



# **APPLICATION OF SIX SIGMA TOOL (DMAIC)**

<sup>1</sup>Neha Verma, <sup>2</sup>Rityuj Singh Parihar

<sup>1</sup>Department of Mechanical Engineering SSIPMT Raipur-492001 <sup>2</sup>Department of Mechanical Engineering NIT Raipur-492001 Email: nv5678@gmail.com , singhrityuj24@gmail.com

Abstract This paper presents an application of Six Sigma using DMAIC viz. Define, Measure, Analyze, Improve & Control model for the defect reduction at a Manufacturing. It focuses on the best possible way to define & measure variations with the intent of discovering its causes & to develop efficient operational means to control & reduce or eliminate these variations / defects. .Many organizations all over the world have tried to use Six-Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) approach and its tools to get optimized organizational achievements. The present work is an attempt to study the impact of Six-Sigma DMAIC approach in manufacturing. This study is to explore the level of usage and level of difficulty of different tools of DMAIC approach. Barriers in implementing Six-Sigma DMAIC approach and the benefits achieved after successful implementation of DMAIC approach have also been identified. Six Sigma is an organized & systematic method for strategic process improvement that relies on statistical & scientific method to make dramatic reductions in defect rates by measuring,

analyzing, improving & then controlling processes. Keyword:- Six Sigma, Design, Measure , Analyze, Improvement, Control

## I. INTRODUCTION

The six sigma method is a project-driven management approach to improve the organization's products, services, and Processes by continually reducing defects in the organization. It is a business strategy that focuses on improving customer requirements understanding, productivity, business systems, and financial performance. The primary objective of the Six-Sigma methodology is the implementation of a measurement based strategy, which focuses on process and subprocesses Improvement through the application of Six-Sigma best practice such as DMAIC and DMADV. The Six-Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) approach is applied for improving existing processes and looking for incremental improvement. The Six-Sigma DMADV (Define, Measure, Analyze, Design, and Verify) approach is applied for developing new processes or products at Six-Sigma quality levels. The success of this methodology within an organization has significant momentum that can only lead to fundamental organizational cultural transformation.

#### Six Sigma has two different processes:

Six Sigma DMADV -- a process that defines, measures, analyzes, designs and verifies new processes or products that are trying to achieve Six Sigma quality. It is basic methodology of introducing new processes. **Define**: the process and where it would fail to meet customer needs. **Measure**: and determine if process meets customer needs. **Analyze**: the options to meet customer needs. **Design**: in changes to the process to meet Customers needs. **Verify**: the changes have met customer needs.

Six Sigma DMAIC -- a process that defines, measures, analyzes, improves and controls existing processes that fall below the Six Sigma specification. It is basic methodology to improve existing processes **Define**: out of tolerance range. **Measure**: key internal processes critical to quality. **Analyze**: why defects occur. **Improve**: the process to stay within tolerance. **Control**: the process to stay within goals.

## II. LITERATURE REVIEW

**Desai, et al.(2008)** performed a case study by applying Six-Sigma DMAIC (Define–Measure-Analyze Improve-Control) methodology in an industry which provides a framework to identify, quantify and eliminate sources of variation in an operational process to optimize the operation variables, improve and sustain performance and found that Six-Sigma improves the process performance (process yield) of the critical operational process, leading to better utilization of resources, decreases variations & maintains consistent quality of the process output.

Bhargava, et al. (2010) Presented tools of Six Sigma for Telecom Industries these can achieve powerful operational improvements that produce sustainable business benefits. Six Sigma Qualtec's dedicated Six Sigma for Telecom practice is specifically designed to help traditional and modern telecommunications providers, become more efficient in their operating procedures. By learning and implementing improvements such as Voice of the Customer (VOC), , Six Sigma, Business Process Management Design for Six Sigma and Lean Enterprise principles, those companies will be able to dramatically improve the way they do business thus attracting and keeping customers in this hyper-competitive industry.

Kumar, et al.(2014) Described The concept of Six-Sigma has dominated the management scene for some decades. Six-Sigma is a rigorous, disciplined, datadriven methodology that was developed to enhance product quality and company profitability by improving manufacturing and business processes. Many organisations all over the world have tried to use Six-Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) approach and its tools to get optimised organisational achievements. The present work is an attempt to study the impact of Six-Sigma DMAIC approach in manufacturing industries of Ludhiana.

**Banuelas et al. (2002)**Noted that six sigma is a disciplined approach to define, measure, analyze, improve and control processes that result in variability and defect reduction. The six sigma of today speaks the language of management: bottom-line results. It institutionalizes a rigorous, disciplined, fact-based way to deliver more money to the bottom line through process improvement and process design projects selected by the top leadership and led by high potentials trained as Black Belts or Master Black Belts in six sigma that aims to create near-perfect processes, products, and services all aligned to delivering what the customer wants.

James R,et al. (2005) explained in their book about the foundations of Six Sigma, principles of quality management, and other introduction concepts of Six Sigma & traces its evolution from earlier approaches to quality management. They also discussed the link between Six Sigma, business results, competitive advantage and secondly project selection, definition, focusing on organization issues. They also explained about process measurement with the help of DMAIC and DMADV in process analysis emphasizing with statistical tools and other valuable methods, which is focusing on process improvement phase.

**Greg Brue, et al. (2006)** Described the introduction to Six Sigma, strategies, techniques, DMAIC, DFSS, Six Sigma which has brought measurable success and bottom line results to Motorola, DuPont, Raytheon and other international giants.

**Steven H,et al.(2006)** explained the creative approach to design new robust process, products and services. This roadmap is focused purposed to obtain significant competitive advantages or quantum leaps over current environments. However DMEDI projects tend to be more time and resource intensive. DMAIC is an analytical data driven approach to eliminate weakness in active processes, products and services. DMAIC brings incremental improvements. He also explained the difference between DMAIC &DMEDI.

