

Implementation of Six Sigma and Other Cost Reduction Techniques for Improving Quality in Selected Manufacturing Industries

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Abstract—In the manufacturing industries the major concern is to optimize the quality of product and production cost. This problem can be reduced by using various techniques. The Six Sigma technique is mostly used to enhance the quality of product, reduce cost and process improvement for the manufacturing industries. This paper identifies the different quality and cost reduction techniques used in selected industries and also find out various processes which reduces source of variation and improves quality and productivity, results increase in customer satisfaction.

Keywords – Six Sigma, DMAIC, Tools, Techniques

I. INTRODUCTION

A. Six Sigma : History

Since 1980, there has been a profound growth in the use of statistical methods for quality and overall business improvement. The term “Six Sigma” was coined by Bill Smith, an engineer with Motorola under the leadership of Robert W. Galvin. Motorola had always been a pioneer in the areas of productivity and quality. 1987 Motorola officially launched its Six Sigma program. Motorola saved more than \$ 15 billion in the first years of its Six Sigma effort. Later it was adopted by General Electric, where it was initiated by Jack Welch.

B. Definition

- **SIGMA:**

A term (Greek) is used in statistics to represent standard deviation from mean value, an indicator of the degree of variation in a set of a process. It is the measures how far a given process deviates from perfection. If Higher sigma capability, better performance.

- **SIX-SIGMA:**

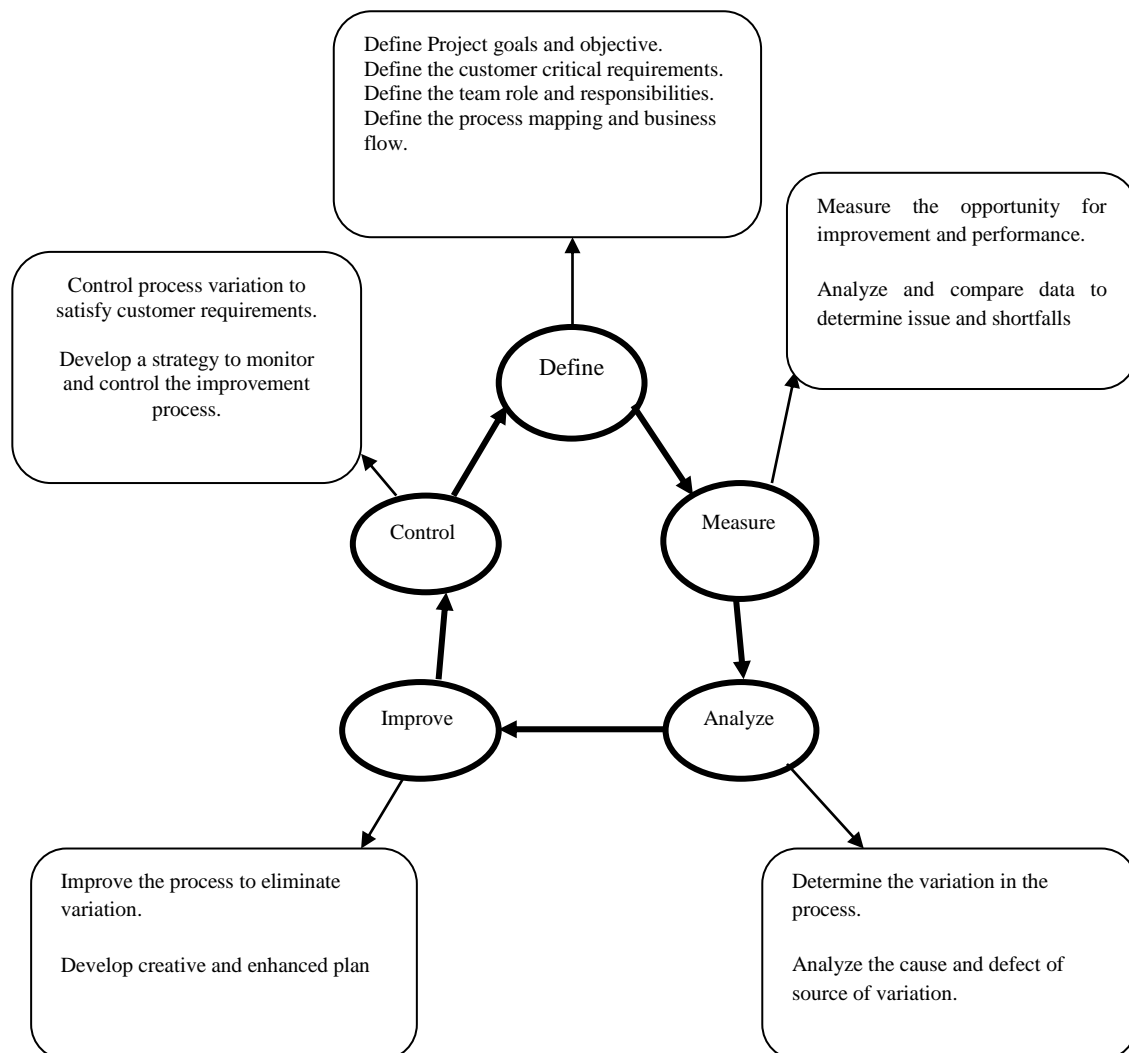
A highly disciplined process that enables organizations delivers nearly perfect products and services. The figure of six arrived statistically from current average maturity of most business enterprises. A philosophy and a goal: as perfect as practically possible. A methodology and a symbol of quality are the statistical concept that measures a process in terms of defects – at the six sigma level, there 3.4 defects per million opportunities. It is a Quality Philosophy and the way of improving performance by knowing where you are and where you could be. The methodology is measure and improves company's performance, practices and systems. A basic concept of six-sigma is process.

