

# Six Sigma Quality Improvement Methodologies: A Review

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**Abstract**—Quality control is an important thing that must be done by the company to minimize defective products. The company can analyze product defects by using the Six Sigma methods. In the current era of globalization, customer is supreme and purchase products from anywhere, hence focus should be on the enchantment of the customer rather than satisfaction. The customer is not liable to pay for any rejection, rework or non-value added activity.

**Keywords**—six sigma, TQM, quality control.

## I. INTRODUCTION

The main aim of six sigma methodology is to reduce variation among products or processes through continuous improvement process. It just not provides quality assurance (QA) but also provide quality control (QC) function. Among various process improvement methodologies, Total Quality Management (TQM) and Six Sigma are two key methodologies widely used by various organizations. TQM has been a dominant management concept for continuous improvement Six Sigma is uniquely controlled by a strong understanding of facts, data, and statistical analysis, as well as careful attention to managing, improving, and reinvesting business.

## II. IMPLEMENTATION OF SIX SIGMA

Adan Valles et al. (Ref-1) presented a Six Sigma project conducted at a semiconductor company dedicated to the manufacture of circuit cartridges for inkjet printers. They tested electrically in the final stage of the process measuring electrical characteristics to accept or reject them. Electrical failures accounted for about 50% of all defects. Therefore, it is crucial to establish the main problems, causes and actions to reduce the level of defects. With the implementation of Six Sigma, it was possible to determine the key factors, identify the optimum levels or tolerances and improvement opportunities. The major factors that were found through a design of experiments 3 factors and 2 levels were: abrasive pressure (90-95 psi), height of the tool (0.06-0.05) and cycle time (7000-8000 msec.). The improvement was a reduction in the electrical failures of around 50%. The results showed that with proper application of this methodology, and support for the team and staff of the organization, a positive impact on the quality and other features critical to customer satisfaction can be achieved.

Souraj Salah and Juan A. Carretero (Ref-2) narrated that industries are continuously facing fierce competition and the challenge of meeting increasing demands for higher quality products at economic costs. The success of an organization is directly related to how effective its implementation of continuous improvement (CI) is. For any manufacturing

system, Total Quality Management (TQM) and Six Sigma are important CI methodologies. Effective understanding of these methodologies and their relationship will provide an industry with a competitive advantage. Many industrial organizations today are using either TQM or Six Sigma as the core for their CI efforts. There is a lot of dispute on which methodology is superior, how As such, the relationship between TQM and Six Sigma is worth further investigation. In this paper, TQM and Six Sigma are introduced followed by a thorough comparison. More particularly, this work investigates their similarities, differences and how they relate to each other. Finally, this research introduces how they fit together in order to develop a new structure for integrating them together which will provide an improved approach for CI.

Mohamed Gamal Aboelmaged (Ref-3) in his paper aims to clarify emerging aspects and trends of Six Sigma literature over 17 years, from 1992 to 2008. Design/methodology/approach – The literature on Six Sigma from 417 referred journal articles in business and management disciplines, information systems and computer science, engineering, healthcare, etc. were systematically analyzed based on a scheme that consists of four distinct dimensions: publication year and journal, major themes, research type, and application sector (i.e. manufacturing vs. service). The paper provides both academics and practitioners with a useful framework for pursuing rigorous Six Sigma research through explaining the chronological growth of Six Sigma, challenging themes of Six Sigma research, dominating research types and application areas in Six Sigma, and the major sources of Six Sigma information.

Hsiang-Chin Hung and Ming-Hsien Sung (Ref-4) presented that in recent years, an increasing number of companies have used different types of quality programs in order to increase internal and external customer satisfaction as well as to reduce quality cost. Among all of these programs, Six Sigma is perhaps the most widely-accepted initiative by all a broad range of organizations. The DMAIC (define-measure-analyze-improve-control) approach has been followed here to solve an underlying problem of reducing process variation and the associated high defect rate. This paper explores how a food company in Taiwan can use a systematic and disciplined approach to move towards the goal of Six Sigma quality level. The DMAIC phases are utilized to decrease the defect rate of small custard buns by 70% from the baseline to its entitlement. At the beginning of this project, the defect rate was 0.45% (Baseline), and after the improvement actions were implemented during a six-month period this fell to below 0.141% (goal). The critical successful factors for Six Sigma projects, especially those in the food industry, are discussed at the conclusion of this paper.



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Monika Smętkowska et al. (Ref-5) narrated that in over the last two decades there has been a growing awareness of the need to improve quality in the industrial sector. This paper presents how to implement the DMAIC cycle as an element of continuous improvement in practice. In order to achieve it, the problem of quality and quality improvement is widely discussed. Based on the recognized problem in the organization, an analysis with the application of DMAIC is done. The propositions of improvements, which can be implemented in the organization in order to increase the effectiveness of production process, are also presented.

M.I.Solanki et al.(Ref-6) in their paper presented that current era of globalization, customer is supreme and purchase products from anywhere; hence focus should be enchantment of the customer rather than satisfaction. The customer is not liable to pay for any rejection, rework or non-value added activity. Six sigma methodology works on principles of customer converging, process oriented, process data driven and breakthrough improvement strategy. Every day new success story reflects the strength of it, but on the other hand, many projects also fail due to lack in implementation. Author here, present a brief literature survey regarding each phase of DMAIC methodology, latest trend of integration two powerful methodologies Lean and Six sigma as well Critical Success Factors for effective implementation of Six Sigma methodology and found that Lean and six sigma both focuses on concept of continuous improvement and also impact of management leadership & commitment and linking six sigma with the business and customer needs are the most significant among all success factor.

Aulia Ishak et al (Ref-7) explained that manufacturing industry competes in improving the quality of products produced; High demand leads to competition in similar manufacturing industries. Therefore, it becomes a challenge for companies to reduce product abnormality. Six sigma is a very early and potential ideology in this field. In production sector across the world, six sigma is well known and its asset is being taken for improving capacity and character achievement and also to make the course sturdy to quality alteration. The effectiveness of Six Sigma is well supported by anecdotal evidence. However, academic research on Six Sigma is still in its early stage. The review of Six Sigma and Grey FMEA case studies that is achieved in modest scale corporation, service company and product construction is showed in this paper.

Hernadewita Hernadewita et al. (Ref-8) focuses that Quality control is an important thing that must be done by the company to minimize defective products. The company can analyze product defects by using the Six Sigma method, by formulating Define, Measure, Analyze, Improve, and Control (DMAIC) that occurs. PT. XYZ as a large company that prints magazines often faces the problem of quality defects in its printouts, resulting in the cost losses due to production defects every year is not small, as a result of not being sold.

The Six Sigma method is an approach method to help control the quality of production. This study conducts to determine the level of sigma from the current production process, the types of defects that are a priority to be addressed, and the causes of disability. From the results of the study, the sigma value of current production is 3.6 or DPMO of 15919.63613. The type of defect that occurs is blurred by 59%, does not register at 29% and paper cut by 12%. To achieve Six Sigma it is necessary to take corrective steps using the results of the analysis.

### III. CONCLUSION

It is very important in any production industries or company to provide finished product with zero defect to increase the production of the industries or company therefore the total quality management and six sigma both are essential in the industries. The six sigma methodology of process improvement is process data driven, customer centric and process oriented methodology which focuses on elimination of causes producing variation.

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