

A Comprehensive Review of Six Sigma for Service Sector Performance Metrics

Marco Rossi¹, Dr. Giulia Ferraro²

¹(Department of Mechanical Engineering, University of Bologna, Bologna, Italy)

²(Department of Mechanical Engineering, Politecnico di Torino, Turin, Italy)

ABSTRACT

Six sigma is very effective tool to enhance quality performance of any process. The methodology calls for collection of historical data, analysis of data and then systematically eliminating causes of defects by using various problem solving techniques. Six sigma techniques are applicable not only for manufacturing but also for service sectors. In recent years, companies have begun using Six Sigma Methodology to reduce errors, excessive cycle times, inefficient processes, and cost overruns related to financial reporting systems. This literature review presents various case studies to illustrate the application of Six Sigma Methodology within various service sector organizations

Keywords: Six sigma, performance measure, service industries.

I. INTRODUCTION

In today's highly competitive market with increasing demands of consumers for getting better products and services, survival of companies in the ever-expanding marketplace, economic success of companies, improvement in productivity, customer satisfaction, profitability, and innovativeness, changing organizational culture, and globalization of world trade. The emergence of quality plays a vital role and has become a top priority for many companies worldwide in order to achieve the above stated objectives and gain competitive edge. The importance of quality for company's performance in several terms and success in marketplace is widely accepted in business literature and practice. In an attempt to improve quality, numerous approaches to management of quality and continuous improvement have been pursued, most notably and a recommended approach is the concept of total quality management (TQM). Many companies claimed substantial benefits of implementing TQM in terms of financial results, operating performance, customer satisfaction, and employee satisfaction. Increased globalization and tough business conditions have brought challenges and opportunities for Indian service companies and made them to promote quality in their products and services, and has become a national imperative for Indian companies to stand and compete in the present market condition.

Quality management has long been established as an important management strategy for achieving competitive advantage. Traditional quality concepts like Statistical Process Control (SPC), Zero Defects and Total Quality Management (TQM), have been key player for many years. While six-sigma is a more recent quality improvement initiative to gain popularity and acceptance in many industries across the globe. The basic elements of six-sigma like, SPC, Failure Mode Effect Analysis (FMEA), repeatability and reproducibility and other tools have been in use for some time. Actually, six-sigma provides a framework which unites these basic quality tools with high level management support. However, most service industries still do not use the basic aspects of SPC (Statistical Process control). In fact they can benefit significantly by implementing both SPC and six-sigma. The implementation of six-sigma helped the industries like Finance, Health Care, Citibank and a few other service industries to drive defects/errors out of their delivery process and create success stories for others to follow.

The limitation of six-sigma in service industries is that the features of service industries are not uniform. The application of six-sigma and its benefits are limited to some specific type of services like health care and banks. The Six Sigma Approach is customer-driven. For a business or a manufacturing process, the Sigma Capability is a metric that indicates how well the process is being performed. The higher the Sigma Capability, the better is the performance, because it measures the capability of the process to achieve defect-free-work (where a defect is anything that results in customer dissatisfaction).

II. LITERATURE REVIEW

Even though the concept of service goes back to 1950s but still there are no accepted definition of service. The earliest approach to define service is by Shostack,1997, [9], in which the author feels that services are rendered, it is experienced. A service cannot be stored on a shelf, touched, tasted or tried on for a size. Services are generally obtained by engaging an interactive process with the provider, Harvey,1998, [14]. Vargo and Lusch,2004, [33] defines service as the application of specialized competences (skills and knowledge), through deeds processes and performances for the benefit of another entity or entity itself. Woodall,2001, [34] feels that service can or could mean any or all of the following:

- The entire manifestation of a business or not-for profit structure perceived to reside within the service sector (e.g. restaurant, insurance company, local council repair depot) – service as an organization.
- The key commercial outputs of a service organization (e.g. bank account, insurance policy, and holiday) – service as core product.
- Any peripheral activity designed to enhance the delivery of a core product (e.g. provision of a courtesy car, complimentary coffee) – service as product augmentation.
- Any product- or customer-oriented activity that takes place after the point of delivery (monitoring, repair, up-dating) – service as product support.
- Service as a mode of behaviour (helping out, giving advice) – service as an act.

There are several other definitions but the most widely used definition of service is based on its characteristics of intangibility, heterogeneity, inseparability and perishability given by Parasuraman et al,1985, [3].