That's any repetitive action –in any manufacturing, services, or transactional environment. The Six Sigma methodology collects data on variations in outputs associated with each process s that it can be improved and those variations can be reduced. It is a disciplined, data driven approach to process improvement of defects from every product.

II. METHODS OF SIX-SIGMA

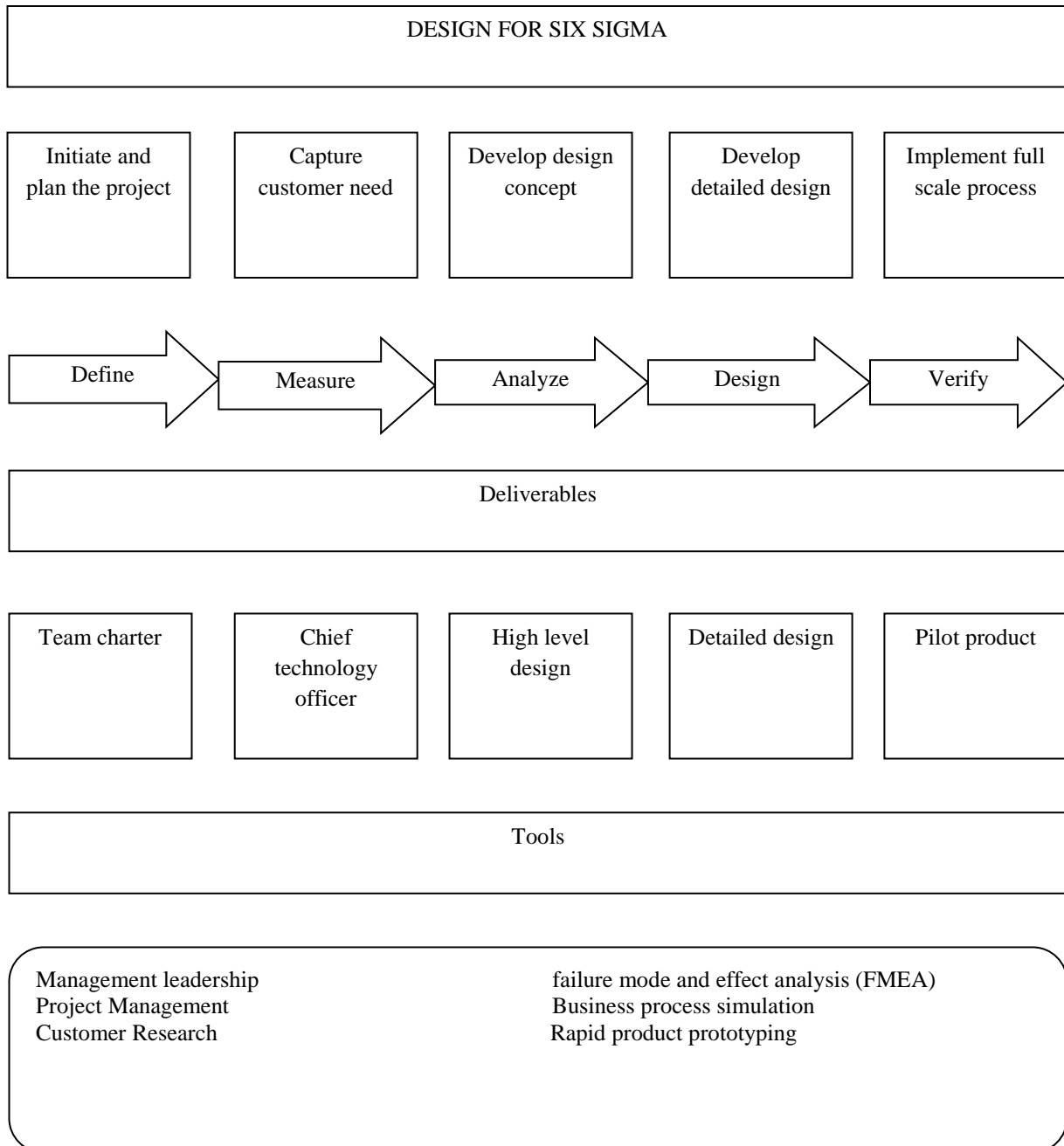
A. DMAIC Process

This approach is called breakthrough approach. Captured the Motorola methods and packaged them in the Define, Measure, Analyze, Improve and Control methodology. It is used when a project's goal can be accomplished by improving an existing product, process, or service.



