

# “A REVIEW ON IMPLEMENTATION OF SIX SIGMA METHODOLOGY IN TRANSFORMER MANUFACTURING INDUSTRY”

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## **ABSTRACT**

Over the last two decades there has been a growing awareness of the need to improve quality in the industrial sector. Application of Six Sigma using the DMAIC(Define, Measure, Analyze , Improve and Control) methodology in the process of product quality control is more effective. This research work 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. In order to analyze the data with some of the statistical quality control tools is being used such as Pareto chart, process map, cause and effect diagram, failure mode effect analysis and checklist. This paper comprises of detailed examination with respect to utilization of six sigma Methodologies in Organizations and Institutions. This paper gives an outline to the writing into different classes and thinks about different strategies/methods proposed in the writing. In light of the survey, roads for additional examination are likewise talked about. This paper shows a review of six sigma case studies related to transformer manufacturing industry. On the basis of present review, I choose to identify defects and to solve defects in **Vapour Phase Drying Process** of transformer manufacturing industry with the help of **SIX SIGMA DMAIC METHOD**.

**Keywords:** DFSS, DMAIC, SS, FLOW CHARTS

## **1. INTRODUCTION**

Six Sigma is said to be a philosophical approach that demands the effective use of data to analyze business issues. The simplest definition for six sigma is to eliminate waste and to mistake proof the processes that creates value for customers. The Six Sigma aim is focused on the reduction of defect frequency in products and processes to a frequency of less than 3.4 defects per million opportunities ( DPMO , equivalent to a quality level of 99.9997%). It is a disciplined, data driven approach and method for eliminating defects. A “defect” is described as anything outside of customer expectations. Six Sigma has been defined as a tool kit or a set of techniques based on statistical process control that can help companies make major improvements in product quality. Experts say companies that have embraced and implemented six sigma as part of their business strategy have seen huge impacts on their bottom line through their ability to reduce costs and increase efficiency.

## **2. BASIC DIFFERENCES BETWEEN SIX SIGMA DFSS AND DMAIC METHODOLOGIES**

DMAIC(Define, Measure, Analyze , Improve and Control) is more focused on reacting, on detecting and resolving problems, while DFSS (Design for Six Sigma) tends to be more proactive, a means a preventing problem DMAIC is for product or services that the organization offers currently; DFSS is for the design of new product or services and processes. DMAIC is based on manufacturing or transactional processes and DFSS is focused on marketing, R& D, and design.

## **3. CONCEPT OF DMAIC METHODOLOGY**

DMAIC is one of the six sigma methodologies used for solving problems and bringing in improvement in process or products. DMAIC refers to Define, Measure, Analyze, Improve and Control. The Methodology is then characterized principally into five stages compelling for all objective components. Which are define stage, measure stage, analyze stage, improve stage and control stage. These are to be executed while actualizing any of the characterized components.

The paper has decided to think upon six sigma(DMAIC) approach:

### 1. DEFINE stage:

- o The Customer – who is the client, what do they need and what are their assumptions? This will include seeing quality control issues and center business measures
- o The venture limits – Where does method start and end?
- o The method to be improved.

Tools used in this method are:

- 1.Pareto chart
- 2.Project charter
- 3.Process Map

### 2.MEASURE stage :

To apply the Six Sigma Methodology and Management System it is fundamental that you measure the exhibition of Core Business Processes. You should –

- o Build up an arrangement for the assortment of information for the cycle
- o Assemble information to recognize kinds of imperfections and measurements
- o Contrast proof with client review results

Tools used in this method are:

1. Data Collection
- 2.Fishbone Diagram
3. Measurement Analysis

### 3. ANALYZE stage:

The following stage in the DMAIC model is to break down the information and interaction guide to set up reasons for deformation and where you can improve:

- o Current execution and objective execution are contrasted with distinguish holes.
- o Openings for enhancements are focused on.
- o sources of variation are distinguished .

Tools used in this method are:

1. FMEA
2. Regression analysis
3. Root cause analysis

### 4. IMPROVE stage:

Utilizing the information from the usage of the above it is presently conceivable to improve the cycle by planning inventive answers for fix and forestall issues. This is accomplished by

- o Using control and innovation to create imaginative arrangements.
- o Develop and execute an arrangement.