Schimdt and S. Aschkenase's, 2004, [21] framework emphasises education and certification (i.e. Champion, Yellow Belt, Green Belt and Black Belt certification) as an important aspect of their implementation model. It can be argued that certification cannot assure the success of Six Sigma implementation. Six Sigma teams should have enough understanding to use basic and advanced quality tools to solve organizational problems. It is not difficult task since these basic and advanced tools of Six Sigma are not new tools, they have used in the TQM or other improvement programs in the past.

The service research is very rich in context of definitions, models and measurement issue. A model attempts to show the relationships that exist between salient variables. It is a simplified description of the actuality. The primary aims of the models reviewed are to enable the management to enhance the "quality" of the organization and its offering in a systematic manner. Each of these models is representative of a different point of view, Ghobadian,1994, [2].

III. WHAT IS SIX SIGMA?

Over the past two decades Six Sigma has evolved from a focus on metric to the Methodology level and finally to the design and development of entire Management Systems. As a Metric, when a process is operating at Six Sigma level, it will produce nonconformance (i.e., defects or errors) at a rate of not more than 3.4 defects per one million opportunities. As a Methodology, Six Sigma leads to business process improvement by focusing on understanding and managing customer expectations and requirements, Brewer and Eighme,2005; [6]. As a Management System, Six Sigma is used to ensure that critical improvement opportunity efforts developed through the Metrics and Methodology levels are aligned with the firm's business strategy. The focus of this paper, however, is on the application of Methodology for business process improvement within the financial reporting process. The core of the Six Sigma Methodology level is DMAIC which stands for define, measure, analyze, improve, and control. These are explained in detail in the following figure.

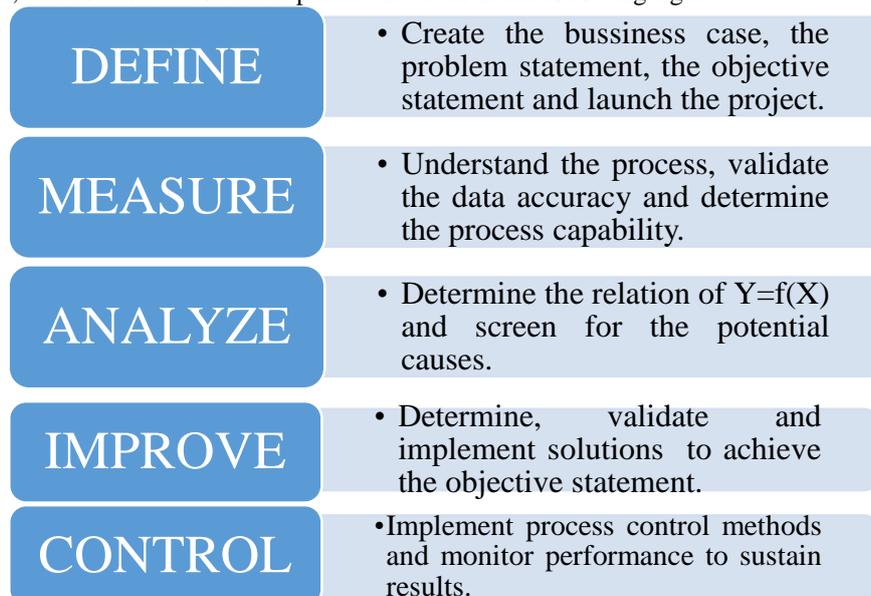


Fig.-1. Six Sigma Methodology level

In the Define phase, the project team must work closely with stakeholders to clearly define the problem statement, project scope, budget, schedule, and constraints. Understanding customer (internal and external) requirements is the key to achieving the project's goal. The team has to define problems and goals of the project that are consistent with customer demands and with the firm's business strategy. Process mapping and "voice of the customer" (VOC) tools are iterative techniques recommended as a means of incorporating customer requirements.

During the Measure phase, the team creates a value stream mapping (VSM) of the process, capturing the flow of information—where and what information is needed. Then, based on the VSM, the team starts collecting data relevant to measuring the current process performance relative to the project's goals. The most important activities in this phase are the identification and validation of data accuracy. The most widely used tools are VSM, run charts, brainstorming, balanced scorecards, documentation tagging, data collection check sheets, and decision metrics.