B. DMADV Process

This is Define, Measure, Analyze, design, Verify are the modified version of DMAIC process. This application is used when customer requires creation, product improvement and adjustment. Its main aim to create a high quality product at every stage to satisfy customer requirements.



III. LITERATURE REVIEW

A. Manufacturing industries

M. Sokovic [1] in his work discusses the implementation of six-sigma to minimize the identification and reduction of production cost in automotive parts company and improve quality level of parts using DMAIC approach. After practical implication the final result gives tool expenses reduced 40%, costs of poor quality reduced 55%, labor expenses for 59% also production time is reduced by 38%.

Tushar N. Desai [2] emphasizes the changing economic condition such as global competition, customer satisfaction in product variety and reduced lead time. This paper proposed that productivity and quality improvement in manufacturing industries. The application of Six Sigma (DMAIC) methodology provides a framework to quantify and eliminate source to optimize the operation variables and improved performance.

Aden Valles [3] implemented a DMAIC approach in a semiconductor company for manufacture of circuit cartridges for inkjet printers. The result showed that the critical factor were found and controlled. This gives result in the reduction of electrical failures of 50%.

Tarek Sadraoui [4] describe that how reduce water consumption in Coca Cola Company. For any company the efficiency and effectiveness are two important factors to arrive at excellence. Using Six Sigma it gives good result according to effective solution. He further stated that quality level equalizes 3L/LPF by Six Sigma

Hsiang-Chin Hung [5] explores how a food company in Taiwan can use a disciplined and systematic approach to reduce the defect rate. The DMAIC stages were employed, and statistical data analysis was used to find the reasons for the defects. This Six Sigma program was first time implement in any food industry.

Dr. Rajeshkumar [6] suggested a DMAIC approach to improve the products, quality and process in mid-sized auto ancillary unit. He also mentioned in his study that this approach is suitable to eliminate defects and continuous improvement in achieve the good quality product with minimum cost.

Md. Enamul Kabir [7] states in his paper how to improve productivity using DMAIC cycle. He also used different tools like 5s, line balancing for improving productivity.

Sachidanand S. More [8] implement new Six Sigma methodologies that are quality Six Sigma. It is integration of six sigma- DMAIC steps. He further mention that it give improvement in overall productivity.

Amit Kumar Singh [9] took an initiative in auto manufacturing firms to reduce the level of defects using Six Sigma. In this attempt has been made to initially apply define phase. Six Sigma with the help of quality management improving productivity and quality at a very high level and achieving customer delight for auto sector which are always susceptible by large scale industries.

Mahmood Al Kindi [10] studied the influence of budget estimation of drilling for gas and oil systems. In drilling process it involves many uncertainties such as labor cost, material, inflation. This paper focuses on to implement Six Sigma to control the budget in minimum production error. Use Newsvendor model and get optimal value for the cost and utilize the expert opinion through Bayesian inference. Expert provides well information to capture their belief for cost distribution and achieved final distribution.

Sneha P. Sawant [11] discusses the quality improvement in construction industry. We take a residential building in which 18 buildings are considered and check internal finishing work then applied six sigma principal. Suggested the proper training, management support and change current work procedure thus helps ultimately customer satisfaction and improve the finishing work which is most important for us.

S. Suresh [12] implements Six-Sigma approach in manufacturing of piston rings to reduce the defect. First define the problem then choose Data Analysis, Pareto chart, Failure Mode Effect Analysis and Design of Experiments and find the cause of the problem and carrying out experiments to resolve the problem. Using DMAIC cycle he can easily short out the problems and reduce defects.

Chethan Kumar [13] proposed guidelines for the control of waste, improvement in garment industry. He further emphasized need of Six Sigma methodologies to improve the service enhancement as well as cost reduction. With the help of DMAIC methodologies the overall defect is reduced.

B. Service industry

Mohammad Abdolshah [14] implements Six Sigma in service industries. The main problem of service industries is the lack of information and difficulty to define factors and quality indicators. Six sigma gives proper guidelines to implement and also quantifying and gathering data from service industries.

Ayon Chakrabarty [15] presents a case study in call center services. In order to improve service quality focus on service process is necessary. So, Six-Sigma if properly applied can be useful for services. Conduct services to analyze, identify, compare critical to quality to get increase customer satisfaction and efficiency.

IV. CONCLUSION

An analysis of review of literature in the area indicates some spade work has been done in the area of cost reduction techniques but in depth thought were not given in quality management system. The review of literature is clearly indicates the following gaps –

1) Leaving aside very few has been made to explore the various dimensions such as planning implantation etc. of six-sigma as quality techniques in manufacturing industry in India.

- 2) DMAIC cost reduction techniques used in manufacturing industry as well as service industry.
- 3) In large scale industry we can also use 5s; Kaizen with DMAIC for continuous improvement.

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