Tools used in this method are:

1. Brainstorming

2. Failure mode & effect analysis

3. Design of experiment

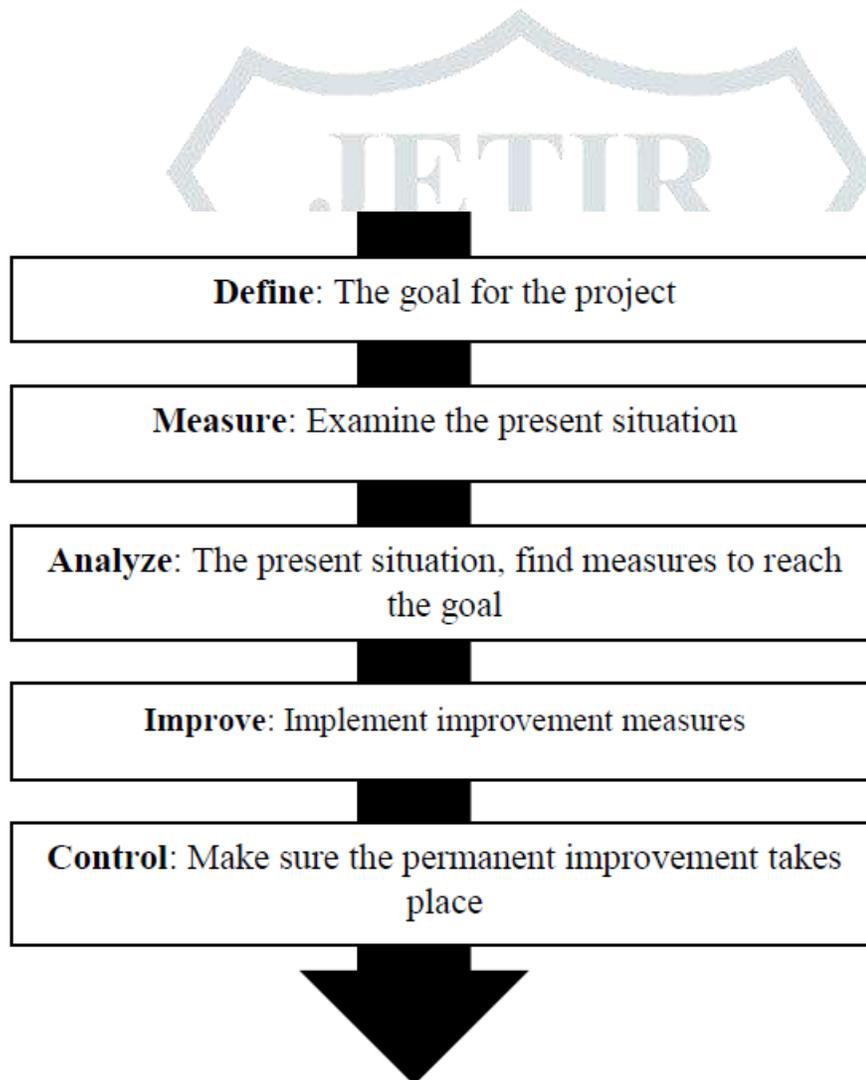
**5. CONTROL stage**

Control and support enhancements after some time by –

- o Preventing the nature to get back to the old methods of getting things done.
- o Developing, recording and actualizing a progressing checking plan .
- o Integrating the upgrades all through the organization using training, staffing and motivations.

Tools used in this method are:

- 1.Hyphothesis Test
2. Control Chart
3. Checklist



**FIG 1. STEPS IN DMAIC METHOD**

#### 4. LITERATURE REVIEW

##### REVIEW OF PAST STUDIES:

**Teun Graafmans Et al.(2020)** This literature provides the potential benefits of using process mining techniques in Six Sigma based process improvement initiatives. PMSS is useful as a guideline to support Six Sigma-based process improvement activities. It offers a structured guideline for practitioners by extending the DMAIC-based standard operating procedure. PMSS can help increasing the efficiency and effectiveness of Six Sigma-based process improving efforts.

**Ali Montazer M Et al.(2020)** This work shows that the implementation of Six Sigma and Lean methods has become more and more common place in the traditional manufacturing sector. The findings documented in various works will also be analyzed to identify commonalities and to establish a menu of the most common tools used and the most common performance indicators for speedy and successful Lean Six Sigma implementations in traditional manufacturing.

**N Mohamad Et al.(2019)** In this studied, the DMAIC (Define, Measure, Analyse, Improve and Control) technique is applied at a company producing Flexible Printed Circuit Board (FPCB) in Malaysia. It is an initiative for continuous improvement by the company. The aim of the study is to reduce the number of open defects during the production of the single sided FPCB which has substantial impact on the profit margin of the company. For the duration of the study, the overall defect rate for the particular line was reduced from 0.6% to 0.37%. The case study showed that DMAIC process is an effective approach that can solve what seems to be a major problems using simple solutions. If conducted properly and efficiently, it has the potential to give good returns to the company.