During the Analyze phase, the team needs to collect and analyze the data to understand the key process input variables that affect the project's goal, such as whether time spent on current activities is value added or non-value added. A VMS may be used as part of the overall analysis to generate a list of potential root causes for why the process is not performing as desired. The tools that can be used are process flow chart, value stream mapping, cause-and effect diagram, Pareto analysis, histograms, control charts, and root cause analysis.

During the Improve phase, the team needs to design and conduct experiments (DOE) on a small scale using a formal evaluation process to identify and evaluate optimal or desired alternatives against the established criteria. A list of all possible solutions should be developed, enabling the team to eliminate the root causes of problems. The recommended tools include brainstorming, cost-benefit analysis, priority metrics, failure mode and effect analysis, and process flow diagrams.

Finally, during the Control phase, the team should standardize and document the new process to support and sustain desired improvements. To sustain long-term improvements, *how* the improved process is expected to result in operational and financial improvements, Foster, 2007; [10] should be transparent to all employees. Tools used include statistical process control charts, flow diagrams, and pareto charts.

IV. DEFINITIONS OF PERFORMANCE MEASUREMENT

Literally, Performance Measurement is defined as the "process of quantifying the past actions, where measurement is the process of quantification and past actions determines current performance", Neely, 1998a, [26]. Procurement executive association define PM as a "process of assessing progress toward achieving predetermined goals, including information on the efficiency with which resources are transformed into goods and services (outputs), the quality of those outputs (how well they are delivered to clients and the extent to which clients are satisfied) and outcomes (the results of a programme activity compared to its intended purpose)". A similar definition has been given by Moxham and Greatbanks, 2000, [23] who state that PM ensures the attainment of goals and objectives of an organization. Since PM systems encompasses supporting infrastructure, a wider definition has been given by Neely, 1998a, [26] as the quantification of efficiency and effectiveness of past actions by means of data acquiring, collection, sorting, analyzing, interpreting and disseminating. Cain identifies PM as the first stage to any improvement process that benefits the end users with lower prices, and the organizations with higher profit margins while enhancing the quality of the product. The significance of positioning the PM strategically has been well documented in the literature, Kaplan and Norton 1992; [16]; Neely et al 1998(b); [27]. Performance measures can be used to translate the strategy of the organization into set of goals and objectives and the results obtained through the measures reflect the successfulness of achieving the strategy. Thus, PM directs the strategy formulation as well as monitors the implementation of the strategy, Handfield and Nichols, 1999; [11]. Any gaps identified from the "actual" and "planned" results will help to challenge and adjust the goals and strategies of the organization, Nanni et al, 1992, [25]. Horonec, 1993, [12] identifies performance measures as "vital signs" of an organization which help to recognize whether the activities of a process or the outputs of the process achieve the specified objectives. Further, these vital signs communicate what is important throughout the organization through communicating the strategy from top management downwards to the organization, results of processes from lower level upwards to top management and control and improvement within a process, Horonec, 1993, [12].

V. IMPORTANCE OF PERFORMANCE MEASUREMENT

Lower benefits were gained by the organizations which lack the utilization of PM systems and feed back into the improvement of management development programmes, Longenecker and Fink, 2001, [17]. According to Neely, 1998b, [27] managers measure for two main reasons namely to know their current position in the market and to influence the subordinate's behavior. From the manager's perspective, PM assists them to move towards the correct direction, to revise the business goals and to re-engineer the business process, Van Hoek, 1998; [35], Beamon and Ware, 1998, [5].

Performance measures indicate the priority factors of the organization and the way the employees should behave to give the maximum out come to the organization, Neely et al, 2002, [28]. Thus, when the measures are aligned with the organizational strategy, they encourage the employee behaviors also to be aligned with the strategy. Hence, performance measures can be considered as a behavioral tool for the employees, Neely et al, 2002, [28] as well as used as an employee motivating determinant. Amaratunga and Baldry, 2002, [1]. Although the importance of PM has been highlighted by many authors, all these reasons fall under four main categories (Neely, 1998a), the four "CPs" of measurement namely;

- check position
- communicate position
- confirm priorities
- compel progress

Due to all these advantages of PM, the UK government white paper on competitiveness, Neely et al, 2002, [28] has mentioned that "to achieve sustainable business success in the demanding world market place, a company must use relevant performance measures". By considering the above arguments, it can be said that PM is an important aspect for any organization to evaluate its actual objectives against the predefined goals and to make sure that the organization is doing well in the competitive environment.

