who are working around the world ,to interactively share their knowledge .(Connor & Gutknecht,1998)
13. Apart from Motorola , some of the other companies like GE,allied Signals, Dupont and Sony successfully profounded Six Sigma management activities which were theoretically valid.

References

- [1]Six sigma Quality : A structured review and the implication for the future research
Mohamed Gamal Aboelimged
Management Department ,College of the Business Administration ,Ajman University of Science and Technology ,Ajman ,United Arab Emirates .
- [2]Implementing Six Sigma in Saudi Arabia: An empirical study on the fortune 100 companies Majed Alsmadi, Brian Lehaney and Zufiqar Khan
Department of Engineering and Knowledge Management ,Coventry University ,Coventry Business School ,Coventry University ,Coventry,UK.
- [3]Alsaleh,N.A.(2007) Application of quality tools by the Saudi Food Industry.
- [4]Almadi,M & Khan,Z (2010,March 30-April 1)Lean six sigma as the new wave of business excellence .
- [5]Antony J, Antony F & Kumar M (2007) Six Sigma in the service organizations :Benefits,Challenges and Difficulties ,common myths ,empirical observations and success factors .International Journal of quality and reliability management.
- [6]Miguel,P.A. & Andrietta,J M (2009).Benchmarking six sigma applications in brazil : Best practices in the use of the methodology .Benchmarking: An international Journal .
- [7]Pulakanam,V.,& Voges,K (2010):Adoption of six sigma :Review of empirical research ,International review of Business Research papers.
- [8]Impact of six sigma in a developing economy:Analysis on the Benefits drawn by Indian Industries . Darshak A.Desai ,Mulchand B Patel
G.H.Patel College of Engineering and Technology ,Vallabh Vidyanagar(India) .Government Engineering College ,Shamlaji road,Modasa(India).
- [6]Research Methodology (A step by step guide for the beginners)-Ranjit Kumar
- [7]www.isixsigma.com
- [8] <http://www.onlinelsttraining.com>.
- [9]Six sigma management activitiwes and their influence on the Corporate Competitiveness Kun Changlee and Bong Choi ,School of Business Administration ,Sungkyunwan University, Samsung Economic Research Institute ,Seoul ,Korea.
- [10].Challenges of the Six sigma in improving the Service Quality Behnam Nakhai,Dept. of Business administration ,Villersville university of Pennsylvania, Pennsylvania,USA. Zoas S Neves ,Dept. of Management,The college of New Jersey,Ewing, New Jersey,USA.

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