**Monika Smętkowska Et al.(2018)** 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.

**Gourav Kolhe Et al.(2018)** This work is based on the study of Implementation of Six Sigma Process in Industry. Six Sigma is the one of the most powerful management tool used to achieve process excellence .The objective of this research is to develop a model for implementation of Six Sigma in Indian organizations. Validation of the model is done by comparing the internal customer satisfaction survey before and after implementing the model. These models can be effectively used to reduce the cycle time of the business process.

**Lenka Girmanová Et al.(2017)** The Six Sigma DMAIC can be considered a guide for problem solving and product or process improvement. In this case study, a variety of tools and techniques like flow chart, histogram, Pareto diagram, analysis of FMEA (Failure Mode and Effect Analysis) data, cause and effect diagram, logical analysis was used. The Sigma level has improved by approximately 13%. The achieved improvements have helped to reduce the quantity of defective products and the processing costs (technology for re-adjusting). Benefits resulting from the DMAIC implementation can be divided into three levels: the qualitative, economic and safety level.

**Nirav Sindha , Kinjal Suthar(2017)** The objective of this paper is to review and examine the advancement and encounters of six sigma practices in Global manufacturing Industries and identify the key tools for each step in successful Six Sigma project executions. The paper also integrates the lessons learned from successful six sigma projects and their prospective applications in various manufacturing Industries. In today scenario, many global manufacturing industries operate their processes at the two to four sigma quality levels.

**Mr. Ganesh P. Jadhav Et al.(2015)** This paper presents a review of the six sigma case studies implemented in the Automobile Industries, small Scale Industries, Service Industries and also the Product Manufacturing Industries. In manufacturing sector worldwide, six sigma is becoming very popular and its advantage is being taken for improving productivity and quality performance and also to make the process robust to quality variations.

**Javed I. Malek, Darshak A.Desai(2015)** Six Sigma has been widely used project-driven management approach to produce high-quality products with the lowest possible cost. The objective of this paper is to explore the impact of Six Sigma in Indian SMEs. This paper is mainly focusing on the DMAIC methodology of Six Sigma which has been successfully adopted by various SMEs. This paper discusses the various tools and techniques used in each phase of DMAIC approach, its impact on bottom line through benefits gained and critical success factors to show the roadmap for other SMEs to initiate Six Sigma in their industries.

**Virender Narula, Sandeep Grover (2015)** The authors have reviewed various journal papers and suggested different schemes of classification. The paper has been categorized in four sections. Section one & two present introduction to Six Sigma and preamble to literature review respectively. Section three presents classification of Six Sigma papers based on research methodology & research contents. Section four presents key findings, conclusion and areas for future research.

#### **4. OBJECTIVE OF WORK**

The objective of review was to understand the status of Six Sigma as on yesterday, today and tomorrow. The object of literature review is:

1. To refresh the data set and to guarantee that it contains writing as current as could be expected.
2. Organizing the journals in an efficient way to empower simple and fast hunt.
3. Arrangement of publications dependent on Research technique, content, diary, year and further sub arrangement.
4. Examination of the result of the papers.
5. Recognizing holes and giving clue to future research.

#### **5. CONCLUSIONS**

The review of literature leads us to believe that there are still several avenues of research that need to be addressed. The zones for additional examination can be summed up as Applications of Six Sigma in producing and administration areas territories which are not investigated at this point with maximum capacity, territories of Six Sigma improvement and mix of Six Sigma with other quality activities, basic achievement factors for fruitful arrangement of Six Sigma and Six Sigma usage techniques. An inadequacy of vapour phase drying process is found to be a big problem in a transformer industry. The objective of my work is to identify defects and to solve defects in the vapour phase drying (VPD) process with the help of six sigma DMAIC methodology in the transformer manufacturing industry. DMAIC methodology opens the market for the cost efficient drying for small power transformers as well as distribution power transformers with vapour phase drying technology. It reduces the chances of failure of transformer. My main focus on the quality improvement of vapour phase drying process by identifying current problem and to reduce major problem in the VPD process with the help of Six Sigma DMAIC methodology. Root causes for the problems will be determined and suggestions for improvement will be suggested. Ultimately to reduce the overall production cost of the transformers and increase efficiency of the production system.

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