VI. OBSERVATION

Based on the above literature review, a conceptual framework can be developed and a research model can be proposed to examine the relationships between TQM practices and company's performance by measuring the 'Quality Performance' as a performance indicator in the Indian service companies. This research model suggests that the greater the extent to which these TQM practices are present, the quality performance of Indian service companies will be higher. In this framework, the independent variables are TQM practices and a dependent variable is quality performance respectively.

Six Sigma has become a frequently used term in discussions regarding quality management. The international and national competitive environment is in a process of constant change by the globalization of markets and the increased independence of economic agents. This process of change has brought increased demands on the organizations' competitiveness and customers have gained a central role in organizations' focus. Six Sigma is considered to be an important management philosophy, which supports organizations in their efforts to obtain satisfied customers.

However, as Six Sigma has become a strategic necessity for service organizations, a large number of tools and techniques have been suggested by academics and practitioners for its implementation. Intriguingly, despite the extensive effort that has been invested and benefits that can be obtained, the systematic implementation of Six Sigma in service organizations is limited.

Furthermore, diversity among researchers exists regarding actual benefits of Six Sigma and its suitability to service organizations. The role and contribution, which service organizations make to the economy, has become widely recognized. As service organizations have been slow to adopt Six Sigma, issues concerning its implementation in services are of major importance. This research work presents results from two aspects. The first concern is with the estimation of success and progress of service organizations due to Six Sigma implementation. This is accomplished by conducting a large-scale survey of service organizations situated in different geographic locations. The results obtained by analyzing the responses indicate that mainly mass services have implemented Six Sigma throughout the organization and they are the most successful and progressive.

VII. CONCLUSION

This literature review has accomplished the various objectives of the study successfully and analyzed the relationship between the TQM practices and quality performance in the Indian service companies. However, the findings also indicated the importance of quality systems, training and education, teamwork and benchmarking for predicting company's quality performance. The framework can be developed on the basis of grounded theory methodology, is an attempt to understand the aspects of Six Sigma implementation and performance in service organizations. The framework provides a set of CSFs, measurable process characteristics, and tools and techniques which will act as a guide and also overcome the difficulties or barriers in Six Sigma implementation in service organizations. Most of the organizations analyzed are in moderate success and moderate progress level. The success and progress of these organizations is not only because of high financial benefits but they are able to sustain the program for long-term by identifying projects on continuous basis and providing training to all levels of employees in the organization. The successful organizations are also able to implement Six Sigma throughout the organization. Further classifying services based on operations management literature showed that the types of organizations which have tasted success in Six Sigma are mainly mass services. The classification also helped us in identifying the preferred tools and techniques used by different types of services. The successful organizations used a limited number of tools and techniques in comparison to less successful one