**Razvan, et al.(200** In their paper has proposed a strategy for the implementation of the Six Sigma method as an improvement solution for the ISO 9000:2000

Quality Standard. Our approach is focused on integrating the DMAIC cycle of the Six Sigma method with the PDCA process approach, highly recommended by the standard ISO 9000:2000. The Six Sigma steps applied to each part of the PDCA cycle are presented in detail, along with some tools and training examples. Based on this analysis, the authors conclude that applying Six Sigma philosophy to the quality standard implementation process is the best way to achieve the optimal results in quality progress and therefore in customer satisfaction.

**Deshmukh,et al.(2009)** Paper was aimed at identifying the factors that need greater attention for successful implementation of Six Sigma in SMEs of India. The finding of the study showed that majority of the surveyed SMEs 75% did not possess ISO certificate. Besides, only 51% were ISI certified, indicating lower importance to quality management practices. The study reveals that training forms an important factor to achieve the desired effect of Six Sigma implementation programme and hence the present DMAIC model needs to be enriched with T (training) making it T-DMAIC.

## III. METHODOLOGY

DMAIC (pronounced De-MAY-ick) is at the center of every Six Sigma project. DMAIC stands for five stages of Six Sigma methodology, namely, define measure, analyze, improve and control. There are five fundamental phases or stages in applying Six Sigma approach to improving performance in a process. In the Six Sigma approach, DMAIC provides a break through strategy & disciplined methods of rigorous data gathering & statistically based analysis

to identify sources of errors & way of eliminating them. The tasks performed during these five stages of DMAIC are described in the following paragraphs:



Fig.1 Process step of DMAIC

#### Define

The main focus of the define stage is to identify the problem in terms of critical to quality (CTQ) parameters.

The problem is defined in terms of some deficiency in CTQ parameters. In other words, in the define stage the problem with respect to one or more CTQ parameters is identified.

#### Measure

During the measure stage an appropriate metric is used to measure the current process capability. The main objective during this stage is to establish the current performance of the process and measure the gap in the process performance and set target for improvement.

#### Analyze

In this stage, the cause and effect relationship between process performance and the process inputs are identified. The causes for performance gap measured in terms of CTQs are identified and solutions to the problems are generated. The best solution is then chosen to improve the process performance.

#### Improve

The main focus during this stage is to implement the solution to the problem identified during the define stage and target set during the Measure stage. Several optimization techniques are used to solve the problem in an optimal way.

#### Control

Sustaining the improvement obtained is equally important as achieving the improvement itself. In the control stage of the DMAIC cycle several statistical tools are used to sustain the quality improvement achieved using the previous four stages. The strength of DMAIC lies in its tool box. The methodology uses several mathematical and statistical tools and techniques to identify and solve the problem.

## **IV. CONCLUSIONS**

This is one of the most important application of DMAIC (Define, Measure, Analyze, improve and Control) in any project. DMAIC is suitable for rather extensive problem solving tasks, requiring all of the components of problem definition, diagnosis, and the design of remedies. It is less suited for problem tasks of a smaller scope. As mentioned most of service industries don't have a proper attitude about customer and related qualified data. This is a new approach to six sigma phases with considering customer and operational strategies in any industries. The statistical aspects of six sigma must complement business perspectives and challenges to the organization to implement six sigma have been applied to increase the overall performance of

different business sectors. However, integrating the data-driven, structured six sigma processes etc.

### REFERENCES

- [1] Desai Venta, E. and El-Houbi, A. (2008), "Business practices and performance in US manufacturing companies: an empirical investigation", International Journal of Business Excellence, Vol. 1, Nos. 1/2, pp.141–159.
- Bhargava et al. (2010) International Journal of Engineering Science and Technology Vol. 2(12), 2010, 7653-7659 Six Sigma Methodology Utilization in Telecom Sector for Quality Improvement- A DMAIC Process
- [3] Kumar et al.(2014) 19 International Journal of Innovative Research in Science, Engineering and Technology .Vol. 3, Issue 5, May 2014 Impact of Six-Sigma DMAIC approach on Manufacturing Industries(An ISO 3297: 2007 Certified Organization)
- [4] Banuelas, R. & Antony, J., (2002). Key ingredients for the effective implementation of Six Sigma program. Measuring Business Excellence, 6(4), 20–27.
- [5] James R. Evams & William M. Lindsay (2005) "An Introduction To Six Sigma Process And Improvement", Cenangage Learning India Pvt. Ltd.
- [6] Greg Brue and Rod Howes (2006) "Six-Sigma Text Book Tata Mc Graw –Hill Publishing Company Limited.
- [7] Razvan Lupan, Ioan C. Bacivarof, Abdessamad Kobi & Christian Robledo 2005): A Relationship Between Six Sigma And ISO 9000:2000, Quality Engineering, Vol. (174), PP. 719-725
- [8] S V Desmukh and R R Lakhe (2009), "An Innovative Model Of Six Sigma For SMES: The T-DMAIC Model".
- [9] Kumar, Sameer, Schmitz, Stephanie (2011), "Managing Recalls In A Consumer Product Supply Chain-Root Cause Analysis And Measures To Mitigate Risks", International Journal Of Production Research, Vol.49 (1), PP.235-253.
- [10] M. Sokovic, D. Pavletic, E.Krulcic (2006), "Six Sigma Process Improvements In Automotive Parts Production", Journal Of Achievements In Materials And Manufacturing Engineering, Vol.19 (1), PP.96-101.

 $\otimes \otimes \otimes$