VIII. REFERENCES

1. Amaratunga, D. and Baldry, D., 2002, *Moving from PM to performance management*, *Facilities*, Vol. 20(5)
2. A. Ghobadian, S. Speller, and M. Jones, "Service Quality: Concepts and Models," *International Journal of Quality & Reliability Management*, Vol. 11 No. 9, pp. 43–66, 1994.
3. A. Parasuraman, V.A. Zeithaml and L.L. Berry, "A Conceptual Model of Service Quality and Its Implication for Future Research," *Journal of Marketing*, Vol. 49 No. 4, pp. 41–50, 1985.
4. A.R. Benedetto, "Adapting Manufacturing – Based Six Sigma Methodology to the Service Environment of a Radiology Film Library," *Journal of Healthcare Management*, Vol. 48 No.4, pp. 263–280, 2003.
5. Beamon, B.M. and Ware, T.M., 1998, "A process quality model for the analysis, improvement and control of supply chain systems", *Logistics Information Management*, Vol. 11(2), pp.105-113.
6. Brewer, P. & Eighme, J. (2005). "Using Six Sigma to improve the finance function". *Strategic Finance*, 86 (7), 27–33.
7. C.H. Lovelock, "Classifying Services to Gain Strategic Marketing Insights," *Journal of Marketing*, Vol.47 No.3, pp. 9– 20, 1983
8. D.H. Stamatis, *Six Sigma Fundamentals*, Productivity Press, New York, 2004.
9. G.L. Shostack, "Breaking Free from Product Marketing," *Journal of Marketing*, April, pp. 73–80, 1977.
10. Foster, S. (2007). "Does Six Sigma Improve Performance?" *The Quality Management Journal*, 14(4), 7-19.
11. Handfield, R. B., Nichols, E. L., 1999, 'Introduction to supply chain management', Prentice Hall, NJ.
12. Hronec, S.M., 1993, "Vital Signs: Using Quality, Time and Cost Performance Measurement to Chart Your Company's Future", Amacom, New York
13. J. Antony, "Six-Sigma in the UK Service Organizations: Results from a Pilot Survey," *Managerial Auditing Journal*, vol.19, no.8, pp. 1006-1013, 2004.
14. J. Harvey, "Service Quality: A Tutorial," *Journal of Operations Management*, Vol. 16, pp. 583–597, 1998.
15. J.S. Oakland and J.A. Dotchin, "Total Quality Management in Services Part 1: Understanding and Classifying Services," *International Journal of Quality and Reliability Management*, Vol. 11, No. 3, pp. 9–26, 1994.
16. Kaplan, R. S. and Norton, D.P., 1992, "The Balanced Scorecard: The measures that drives performance", *Harvard business review*, Jan-Feb, pp 71-79
17. Longenecker, C.O. and Fink, L.S., 2001, "Improving management performance in rapidly changing organizations", *Journal of Management Development*, Vol. 20(1), pp 7-18.
18. L. Hendry and P. Nonthaleerak, "Six-sigma: Literature review and key future research areas", *Lancaster University Management School (Working Paper)*, 2005.
19. L. Sehwail and C. De Yong, "Six Sigma in Health Care," *International Journal of Health Care Quality Assurance*, Vol. 16 No. 6, pp. 1–5, 2003.
20. M. Harry and R. Schroeder, "Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations", 1st ed., Random House Inc., New York, 2000
21. M. Schimdt and S. Aschkenase, "The Building Blocks of Service," *Supply Chain Management Review*, July – Aug, pp.34–40, 2004.
22. M.H. Jones, "Six-Sigma: At a Bank?" *ASQ Six Sigma Forum Magazine*, Vol. 3 No. 2, pp. 13–17, 2004.

23. Moxham, C. and Greathanks, R.W., 2000, "Does changing demand necessitate change in performance measures? A practical case study analysis", Neely, A. (Ed.), "Performance Measurement: Past, Present and Future", Centre for Business Performance, Cranfield.
24. M.S. Raisinghani, "Six Sigma: Concepts, Tools and Applications," *Industrial Management & Data Systems*, Vol. 105 No. 4, pp. 491–505, 2005.
25. Nanni,A.J., Dixon, J.R.,Vollmann, T.E., 1992, "Integrated Performance Measurement: Management accounting to support the new manufacturing realities", *Journal of Management Accounting Research*, Vol. 4, pp1–19.
26. Neely, A., 1998 (a), "Measuring Business performance", *Economist books*, London
27. Neely, A., 1998(b), "Three models of measurement: theory and practice", *International journal of business performance management*, Vol. 1. (1), pp. 47-64.
28. Neely, A., Adams, C. and Kennerley, M., (2002), "The performance prism", *Prentice Hall*, London.
29. P.A.S. Johnstone, et al. "Ancillary Services in the Health Care Industry: Is Six-Sigma Reasonable?" in *Health" Quality management Care*, Vol. 12 No. 1, pp. 53–63, 2003.
30. R.C.H. Chua, "What you need to know about Six-Sigma?" *Productivity Digest*, Dec, pp. 37-44, 2001
31. R.L. Hensley and K. Dobie, "Assessing Readiness for Six Sigma in a Service Setting," *Managing Service Quality*, Vol. 15 No. 1, pp. 82–101, 2005
32. R. Rucker, "Citibank Increases Customer Loyalty with Defect – Free Processes," *Association for Quality and Participation*, pp. 32–36, 2000.
33. S.L. Vargo and R.F. Lusch, "The Four Service Marketing Myths," *Journal of Service Research*, Vol. 6 No. 4, pp. 324–335, 2004.
34. T. Woodall, "Six Sigma and Service Quality: Christian Grönroos Revisited," *Journal of Marketing Management*, Vol. 17, pp. 595–607, 2001.
35. Van Hoek, R.I., 1998, "Measuring the un measurable- measuring and improving performance in the supply chain", *International Journal of Supply Chain Management*, Vol. 3 (4), pp. 187-92